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Clinical paper

Automated external defibrillator accessibility is crucial for bystander defibrillation and survival: A registry-based study

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Abstract

Aims: Optimization of automated external defibrillator (AED) placement and accessibility are warranted. We examined the associations between AED accessibility, at the time of an out-of-hospital cardiac arrest (OHCA), bystander defibrillation, and 30-day survival, as well as AED coverage according to AED locations.

Methods: In this registry-based study we identified all OHCAs registered by mobile emergency care units in Copenhagen, Denmark (2008–2016). Information regarding registered AEDs (2007–2016) was retrieved from the nationwide Danish AED Network. We calculated AED coverage (AEDs located $\leq$200 m route distance from an OHCA) and, according to AED accessibility, the likelihoods of bystander defibrillation and 30-day survival.

Results: Of 2500 OHCAs, 22.6% (n = 566) were covered by a registered AED. At the time of OHCA, <50% of these AEDs were accessible (n = 276). OHCAs covered by an accessible AED were nearly three times more likely to receive bystander defibrillation (accessible: 13.8% vs. inaccessible: 4.8%, $p < 0.001$) and twice as likely to achieve 30-day survival (accessible: 28.8% vs. inaccessible: 16.4%, $p < 0.001$). Among bystander-witnessed OHCAs with shockable heart rhythms (accessible vs. inaccessible AEDs), bystander defibrillation rates were 39.8% vs. 20.3% ($p = 0.01$) and 30-day survival rates were 72.7% vs. 44.1% ($p < 0.001$). Most OHCAs were covered by AEDs at offices (18.6%), schools (13.3%), and sports facilities (12.9%), each with a coverage loss >50%, due to limited AED accessibility.

Conclusions: The chance of a bystander defibrillation was tripled, and 30-day survival nearly doubled, when the nearest AED was accessible, compared to inaccessible, at the time of OHCA, underscoring the importance of unhindered AED accessibility.

Keywords: cardiac arrest, resuscitation, automated external defibrillator, survival

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Introduction

Early defibrillation with an automated external defibrillator (AED) can increase survival from an out-of-hospital cardiac arrest (OHCA) to >50%,[1,2] and is associated with improved long-term survival, and lower risks of anoxic brain damage and nursing home admission.[3] Half of patients are <65 years of age,[4] which poses a substantial public health burden and a considerable economic impact.[5] In recognition of the enormous unutilized potential for improving outcomes, the American Institute of Medicine, the American Heart Association and the European Resuscitation Council have specifically called for actions to improve early defibrillation during OHCAs.[4,6,7]

AEDs are often untraceable or inaccessible, and thus, difficult to locate when needed.[8–11] Furthermore, AEDs are substantially more likely to be used when registered and linked to emergency medical dispatch centres.[12] In Denmark, efforts have been made to improve resuscitation after OHCAs including establishment of a nationwide volunteer-based AED network (linked to emergency medical dispatch centres since 2011).[8,10,13] Although defibrillation by bystanders in public locations have increased in Denmark, the overall rate has remained low.[13] Similar low rates have been reported in several studies (stagnated around 2%–4%).[14–17] Data on whether AED accessibility is associated with bystander defibrillation and influences patient survival is scarce.

The primary aims of this study were to (1) examine whether AED accessibility at the time of OHCA was associated with bystander defibrillation and 30-day survival in Copenhagen, Denmark, and (2) examine the proportions of OHCAs that were covered by a registered, accessible AED, at the time of OHCA, according to the type of AED location in Copenhagen. As secondary aims, we examined temporal changes in AED location types, AED registrations, and the 24/7 accessibility of registered AEDs, both in Copenhagen and on a nationwide level.

Methods

Study design and setting

This registry-based, retrospective study included data on (1) the numbers of registered AEDs (2007–2016) and the number of OHCAs (2008–2016) in Copenhagen; and (2) the number of AEDs sold in Denmark and the proportion registered in the nationwide Danish AED Network (2007–2016). In 2016, Copenhagen had approximately 600 000 inhabitants and covered 97 km^2, and Denmark had 5.7 million inhabitants and covered 42 900 km^2.[18]

The Danish AED Network

The Danish AED Network was established in Copenhagen in 2007 and extended nationwide in 2010. The registry links information about individual AEDs to all emergency medical dispatch centres across the country, which enables identification of the nearest accessible AED in the event of an OHCA. The registry includes private and public AEDs, and it can also be viewed by any individual, on a smartphone and/or on a public webpage.[13] Registration of AEDs is voluntary, but recommended by the Danish Health Authority (also recommending 24/7 AED accessibility) and most AED vendors.[8,13]

Four time points on nationwide registered AED data were available: end of 2007, February 2012, January 2015, and January 2017. Registration of AEDs is continuously updated; thus, AEDs can be removed, in case of improper validation, or if taken down/moved to another location. The following information was retrieved for every AED: date of registration, exact address/coordinates, the type of organization of AED deployment, and the exact days/hours of accessibility. To determine the specific type of location for each registered AED, we used: (1) coordinates for the AED location, (2) information about the Danish Industrial Classification that pertained to the AED location, and (3) the type of organization where the AED was deployed. The Danish Industrial Classification is a statistical classification of economic activities, which is the National version of the European Union's nomenclature.[19] The AED classification according to the type of location is shown in Table 1 in Ref.[20]

OHCA study population in Copenhagen

The study population included all Emergency Medical Services (EMS) treated OHCAs registered by the Copenhagen physician-staffed mobile emergency care unit (MECU) physicians in the municipality of Copenhagen, Denmark (2008–2016), as described previously.[8,10,21] For any bystander intervention registered in Copenhagen during the study period (CPR and/or defibrillation), a bystander was defined as a person, with or without any previous training in resuscitation, present at the scene of OHCA or present at an AED location nearby contacted by the emergency medical dispatch centre and asked if they could bring the AED to the OHCA location. During the study period there were no dispatch first-responder programs for neither citizens nor professional first-responders (such as police/firefighters delivering an AED), in Copenhagen.

Geocoding and analysis of AED coverage of OHCAs in Copenhagen

OHCAs with complete addresses were geocoded with the Building and Housing Registry[22] and MMQGIS in Quantum GIS 2.18.7.[23] The route distances (using road/pedestrian routes) from OHCAs to AEDs were calculated with the network analyst feature in ArcMap 10.5.[24] First, an OHCA was defined as covered by an AED, if the OHCA occurred ≤200 m from an AED and if the AED had been placed at the location before the date of OHCA. The American Heart Association has previously recommended AEDs to be placed ≤1.5 min of brisk walking distance to OHCA locations; commonly translated to a straight-line distance of 100 m.[10,11,25] However, when taking the local infrastructure into account, the route distance would be longer, and longer distances are being used.[26] Second, each covered OHCA was revaluated after considering the time and date of the OHCA and the accessibility of the AED, and coverage was categorized as (1) coverage by an accessible AED or (2) coverage by an inaccessible AED. Loss of coverage was calculated as the number of OHCAs ≤200 m from an AED, irrespective of AED accessibility, minus the number of OHCAs ≤200 m from an accessible AED, divided by the number of OHCAs ≤200 m from an AED, irrespective of AED accessibility.[10]

Bystander defibrillation and 30-day survival, according to AED coverage in Copenhagen

For each OHCA, we obtained information on 30-day survival from the Danish Central Population Registry. We analysed all OHCAs covered, and a subgroup of that group that comprised bystander-witnessed OHCAs with a shockable heart rhythm, according to AED accessibility (accessible AED vs. inaccessible AED), and associations with bystander defibrillation and 30-day survival.

Number of AEDs sold vs. registered on a nationwide scale

In Denmark, AED companies/vendors anonymously report the total AED sale numbers/year to the Danish Resuscitation Council. Sales numbers are collected for AEDs that are potentially publicly accessible. AEDs sold for use in ambulances, MECUs, in-hospital settings, the military, offshore facilities, or for deployment outside of Denmark are not included because these AEDs are inaccessible to the public in Denmark.

Statistics

We used the chi-squared test to compare bystander defibrillation and 30-day survival proportions among (1) all OHCAs in Copenhagen covered by accessible vs. inaccessible AEDs, and (2) bystander-witnessed OHCAs with a shockable heart rhythm in Copenhagen covered by accessible vs. inaccessible AEDs. A 2-sided p-value <0.05 was considered significant. Logistic regression analyses were performed to examine associations between AED accessibility and bystander defibrillation and 30-day survival among bystander-witnessed OHCAs in Copenhagen (adjusted for age and sex). Results are presented as odds ratios (ORs) with 95% confidence intervals (CIs).

The number of registered AEDs/100 000 inhabitants in Copenhagen, and the number of sold and registered AEDs/100 000 inhabitants nationwide were calculated for year 2007 and 2016. The cumulative number of sold vs. registered AEDs nationwide are presented for year 2006, 2007, 2011, 2014, and 2016. For the same years, except 2006, the number of registered AEDs in Copenhagen is presented. All analyses were performed with SAS (software version 9.4, SAS institute Inc., NC, USA).

Ethics

This study was approved by the Danish Data Protection Agency (Ref. no. 2007-58-0015, local ref. no. GEH-2014-107, I-Suite no. 02735). No ethical approval was required for retrospective registry studies in Denmark.

Results

We identified 2530 non-EMS witnessed OHCAs of presumed cardiac cause, at known locations and addresses. We excluded 28 cases with missing information on bystander defibrillation and 2 cases, where it was not possible to calculate the distance to an AED by any route. The final study population included 2500 OHCAs. Cardiac arrest-related characteristics of the OHCA study population in Copenhagen (2008–2016) are presented in Table 4 in Ref.[20]

AED accessibility, bystander defibrillation and survival in Copenhagen

Of 2500 OHCAs, 566 (22.6%) were covered by an AED. About half of these (n = 276) were covered by an accessible AED at the time of OHCA (total coverage loss: 51.2%). Most OHCAs were covered by AEDs placed at companies/offices (18.6%), school/education facilities (13.3%), sports facilities (12.9%), and health clinics (12.5%). These AED locations had a coverage loss >50%, due to limited AED accessibility at the time of OHCA (Table 1).

Table 1 – Loss of AED coverage, due to limited AED accessibility, according to AED location in Copenhagen.

AED location	All OHCAs located ≤200 m of an AED, n (%)	OHCAs located ≤200 m of accessible AEDs, n (%)	OHCAs located ≤200 m of inaccessible AEDs, n (%)	% coverage loss due to AED inaccessibility[a]
Total	566 (100.0)	276 (48.8)	290 (51.2)	51.2%
Transportation facility	12 (2.1)	10 (83.3)	2 (16.7)	16.7%
Residential settings	38 (6.7)	31 (81.6)	7 (18.4)	18.4%
Church/ community centre	5 (0.9)	4 (80.0)	1 (20.0)	20.0%
Hotels and conference venues	13 (2.3)	9 (69.2)	4 (30.8)	30.8%
Sports facility	73 (12.9)	42 (57.5)	31 (42.5)	42.5%
Other	37 (6.5)	20 (54.1)	17 (46.0)	46.0%
Shopping malls/ shops/banks	45 (8.0)	24 (53.3)	21 (46.7)	46.7%
Attractions/ recreational areas	21 (3.7)	11 (52.4)	10 (47.6)	47.6%
Companies/ offices	105 (18.6)	52 (49.5)	53 (50.5)	50.5%
Public building	36 (6.4)	16 (44.4)	20 (55.6)	55.6%
Union/association	35 (6.2)	12 (34.3)	23 (65.7)	65.7%
School/education facility	75 (13.3)	25 (33.3)	50 (66.7)	66.7%
Health clinics	71 (12.5)	20 (28.2)	51 (71.8)	71.8%

AED, automated external defibrillator; OHCA, out-of-hospital cardiac arrest.

[a] Loss of AED coverage was calculated as the number of OHCAs located ≤200 m of an AED, irrespective of AED accessibility, minus the number of OHCAs located ≤200 m of an accessible AED, divided by the number of OHCAs located ≤200 m of an AED, irrespective of AED accessibility.

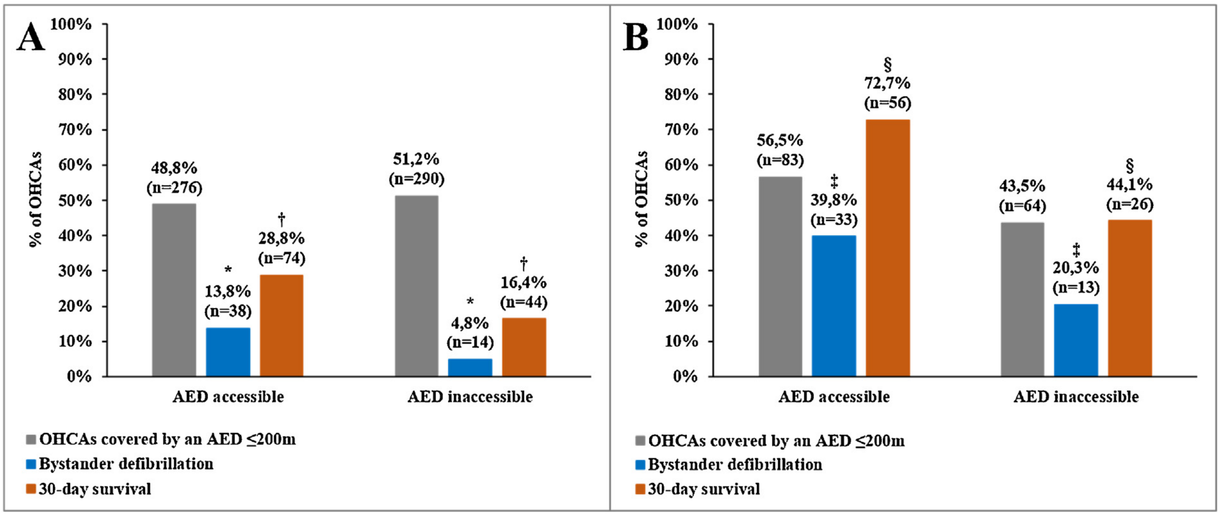

Fig. 1 – Bystander defibrillation and 30-day survival among OHCAs covered by an accessible AED vs. an inaccessible AED in Copenhagen.

Bystander defibrillation and 30-day patient survival among OHCAs covered by an accessible AED vs. an inaccessible AED in Copenhagen. (A) all OHCAs (n = 566). *p < 0.001 for bystander defibrillation. †p < 0.001 for 30-day survival; however, 40 OHCAs had missing information on survival status; therefore, the percentages for survival data are based on n = 257 for accessible AEDs, and n = 269 for inaccessible AEDs. (B) a subgroup of witnessed OHCAs with shockable heart rhythm (n = 147). ‡p = 0.01 for bystander defibrillation. §p < 0.001 for 30-day survival; however, 11 OHCAs had missing information on survival status; therefore, the percentages for survival data are based on n = 77 for accessible AEDs, and n = 59 for inaccessible AEDs.

AED, automated external defibrillator; OHCA, out-of-hospital cardiac arrest.

Investigating all OHCAs, those covered by an accessible AED were three times more likely to receive bystander defibrillation compared to those covered by an inaccessible AED (13.8% vs. 4.8%, $p < 0.001$) and nearly twice as likely to achieve 30-day survival (28.8% vs. 16.4%, $p < 0.001$). The corresponding figures among bystander-witnessed OHCAs with shockable heart rhythms (n = 147) were (accessible vs. inaccessible AEDs): 39.8% vs. 20.3% ($p = 0.01$) for bystander defibrillation and 72.7% vs. 44.1% ($p < 0.001$) for 30-day survival (Fig. 1). For the OHCAs that were bystander defibrillated, but where the nearest AED ≤ 200 m was inaccessible at the time of OHCA, >60% had an accessible AED within 201–500 m (Table 6 in Ref.[20]). Compared to OHCAs covered by an inaccessible AED, OHCAs covered by an accessible AED were more likely to occur in public, receive bystander CPR, and have a shockable heart rhythm. There was no significant difference in age, sex and EMS response times (Table 5 in Ref.[20]).

Of the 566 OHCAs covered by an AED, 337 were bystander-witnessed. Limiting the analysis to bystander-witnessed OHCAs only in logistic regression analyses, we found an OR of 3.3 (95% CI: 1.6–7.0) for bystander defibrillation and 2.5 (95% CI: 1.5–4.2) for 30-day survival, for OHCAs covered by an accessible AED vs. an inaccessible AED (adjusted for age and sex).

AED registration, 24/7 accessibility, and AED location in Copenhagen

In 2007–2016, the number of registered AEDs in Copenhagen increased from 39 to 1573 (7 to 223 AEDs/100 000 inhabitants) and the proportion of AEDs with 24/7 accessibility from 7.7% to 20.5% (Fig. 2). The most frequent locations for AED deployment were companies/offices (27.2%), school/education facilities (14.8%), unions/associations (8.1%), and sports facilities (8.0%) (Table 2).

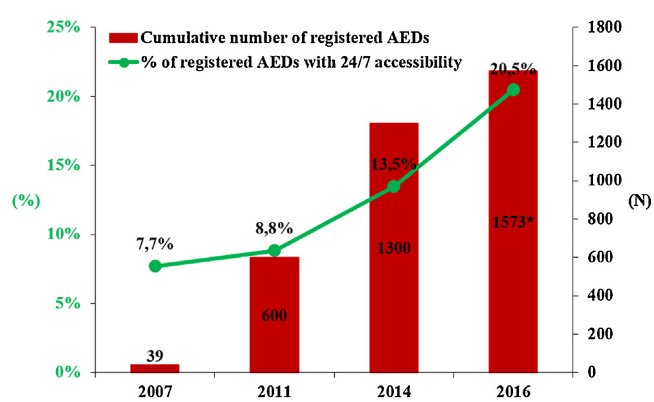

Fig. 2 – Cumulative number of publicly available AEDs registered in Copenhagen, and temporal changes in 24/7 AED accessibility.

***In total, 1830 AEDs were registered in Copenhagen from 2007 through 2016, and 257 (14.0%) of these were withdrawn during the study period.**

AED, automated external defibrillator; 24/7, 24 h per day, 7 days per week.

Table 2 – Overall distribution of registered AEDs, according to type of location, in Copenhagen and Denmark, nationwide.

Setting	Copenhagen, n (%)	Nationwide, n (%)
Total number of registered AEDs (2007–2016)	1830 (100.0)	17 106 (100.0)
Companies/offices	497 (27.2)	5003 (29.2)
School/education facility	270 (14.8)	2117 (12.4)
School	134 (49.6)	1379 (65.1)
University	93 (34.4)	414 (19.6)
Day-care	12 (4.4)	176 (8.3)
Library	22 (8.2)	126 (6.0)
Other education facility	9 (3.3)	22 (1.0)
Sports facility	147 (8.0)	1623 (9.5)
Sports facility/centre	84 (57.1)	1,322 (81.5)
Fitness	50 (34.0)	193 (11.9)
Public swimming pool	13 (8.8)	108 (6.6)
Residential settings	84 (4.6)	1518 (8.9)
Housing association/apartments	46 (54.8)	860 (56.7)
Nursing home/elderly housing/ activity centre	19 (22.6)	347 (22.8)
Private home	6 (7.1)	149 (9.8)
Housing support	13 (15.5)	123 (8.1)
Other residential	0 (0.0)	39 (2.6)
Shopping malls/shops/banks	131 (7.2)	1236 (7.2)
Grocery store	19 (14.5)	504 (40.7)
Bank	91 (69.5)	493 (39.9)
Other store	11 (8.4)	127 (10.3)
Pharmacy	2 (1.5)	63 (5.1)
Shopping mall/centre	8 (6.1)	49 (4.0)
Union/association	148 (8.1)	1026 (6.0)
Attractions/recreational areas	100 (5.5)	1020 (6.0)
Harbour	34 (34.0)	252 (24.7)
Culture institution/museum	28 (28.0)	193 (18.9)
Camping/summer housing area	0 (0.0)	178 (17.4)
Golf course	0 (0.0)	166 (16.3)
Other attractions	29 (29.0)	154 (15.1)
Parks/other recreational areas	9 (9.0)	77 (7.6)
Health clinics	103 (5.6)	781 (4.6)
Support centre/other health clinics	53 (51.5)	390 (49.9)
General practitioner/dentist	48 (46.6)	359 (46.0)
Public and private hospital	2 (1.9)	32 (4.1)
Public building	116 (6.3)	641 (3.7)
Church/community centre	27 (1.5)	597 (3.5)
Hotels and conference venues	46 (2.5)	311 (1.8)
Transportation facility	33 (1.8)	179 (1.0)
Train station	32 (97.0)	114 (63.7)
Airport	0 (0.0)	48 (26.8)
Bus terminal	1 (3.0)	17 (9.5)
Other	128 (7.0)	1054 (6.2)

AED, automated external defibrillator.

AED registration, location type and accessibility on a nationwide scale

In 2007–2016, the total number of AEDs sold in Denmark increased from 3583 to 24 474 (66 to 429 AEDs/100 000 inhabitants), and the number of AEDs registered with the AED Network from 140 to 15 301 (3 to 268 AEDs/100 000 inhabitants). Thus, of the total number of AEDs sold, those registered increased from 4% to 63%. Concurrently, 24/7 AED accessibility of registered AEDs increased from 11.4% to 40.6% (Fig. 3).

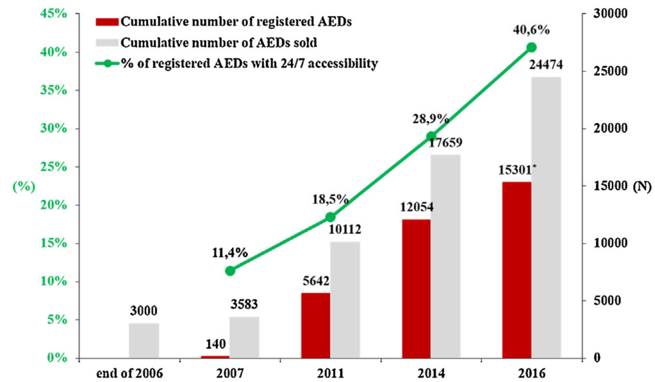

Fig. 3 – Cumulative number of all AEDs sold and registered within the nationwide Danish AED Network, and temporal changes in 24/7 AED accessibility.
***In total, 17 106 AEDs were registered with the nationwide network from 2007 through 2016, and 1805 (10.6%) of these were withdrawn during the study period (Table 3 in Ref.[20]).**
AED, automated external defibrillator; 24/7, 24 h per day, 7 days per week.

The most frequent locations for AED deployment on a nationwide scale were similar to those observed in Copenhagen (Table 2). Most newly registered AEDs/year were deployed at companies/offices, and few AEDs were deployed in residential settings, although a significant increase was observed near the end of the study period (Table 2 in Ref.[20]). AEDs deployed in residential settings had the highest 24/7 accessibility (86.4%, n = 1232/1426). 24/7 accessibility was lowest at the most frequent AED locations: companies/offices (18.2%, n = 802/4411), school/education facilities (30.2%, n = 572/1896), and sports facilities (39.2%, n = 550/1403 (Fig. 4).

Discussion

The chance of bystander defibrillation was tripled (13.8% vs. 4.8%) and 30-day survival almost doubled (28.8% vs. 16.4%), when the nearest AED was accessible, compared to inaccessible, at the time of OHCA in Copenhagen, and more than half of OHCAs covered by an AED lost coverage due to limited AED accessibility. The proportion of registered AEDs nationwide increased almost 16-fold (4% in 2007–63% in 2016), and the number of AEDs with 24/7 accessibility increased substantially during the same period. However, AED accessibility was highly dependent on AED location; the most frequent locations (offices, schools and sport facilities) had the lowest 24/7 accessibility, which greatly limits the potential of the EMS to refer to an AED. Our novel findings indicated that bystander defibrillation and 30-day survival are highly associated with AED accessibility at the time of OHCA, underscoring the importance of unhindered AED accessibility.[27]

Among bystander-witnessed OHCAs with a shockable heart rhythm, 39.8% received bystander defibrillation, when an accessible AED was located ≤200 m at the time of OHCA, compared to 20.3%, when the AED was inaccessible. A recent study from the United States found that only 18.8% of patients with public, witnessed OHCA and shockable heart rhythms received bystander defibrillation, and 66.5% of those defibrillated by bystanders survived to hospital discharge.[28]

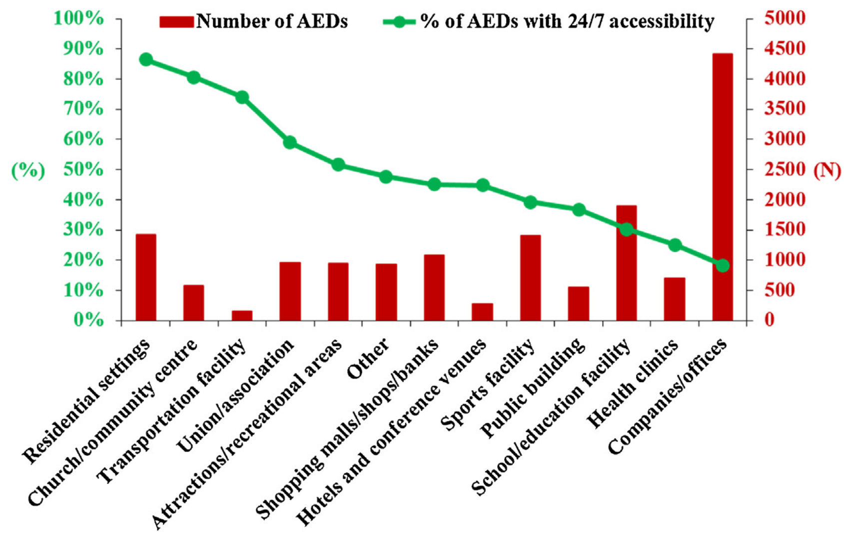

Fig. 4 – The nationwide number of registered AEDs and 24/7 accessibility, according to the type of location in 2016. AED, automated external defibrillator; 24/7, 24 h per day, 7 days per week.

Notably, in our study, 30-day survival rates reached 72.7%, when patients with a witnessed OHCA and shockable heart rhythm were covered by an accessible AED; consistent with the highest observed survival rates previously reported in public access defibrillation studies.[2,12] Our findings indicate that improving AED accessibility and linkage to emergency dispatch centres holds potential for increasing the rates of bystander defibrillation and survival after an OHCA. The highest survival rates after an OHCA have been observed in environments where AEDs were accessible 24/7[1,2]; consequently, the issue of limited AED accessibility has become highlighted,[4,10,11] but not emphasized, in the latest international guidelines.[6,7] Hence, future guidelines should consider including this important aspect of AED implementation.

After the implementation of the AED network and efforts to increase AED registration and accessibility, we observed a significant increase in the proportion of AEDs with 24/7 accessibility, which overall indicates that those efforts were relatively successful. However, AED location types covering the highest proportion of OHCAs in Copenhagen, had the highest coverage loss, due to limited accessibility (>50%). This information could provide a basis for targeted campaigns that aim to increase 24/7 AED accessibility, which would ultimately improve AED coverage of OHCAs. Other strategies, such as mathematical optimization models for strategic AED deployment, also seem promising, but remain to be tested in practice.[11]

A previous study from Denmark found that the proportion OHCAs that were defibrillated by bystanders in public locations increased significantly from 1.2% to 15.3% (2001–2012), but defibrillation in residential settings remained low (around 1%).[13] In our study, only 8.9% of all nationwide AEDs were deployed in residential settings, where the majority of OHCAs occur.[13] However, AED deployment in residential settings increased during the study period, and in 2016, it was the location with the highest proportion of 24/7 accessible AEDs. Deployment of AEDs in homes of individuals at high-risk of OHCA has not been shown to improve survival.[29] More promising results on AED use in residential settings have been reported with an alert-system sending text messages to nearby bystanders.[30] Deploying AEDs within a residential area, rather than at a specific home, combined with such systems may be a promising strategy for increasing bystander defibrillation in residential settings. Importantly, the greatest benefit of those systems relies on information about the locations and accessibility of AEDs, linkage to emergency medical dispatch centres, and high AED accessibility; all these factors were shown to be important for improving bystander defibrillation.

We found a 16-fold increase (between 2007 to 2016) in the proportion of total AEDs sold that were registered and accessible to emergency medical dispatch centres in Denmark. The proportion of registered/sold AEDs was previously only estimated in Sweden (36% in 2013).[12] In Denmark (end of 2016), there were 429 AEDs sold/100 000 inhabitants (including registered and unregistered AEDs). However, increasing AED sales does not necessarily lead to a substantial increase in AED use. A high number of AEDs were sold in Japan (>500 000) without an AED registry link to the emergency medical dispatch centres; thus, <1% of all cardiac arrests were defibrillated before EMS arrival.[16,31] In the United States, one common, effective strategy for identifying and locating AEDs in the community has been "crowd sourcing".[32] However, that strategy does not necessarily establish the AED's location, accessibility to an emergency medical dispatch centre, or viability for use (batteries, electrodes etc.). Thus, AED use could remain random, and low use rates could persist, despite high sales.[17]

Limitations

First, this study was limited by its observational nature. Thus, our results regarding the relationships between AED coverage, accessibility, bystander defibrillation, and survival were only associations, not causal. We could not be sure that the nearest accessible AED located ≤200 m was the AED that was used for bystander defibrillation. We only had information on the geographical location for registered AEDs and OHCAs, and no data on whether a bystander used a specific AED. Second, data on the exact geographic locations of OHCAs on a nationwide level were not available. Thus, we could only investigate loss of AED coverage for nearby OHCAs in Copenhagen. However, the distribution and accessibility of registered AEDs were similar in Copenhagen and nationwide. Moreover, consistent with Copenhagen data, recent nationwide studies have reported a low proportion of AEDs placed in residential settings and low rates of bystander defibrillation in those settings.[13] Third, information on AED location and accessibility was only available for AEDs registered in the Danish AED Network; unregistered AEDs were not validated, regarding location, accessibility, or functionality. This limitation was not likely to impact our results substantially, because unregistered AEDs were not linked to emergency medical dispatch centres, and they were not visible to the public; therefore, they were less likely to be used.[12] Finally, during the collection of AED sale numbers we cannot exclude that parallel import may have occurred. However, according to direct communication with the AED vendors in Denmark, parallel import of AEDs is currently very limited.

Conclusions

The chance of bystander defibrillation was tripled, and 30-day survival almost doubled, when the nearest AED was accessible, compared to inaccessible, at the time of OHCA. These findings underscored the importance of unhindered AED accessibility and linkage to emergency dispatch centres for improving rates of bystander defibrillation and patient survival following OHCA.

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Conflicts of interest

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