Resuscitation 125 (2018) 90–98

Contents lists available at ScienceDirect

Resuscitation

journal homepage: www.elsevier.com/locate/resuscitation

Clinical paper

Survival after out-of-hospital cardiac arrest in nursing homes – A nationwide study

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ARTICLE INFO

Keywords:
Out-of-hospital cardiac arrest
Resuscitation
Survival
Nursing home
Defibrillation

ABSTRACT

Background: Survival among nursing home residents who suffers out-of-hospital cardiac arrest (OHCA) is sparsely studied. Deployment of automated external defibrillators (AEDs) in nursing home facilities in Denmark is unknown. We examined 30-day survival following OHCA in nursing and private home residents.

Methods: This register-based, nationwide, follow-up study identified OHCA-patients ≥18 years of age with a resuscitation attempt in nursing homes and private homes using Danish Cardiac Arrest Register data from June 1, 2001 to December 31, 2014. The primary outcome measure was 30-day survival. Multiple logistic regression analyses were used to assess factors potentially associated with survival among nursing and private home residents separately.

Results: Of 26,999 OCHAs, 2516 (9.3%) occurred in nursing homes, and 24,483 (90.7%) in private homes. Nursing home residents were older (median 83 (Q1–Q3: 75–89) vs. 71 (Q1–Q3: 61–80) years), had more witnessed arrest (55.4% vs. 43.4%), received more bystander cardiopulmonary resuscitation (CPR) (49.7% vs. 35.3%), but less pre-hospital defibrillation (15.1% vs. 29.8%). Registered AEDs increased in the period 2007–2014 from 1 to 211 in nursing homes vs. 1 to 488 in private homes. Average 30-day survival in nursing homes was 1.7% [95%CI: 1.2–2.2%] vs. 4.9% [95%CI: 4.6–5.2%] in private homes ($P < 0.001$). If bystanders witnessed the arrest, performed CPR, and pre-hospital defibrillation was performed, 30-day survival was 7.7% [95%CI: 3.5–11.9%] vs. 24.2% [95%CI: 22.5–25.9%] in nursing vs. private home residents.

Conclusions: Average 30-day survival after OHCA was very low in nursing home residents, but those who received early resuscitative efforts had higher chance of survival.

Introduction

Nursing home residents are often of high age and have significant comorbidity burden [1–4]. As a consequence, it is often debated whether resuscitative efforts and placement of automated external defibrillators (AEDs) in nursing homes are futile [5–9]. Nursing homes are often located in community centers with 24/7 accessibility. Placement of AEDs in nursing homes can potentially benefit both nursing home and private home residents, as well as out-of-hospital cardiac arrests (OHCAs) occurring in public.

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https://doi.org/10.1016/j.resuscitation.2018.02.004
Received 2 December 2017; Received in revised form 28 January 2018; Accepted 5 February 2018

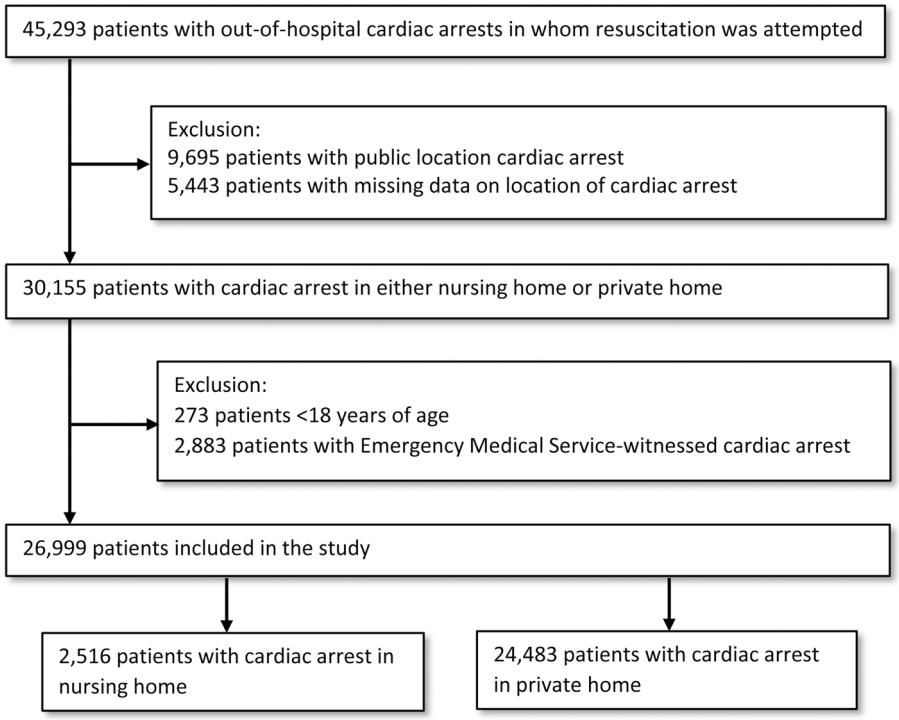

Fig. 1. Selection of the study population.

During the past decades, a shift has been made towards treating serious illnesses in the very old, offering intensive care treatment and invasive medical treatments to patients above 80 years of age [10,11]. Increasing age is associated with lower 30-day survival after OHCA [1–4,12,13]. In Denmark, 30-day survival after OHCA among patients ≥80 years was 2.0% by 2011 [1], and failed to increase significantly despite increasing bystander cardiopulmonary resuscitation (CPR) [1,14–16].

Survival after OHCA in nursing homes is not reported on a nationwide scale. Older studies report similar survival rates between nursing home residents and persons living in the community [7,17,18]. Recent studies from Osaka, Hong Kong, and Copenhagen report 30-day survival rates from 0.3% to 9% [12,19,20].

Using Danish national administrative registries, we aimed to examine survival after OHCA in nursing homes in relation to private residential locations during 2001–2014. Although nursing home residents differ from patients in residential areas regarding demographic and clinical characteristics, they are more comparable than OHCA-patients in public locations [21]. In recognition of the differences between nursing home and private home residents, we analyzed the data from the two locations separately, analyzing factors associated with survival in each location. Following recent AED dissemination in Denmark, we assessed annual changes in newly registered AEDs in nursing homes and residential locations during 2007–2014 to put defibrillation rates in context to AED coverage in nursing home and other private locations. Finally, we examined 30-day survival in an optimized scenario where bystanders witnessed the arrest, performed CPR, and bystanders and/or Emergency Medical Services (EMS) personnel delivered pre-hospital defibrillation. We compared the results to the opposite worst-case scenario (unwitnessed arrest, no bystander CPR, and no pre-hospital defibrillation), since these factors are commonly used in clinical practice when considering termination of resuscitation [9].

Methods

Study setting

Nationwide OHCA-data between June 1, 2001 and December 31, 2014 was used. The Danish population consisted on average of 5.6 million inhabitants. The OHCA incidence rate was 59 per 100.000 citizens in 2014 [16,22]. The EMS-system is tax-financed and dispatched to all emergencies, including OHCAs, covering the entire country. Ambulances staffed with emergency medical technicians and paramedics are able to perform basic and advanced life support. The EMS personnel are obliged to initiate resuscitation, except cases with obvious signs of death or if patients have an active Do-Not-Attempt-Resuscitation (DNAR)-order. To terminate resuscitation in cases without DNAR-orders, EMS personnel are legally required to consult the emergency physician. Mobile emergency care units staffed with a physician or paramedic can rendezvous with the ambulances. Resuscitation treatment was given in accordance with latest international guidelines at the given time throughout the study period [23,24].

Mandatory CPR-training was implemented in elementary schools in 2005, and when acquiring a driver's license in 2006 [14]. Dispatcher-assisted CPR was provided when contacting the emergency medical dispatch center in the greater Copenhagen Area in 2009, and extended to a national level in 2011. The first publicly accessible AED was registered in the Danish AED Network in 2007, and since 2011, bystanders were able to locate the nearest registered AED using a free smartphone application, or when calling the emergency medical dispatch center [25–27].

Recording of OHCAs

The Danish Cardiac Arrest Register [16] covers OHCAs where bystanders (layperson or healthcare worker) and/or EMS personnel initiate a resuscitation attempt, except cases with obvious signs of death. By contractual agreement, EMS personnel are obliged to complete a short case report form for every OHCA making case ascertainment close to complete.

Study population

We included patients with OHCA in nursing homes and private homes. We excluded patients with OHCA occurring in public or unknown locations, patients < 18 years of age, and EMS-witnessed arrests.