Current Problems in Cardiology 49 (2024) 102484

Contents lists available at ScienceDirect

Current Problems in Cardiology

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

Invited Review Article

Health inequalities in cardiopulmonary resuscitation and use of automated electrical defibrillators in out-of-hospital cardiac arrest

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ARTICLE INFO

Keywords:
OHCA
CPR
AED
Health inequalities

ABSTRACT

Out of hospital cardiac arrest (OHCA) outcomes can be improved by strengthening the chain of survival, namely prompt cardiopulmonary resuscitation (CPR) and automated external defibrillator (AED). However, provision of bystander CPR and AED use remains low due to individual patient factors ranging from lack of education to socioeconomic barriers and due to lack of resources such as limited availability of AEDs in the community. Although the impact of health inequalities on survival from OHCA is documented, it is imperative that we identify and implement strategies to improve public health and outcomes from OHCA overall but with a simultaneous emphasis on making care more equitable. Disparities in CPR delivery and AED use in OHCA exist based on factors including sex, education level, socioeconomic status, race and ethnicity, all of which we discuss in this review. Most importantly, we discuss the barriers to AED use, and strategies on how these may be overcome.

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https://doi.org/10.1016/j.cpcardiol.2024.102484

Available online 23 February 2024

Background

Out-of-hospital cardiac arrest (OHCA) is defined as "the cessation of mechanical activity and the absence of signs of circulation" occurring outside of the hospital setting.[1] The majority of OHCAs occur at home, with the data from English ambulance services showing 80% occurring at a place of residence and around 12% occurring in a public place".[2]

OHCA is a major cause of mortality worldwide, with a high incidence and low survival rate.[3] Prompt cardiopulmonary resuscitation (CPR) and automated external defibrillator (AED) use are major contributors in the "chain of survival" for OHCA.[4] The chain includes 4 steps (Supplementary Fig. 1).[5,6] The first three of four steps in this chain occur within the community setting, hence, the response of a community plays a key role in determining the outcomes in OHCA.[6] Immediate provision of CPR can increase survival rates by up to four times, and AED use within three to five minutes can improve survival rates by 50-70%.[7] The outcomes of OHCA are affected by health inequalities in bystander CPR and AED use, due to factors such as differences in sex, ethnicity, and socioeconomic status amongst others.[8] In this review, we discuss the health inequalities due to population and neighbourhood characteristics impacting bystander CPR, AED use and the outcome of OHCA, why these exist and potential strategies to overcome these; this will allow better planning and development of the optimal strategies to improve OHCA survival rates and reduce disparities.

OHCA, CPR, and AED use in the UK

In the UK, the incidence of OHCA is 55 per 100,000 people annually. Bystander CPR is reported to be attempted in 7 out of 10 cases of OHCA, whilst public AED use is seen in less than 10% of cases.[9] The distribution of CPR provision in the UK across regions can be seen in Fig. 1a, with AED use seen in Fig. 1b and the number of AEDs per region in the UK in Fig. 1c. According to the Resuscitation Council UK (RCUK), in 2018 only 59% of the UK adult population had received training on CPR and only 19% in AED use.[9]

Health inequalities in OHCA

Health inequalities are defined as differences in the care and opportunities people receive to lead healthy lives.[8] The immediate community response to cardiac arrest is critical, and relies on early recognition, early CPR by bystanders, and early defibrillation using an AED.[8] Inequalities in pre-hospital care can be classified based on either patient characteristics or bystander characteristics. Population characteristics which have been identified to influence CPR and AED delivery include factors such as their sex, ethnicity,

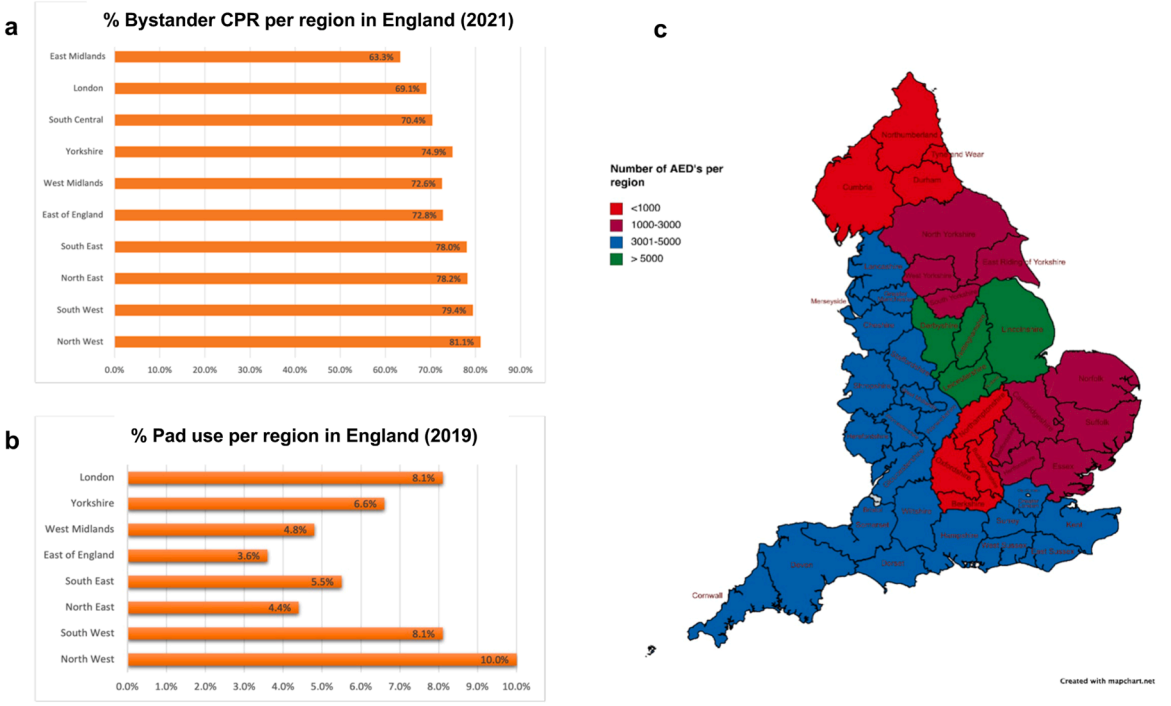

Fig. 1. *CPR and AED disparities in the UK* a) shows percentage of bystander CPR per region in England.[65] b) % AED Pad use in England per region.[65] c) Number of AEDs per region in the UK.[66] The figure has been created using data from Warwick Clinical Trials Unit's ambulance service map. The ambulance service map showed that the highest percentage of bystander CPR as well as pad use was in the Northwest of England.[65] Data from Brown et al., showed disparities in the location of AEDs in the UK, c) shows the highest number of AEDs in the East Midlands region and the lowest in the North of England.[66]
Original figures created using Microsoft Excel

socio-economic background, and age.[10] Factors influencing bystander response to OHCA include bystander education level, and neighbourhood characteristics such as deprived versus affluent communities, Black versus Caucasian communities and rural versus urban neighbourhoods.[10,11] Literature shows patients from lower socio-economic backgrounds are more likely to have risk factors for a cardiac arrest and are therefore more likely to have OHCA.[12] Ji et al. created risk prediction models looking at OHCA outcomes in England, which showed that location and socioeconomic status (measured using index of multiple deprivation scores) influenced survival outcomes.[13,14] Data from United States based Cardiac Arrest Registry to Enhance Survival (CARES), from 2013 to 2017 found that compared with high income neighbourhoods, those in low-income neighbourhoods were 12% less likely to survive to hospital discharge with OHCA (adjusted OR 0.88; 95% CI 0.83-0.94; P<0.001).[15] Closely interlinked with socioeconomic background is the geography of different regions, particularly when comparing urban to rural areas and the disparities that may exist between them. It is well known that emergency medical services (EMS) response times are longer in rural areas than urban areas.[14,16]

We will now discuss literature surrounding different health inequalities in CPR and AED use due to population and neighbourhood characteristics in more detail.

Sex differences

Multiple studies have been performed in analysing sex-based outcomes for individuals with OHCA. A meta-analysis by Feng et al., assessed sex differences and survival after OHCA, including data from 23 studies.[17] The meta-analysis showed an 8% increased likelihood of survival in females when compared to males (OR = 1.08, p<0.05, I2 = 52.3%), despite a 7% lower rate of bystander CPR provided to female OHCA victims (RR = 0.93, 95% CI: 0.88–0.98, p <0.05), highlighting a disparity in bystander response.[17,18] The meta-analysis demonstrates that sex disparity in bystander responses to OHCA exists and that females stand to benefit more from bystander CPR but appear to be receiving the intervention less.[17] However, this may be due to females experiencing OHCA less than males; this is substantiated by ambulance data that shows 66% males versus 34% females with OHCA.[2,17] Studies have also reported lower rates of bystander AED use in females compared to males. A study published by Grunau et al, analysed data from the Resuscitation Outcomes Consortium registry (2011–2015). It showed that 34% of OHCA occurred in females and they were 24% less likely to have an AED used in an OHCA (adjusted OR 0.76, 95% CI 0.64-0.90).[19] Reasons for the lower CPR and AED use rates in the female population may be related to several factors. Studies have found that women are less likely to experience OHCA in a public area where bystanders for CPR and AEDs would be present. Grunau et al. found that women were more likely to have OHCA in residential areas and non-acute healthcare institutions, and AED use in these settings for female were only 12% and 43% respectively.[19] In addition, lower rates of CPR and AED could be due to the fear of exposure of a females' breasts in public. In a questionnaire completed by participants at CPR training events, it was reported that 14.1% of participants were concerned about exposing the female patient, or concerns that the patient's breasts could interfere with CPR. 60% participants also reported being concerned about being accused of sexual assault. The results from the survey could have been affected by lack of participant experience in CPR as 96% had no prior experience.[20] Moreover, the sex differences may also be explained due to lack of female mannequins and actors available for CPR training. In the US, Canada and Switzerland, there has been growing use of female mannequins or vests to try to combat this issue.[21]

Sex disparities in bystander CPR and AED, along with the concerns raised by CPR training participants, highlight the need for refinement of the current Basic Life Support training to tackle the concerns driving differences in CPR and AED delivery for females as well as improving availability of AEDs.[17,22] The higher survival rates of OHCA in women overall suggests that if CPR and AED were appropriately delivered then a larger number of females experiencing OHCA could survive.[2,17] In countries where religious attire, such as modest Islamic dressing for females is more common, it is yet to be investigated whether this would have an impact on disparities between sexes in bystander CPR provision and AED use and subsequently survival from OHCA.

Socioeconomic differences

Lower rates of CPR have been associated with lower income neighbourhoods. The CARES data shows that compared with high income neighbourhoods, those in middle-income neighbourhoods were 12% (adjusted OR 0.88; 95% CI 0.85-0.92; P<0.001) less likely to receive CPR, whereas those in low-income neighbourhoods were 33% (adjusted OR 0.67; 95% CI 0.64-0.70; P<0.001) less likely to receive bystander CPR. Even after adjustment for CPR, compared with high-income neighbourhoods, those in middle-income (adjusted OR 0.90; 95% CI 0.86-0.95; P<0.001) and low-income (adjusted OR 0.90; 95% CI 0.85-0.96; P=0.001) neighbourhoods were both 10% less likely to survive to discharge.[15]

In addition, a study by Huebinger et al. showed that lower income was associated with a lower rate of bystander CPR and survival to hospital.[23] They also found that high unemployment was associated with lower rate of bystander CPR and AED use. Although, the study highlights the impact of socioeconomic background on bystander CPR and AED use, there may be an element of selection bias leading to limited external validity as it uses Texas-CARES data from 13 emergency service agencies that provide care to only roughly 30% of the state population in the USA.[23]

Uny et al. suggested that lower rates of CPR in deprived communities may be associated with lower levels of confidence in performing CPR which may be affected by cultural barriers.[11] An explanation for lower bystander CPR rates in deprived communities may be explained by differences in CPR training.[11]

Weiner et al., showed that alongside income other socioeconomic factors such as English being the first language were associated with patients more likely to be trained in CPR and recognise AEDs.[24] Targeting deprived areas with tailored training and access to AEDs can be beneficial in improving CPR outcomes in those communities. Disparities in CPR training often overlap between factors such as being from ethnic minorities and socioeconomic status. Additionally lower survival and inequalities in AED use in lower

socioeconomic areas can be related poorer public access to defibrillators.[25] Burgoine et al., found that there are differences in distances to nearest accessible 24/7 AED, between the most and least deprived communities. They found that, a 24/7 AED in England and Scotland were at least 99.2 m and 317.1 m, respectively, away in the most deprived than least deprived communities.[25]

Urban versus rural geographical area differences

Bystander CPR in urban areas has been associated with increased patient survival rates, whilst in rural areas it was shown to provide limited benefit, perhaps due to the delayed response times.[26] Interestingly, the CARES census review in 2022 found that bystander CPR rates were 15.4% higher in rural areas compared to urban areas. Meanwhile, bystander AED use was similar in both urban and rural areas but overall low, ranging from 10-13%.[27] The difference could be due to a higher proportion of patients being home alone in urban areas compared to rural areas and as we know most OHCA occur at home rather than in public areas.[2] Interestingly, the same study showed that AED use was strongly associated with OHCA survival rates in rural areas despite AED devices being less readily available in these areas, hence if AED training was further improved in such areas, higher OHCA survival rates could be achieved. This suggests there are lower rates of bystander CPR in urban areas and highlights the real need in educating more individuals especially from a public health perspective in how to perform CPR and use an AED, as more people are likely to be in attendance of an OHCA in urban areas than rural ones. Other reasons of disparities between urban and rural regions in CPR rates could be due to the greater social network in close-knit rural communities compared to those in urban areas thus residents may be more willing to provide CPR; there is currently limited evidence to support this and further studies exploring differences in attitudes and willingness to perform CPR in urban and rural regions need to be carried out.

Chen et al. found that a greater proportion of residents in urban areas continue CPR until the arrival of Emergency Medical Services (EMS) compared to residents in rural areas.[28] This highlights a key need for education on the duration of bystander CPR in rural areas where EMS response times are longer.[28]

Bystanders in urban settings appear to be more confident in performing bystander CPR when they can perform dispatcher-assisted CPR.[28] Dispatcher-assisted CPR allows emergency service staff to guide and instruct a bystander on exactly what to do for CPR over the telephone when they are called and whilst awaiting EMS to arrive, thus, highlighting the importance of education and support in the delivery of bystander CPR.[28]

Race and ethnicity differences

Disparities exist in receiving CPR and use of AED based on the race and ethnicity of the patient with those in ethnic minorities in Western countries being adversely impacted. Garcia et al. found that the odds of receiving bystander CPR in Black and Hispanic individuals at home were 26% less and in public locations 37% less compared to White individuals.[29] Interestingly, the incidence of bystander CPR was lower in Black and Hispanics individuals at home and in public compared to White individuals in predominantly White neighbourhoods, majority Black neighbourhoods as well as integrated neighbourhoods.[29] The study is significant and shows that Black and Hispanic individuals in the United States are less likely than White individuals to receive lifesaving CPR at home and in public locations, regardless of racial and ethnic demographics or income level of the neighbourhoods.[29] Similarly, Toy et al., found that bystander CPR rates were 60% and 67% in Black/Hispanic and White groups, respectively. The odds of receiving bystander CPR was lower in Black/Hispanic groups compared to White groups both in the home (adjusted OR 0.77) and in public (adjusted OR 0.69) regardless of neighbourhood income level, socioeconomic status and urban-rural locations.[30]

Sasson et al. showed that there was a 23% higher rate of bystander CPR in non-Black neighbourhoods compared Black neighbourhoods. When income was combined with racial majorities of the areas, the rates of bystander CPR were lowest in low-income Black neighbourhoods and highest in high income White neighbourhoods.[31] In addition, Starks et al. found that the proportion of patients receiving bystander CPR or AED use was inversely associated with the proportion of Black residents within a neighbourhood.[32] They also found that patients experiencing OHCA in mixed or predominantly Black neighbourhoods had lower adjusted survival rates to discharge from hospital when compared to White neighbourhoods.[32] Moreover, Naim et al., showed that even in paediatric cases, when compared to White children, bystander CPR rates were 10.3% lower in Hispanics and 17.6% lower in Black children ($p<0.001$).[33]

A large disparity in provision of bystander CPR as well as survival rates in the Black population and predominantly Black neighbourhoods exists, even when adjusted for income, socioeconomic background, and urban-rural locations. Reasons for such a large difference could be due to limited training in CPR delivery and AED use in Black and Hispanic communities, suggesting a potential target for education of this group.[33] Other reasons include potential structural racism and implicit bias in communities leading to reduced investment and provision of resources such as training and AED placement.[29,34] Language barrier can also pose a barrier to performing bystander CPR.[35] The disparity in Black and Hispanic individuals in rates of CPR provision suggests that a wider scale public health response and intervention is required in addressing the poorer outcomes of OHCA by increasingly training opportunities. Providing targeted education in the native language of individuals on CPR and AED use may also reduce barriers to learning. Currently there is limited evidence for disparities in other ethnic minorities such as South Asian communities in the UK and USA, which requires further research. In addition, the role of providing CPR training in native language of individuals and its impact on rates of delivery of CPR and survival from OHCA also needs to be explored further.

Level of education differences

There is some association between level of education and bystander CPR. Owen et al. showed that higher levels of attainment were associated with an increased likelihood of AED training.[36] A study by Li et al., showed individuals from lower socioeconomic backgrounds had poor knowledge of bystander CPR which was improved by training.[37] Consistently, a study by Bray et al., showed that areas with lower levels of CPR education and training were associated with lower levels of bystander CPR and survival.[38]

In a study by Aldulhaye et al., a higher level of education was associated with a higher probability of receiving CPR training, with Masters and Doctoral graduates having an 8-times higher likelihood of being trained when compared to those having less than high school completion ($p<0.001$).[39] The results from this study could explain the inequalities in CPR use as those who are less educated may be less likely to use AEDs and perform CPR.[38,39] Additionally, given the association between education level and socio-economic status, there is likely to be significant overlap between the two factors. Education levels have also been related to survival post-CPR in OHCA.[40] Jonsson et al., showed evidence for higher educational levels being associated with increased 30-day survival after OHCA.[40]

Overall, most studies indicate lower levels of CPR education and training are associated with lower rates of out-of-hospital CPR rather than the level of education at an individual level.[36–40] However, further research needs to be conducted to show how individual attainment levels and IQ can affect one's ability to perform CPR. Further research also needs to be conducted on whether there are inequalities in CPR provision and AED use in patients with learning difficulties and if that subsequently affects OHCA outcomes in these patients.

Age differences

Due to the physical nature of CPR manoeuvres, age and frailty of the patient can both impact the outcome of the resuscitation, as well as the likelihood for a bystander to begin CPR. A study by Hawkes et al., showed the mean age of patients with OHCA was 68.6 years.[41] As physiological reserve declines with age, survival rates after OHCA were also found to be lower in older victims.[42] Oh et al., suggested that lower survival rates in OHCA could be explained by a combination of increasing frailty, declining cerebral performance score and worsening of comorbidities, which are expected to change with increasing age.[43]

In a study by Libungan et al., it was noted that patients aged 70–79-year-olds had 30-day survival rates of 6.7%, 80-89 years olds 4.4%, and those 90 years or older had a survival rate of 2.4% following an OHCA.[44] Marcus et al., found that survival outcomes for OHCA were better for patients between 18-80 years-old than for patients over 80 years-old at any given time point, including on hospital discharge and late follow-up. They also concluded that patient independence in daily living activities before the arrest was a significant determinant to the outcome of resuscitation, with each additional point in the activities of daily living score, suggesting deteriorating independence, being associated with a 5.8% increase in mortality (HR 1.058 [1.043-1.074]).[45] However, in this study, it is not clear whether patients were stratified by ethnicity, as outcomes in the Jerusalem District have been noted to be worse in Palestinian Arabs compared with the Jewish population.[46]

Other studies have concluded that age can be an independent predictor of prognosis. Terman et al., found that age rather than burden of co-morbidities was associated with poorer prognosis after OHCA; age was found to be associated with favourable neurological outcomes rather than comorbidity index.[47]

Interestingly, the decision for a bystander to perform CPR has also been noted to vary depending on age. Weinmeister et al., found that the rate of dispatcher-assisted bystander CPR in paediatric population was 19% compared to 9% in patients above 55 years old; this highlights an inequality in CPR delivery based on age. However, this may be partly due to higher likelihood of a parent or guardian in the case of paediatric group. The results may have been affected by differences between the communities providing the CPR-dispatcher information and the accessibility to dispatcher-assisted CPR as the difference between the location of OHCA in paediatric and patients above 55 years was not recorded.[48]

Interestingly, Kim et al., demonstrated that cardiac arrest recognition was greatest in children under the age of one, whilst children aged 7-18 were associated with a delay in recognition.[49] The results can potentially be explained by the closer supervision from parents and carers at a young age, along with the lower threshold to raise concern. Moreover, Wiel et al., found significantly less basic life support initiation, shorter advanced cardiac life support duration, less use of automated chest compressions, lower rates of ventilation and lower rates of epinephrine injection given by mobile medical teams (MMT) in the community in patient's over 65 years compared to patient's compared to younger patients; the authors attributed this to the lower rates of survival in over 65-year-olds. However, from the study the reasons behind decisions of the MMT is unclear and whether comorbidities and futility of CPR were considered when deciding to initiate BLS.[50]

In a survey conducted at a CPR training event by Beckar et al., the most common factor affecting the decision to start CPR in a geriatric patient was a concern that it may cause injury to the patient; it was reported by 63% of the participants when considering CPR in a geriatric patient, compared to 51% when considering CPR on an adolescent.[20] This suggests a potential target for public education on the importance of CPR in preserving life and balancing this with the individuals' pre-existing wishes for resuscitation and the risk of futility or harm.

In most studies discussed above it is unclear, whether any of the patient's over 65 years had a community DNACPR in place as that would affect the decision to perform CPR in the geriatric population. We also do not know whether over factors such as comorbidities, ethnicity and socioeconomic factors were adjusted. Further research needs to be carried out to fully understand if age is an independent factor affected CPR and AED use in the geriatric population.

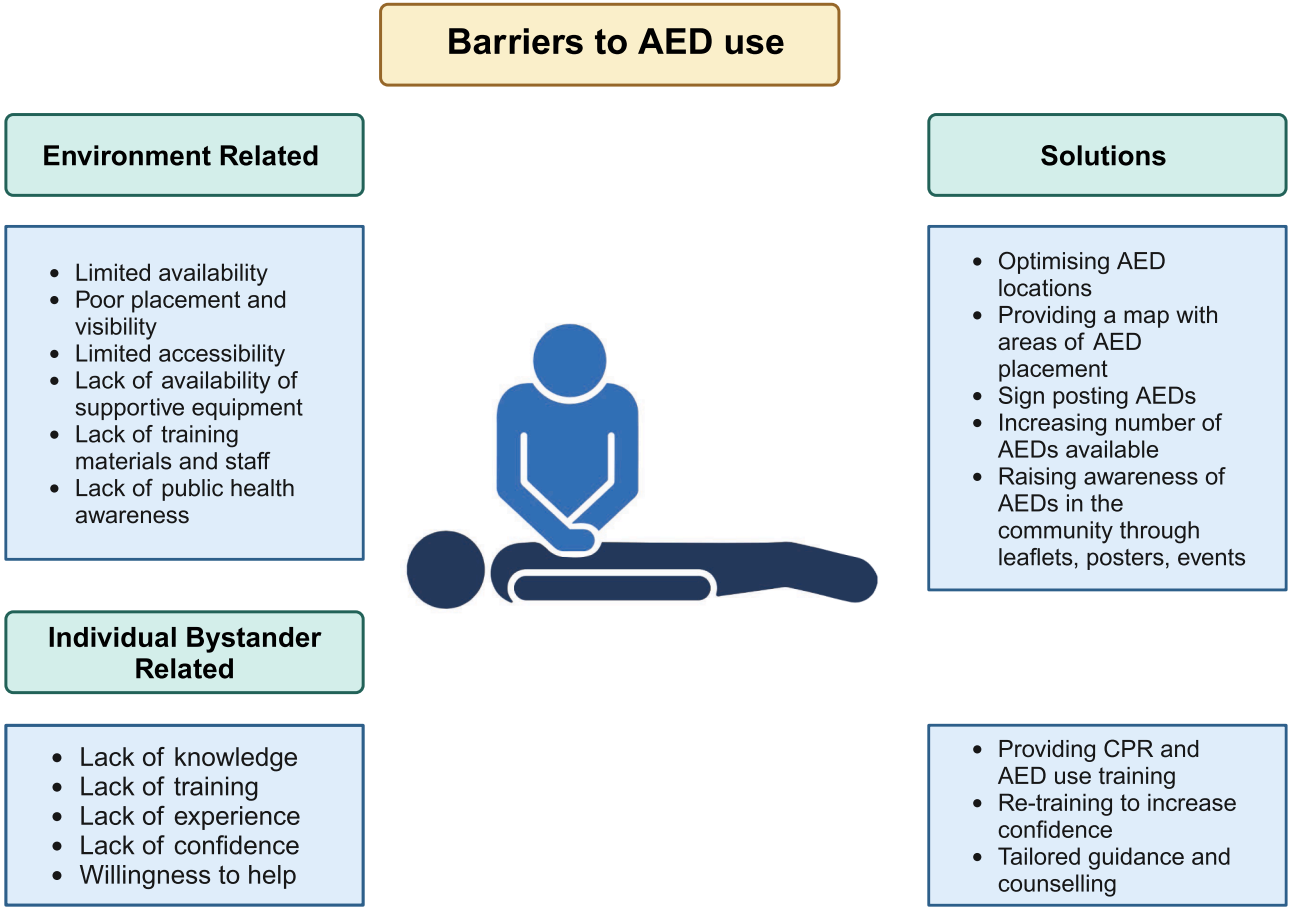

Fig. 2. Barriers to bystander CPR at the different levels of the 'chain of survival' with potential solutions.[11,12,20,21,24,30,31,35,37,39,42,48,51,52,62]

Barriers to CPR and AED use- what are the solutions?

There are several potential barriers to delivery of bystander CPR including fear of transmission of disease, fear of litigation, causing injury and lack of confidence. Fig. 2 highlights the potential barriers to CPR delivery and possible solutions. Bouland et al., showed that providing CPR training led to a significant decrease in barriers such fear of litigation, disease transmission and causing injury in bystander CPR provision to strangers and family.[51]

Dwyer et al., found that confidence was a key determinant in individuals performing bystander CPR. They found that individuals over 65 were least likely to have received training in CPR and were the least confident. They found that individuals who did not feel confident in performing CPR had concerns about failing or performing it incorrectly.[52] Moreover, a systematic review by Uny et al., found that although individuals from lower socioeconomic backgrounds were willing to learn CPR, it was lower than those from other socioeconomic backgrounds; this could be attributed to potential financial barriers related to cost of attending training, difficulties finding transports and lack of motivation due to CPR training not being a job requirement. They also found that risk to personal health and safety, fear of litigation, lack of community cohesion and cultural barriers were also significant in a bystander receiving CPR in OHCA and these were more prevalent in deprived communities.[11]

The survival in OHCA can be affected by inequalities in bystander CPR but also AED use in the community. Barriers to AED use is a key factor that needs to be considered in OHCA. In Fig. 3, we provide an overview of the key barriers found to influence AED use in the community when responding to an OHCA and potential solutions to address these.

Environmental factors affecting AED use include availability, visibility, accessibility, support, extra equipment, training materials, staffing, and awareness. Individual factors which may influence a bystander's choice to use an AED include level of knowledge, training, experience, confidence, and willingness to help. Dobbie et al., found that confidence level was a significant barrier to AED use, especially in more deprived communities. They found that lower self-esteem levels influence individual's ability to use an AED with a common understanding that only trained individuals or health professionals are allowed to perform CPR. They also found that communities with a lower income were less likely to receive training in CPR and AED use as their priorities were focused on daily living, rather than learning CPR. The study provides a target for public health education in CPR in individuals from lower socio-economic background.[12]

Staerk et al., investigated barriers to successful use of AEDs. They found that people were more successful in using an AED if they had been recently trained, had previous experience using an AED, or had good leadership skills.[53] They suggest that regular training, retraining and non-technical skills are vital in AED use. Moreover, Lee et al., also highlighted how retraining to maintain knowledge of

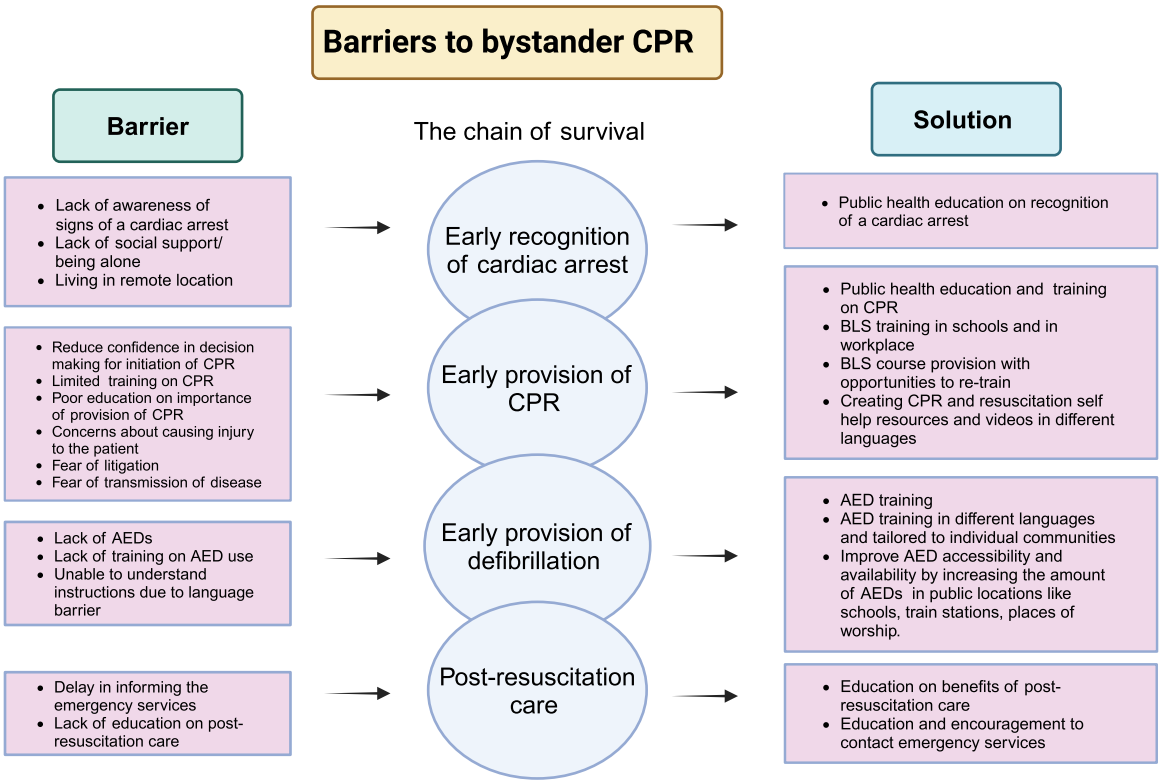

Fig. 3. Potential barriers to Automated external defibrillator (AED) use and solutions.[20,31,34,35,37,38,51,53,56,57,61,66] There are both environment and individual bystander related barriers to AED use which can be overcome by introduction of targeted local strategies described in the diagram. Original diagram created using Biorender.com.

AED use is imperative for success.[54]

Delhomee at al., found that rates of AED use can be improved by optimising AED locations and the number of AEDs deployed. They found that factors affecting AED use were unable to identify their location, poor regulation, and reliability of the devices. Ways to improve this included placing AEDs at more recognisable locations such as at bike hubs and schools and places of worship and ensuring they are accessible to the public.[55] Several countries have also developed dispatcher-assisted AEDs, these allow notification of the location of the nearest AED device via text when help is sought. They have also suggested the use of drones to deliver AEDs at the site of emergency, which may be particularly beneficial in rural settings.[56] Key reasons for lower rates of AED use by bystanders were limited knowledge about AED use, feeling uncomfortable to use it, as well as fear of causing harm either to the patient or to themselves; this again highlights the need for population education to mitigate misconceptions about AED use.[56]

Burgoine et al. showed that the distance to the nearest 24/7 access to AED was increased with socioeconomic deprivation, and a 24/7 AED was 99.2 m and 317.1 m further away in the most deprived than least deprived communities in England and Scotland, respectively.[25] They highlight the importance of targeting these socioeconomically deprived areas for AED placement. Economic modelling of AED programmes in schools with 24/7 a week access to an AED has shown quality-adjusted life years (QALY) of 0.26 additionally, in cardiac arrest survivors compared with no AED programme and have been shown to be cost effective.[57]

Locating AEDs in public libraries, shopping malls, trains stations, community centres especially in socioeconomically deprived areas and allow 24/7 AED access is key; this could help to improve rates of AED use and hence survival of OHCAs. Other strategies involve more equitable placement of AED; this can be improved through use of national AED registers where ambulance services are able to locate the nearest possible AED and can provide bystanders with the nearest location. Registering AEDs on national databases such as the Circuit in the UK, would allow accurate recording of AEDs and assist in wider availability to the public.[58] Locations can also be made available on apps with mapping functionality for the public and bystanders such as the GoodSAM app.[59] Moreover, increased availability of AEDs in areas where they are lacking, particularly those areas with high OHCAs, could further help to increase AED use.[2] Use of drones in AED placement has been shown to be cost effective, these could be used to target socioeconomically deprived areas.[60] Mathematical models to find optimal AED locations has also shown to improve OHCA outcomes and can help to improve coverage in socioeconomically deprived areas.[61]

Strategies to overcome health inequalities

Robust public health interventions are required to address inequalities affecting bystander CPR and AED use in OHCA. An important strategy to reduce the impact of health inequalities in CPR and AED use is public health education. Basic Life Support (BLS) training and education needs to be particularly focused on areas where the rates of bystander CPR and AED are the lowest and in socioeconomically disadvantaged neighbourhoods.[8]

Education should focus on areas such as conducting BLS on both male and female patients, recognising cardiac arrest, tailoring BLS to difference ages as well as provision for training in different languages, including sign language. Like some other countries, CPR training is now being implemented in the school curriculum in the UK as part of a government initiative; this would potentially help tackle the inequalities in CPR provision and AED use.[62]

Provision of BLS training in places of worship has also been an initiative implemented globally such as the British Islamic Medical Association's Lifesaver programme, which has been well received. The programme delivers BLS training to the local public through mosques. Expansion of such initiatives to other places of worship could help tackle the inequalities in CPR provision and AED use by targeting different communities who may not otherwise receive BLS training.[63]

Further studies and pathways on the most effective, cost efficient and environmentally friendly practice are required to explore community-based interventions and national strategies to overcome health inequalities in bystander CPR and AED use.[64] Strategic collaborations between the government organisations, charities and public health research groups should help to overcome some of these variations shown by local and national data and help to improve OHCA survival in a more equitable manner.

Conclusions

Health inequalities exist in bystander CPR and AED use in OHCA driven by inequalities in training and education. Differences have been documented based on sex, ethnicity, minority groups, socioeconomic status, and geography. Actively addressing these inequalities by targeting areas and communities where disparities exist will help to reduce some of these variations. Increasing awareness and education for the public in CPR delivery and AED use along with more equitable placement of AEDs can help to improve OHCA survival and reduce disparities. Coordinated strategies at both national and local level by key stakeholders is required with the hope of overcoming existing barriers and variations in survival outcomes for OHCA.

Declarations

Adam J Boulton is supported by an NIHR Doctoral Research Fellowship. The views expressed in this publication are those of the author(s) and not necessarily those of the NIHR, NHS or the UK Department of Health and Social Care.

Availability of data and materials

Not applicable.

Ethical approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

CRediT authorship contribution statement

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Declaration of competing interest

All other authors declared that there are no conflicts of interest.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.cpcardiol.2024.102484.

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