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Protocol paper

Facilitating cardiopulmonary resuscitation training in high-risk areas of England: A study protocol



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Abstract

Introduction: Bystanders' interventions improve chances of survival from out-of-hospital cardiac arrest (OHCA) before Emergency Medical Services arrive. Some areas in England are of concern. These high-risk areas have a higher incidence of cardiac arrest combined with lower-than-average bystander CPR rates and are characterised by higher proportions of minority ethnic group residents and deprivation.

Collaborating with people from the Black African and Caribbean and South Asian minority communities in deprived areas of England, we aim to develop and evaluate the implementation of theoretically informed intervention(s) to address factors contributing to lower bystander intervention rates.

Methods: The study is a collaborative realist enquiry, informed by the Theoretical Domains Framework and associated Behaviour Change Wheel. It consists of 1) a realist evidence synthesis to produce initial program theories developed from primary workshop data and published evidence. It will include identifying factors contributing to the issue and potential interventions to address them; 2) theoretically informed intervention development, using the initial program theories and behaviour change theory and 3) a realist mixed methods implementation evaluation with embedded feasibility. Public involvement (PPI) as study team and public advisory group members is key to this study.

We will conduct realist evidence synthesis, qualitative and statistical analyses appropriate to the various methods used.

Dissemination: We will develop a dissemination plan and materials targeted to members of the public in high-risk areas as well as academic outputs. We will hold an event for participating community groups and stakeholders to share findings and seek advice on next steps.

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Keywords: Out-of-hospital-cardiac arrest, CPR, Bystander, Lay rescuers, Ethnicity, Socioeconomic status

Introduction

Bystanders can improve chances of survival from out-of-hospital cardiac arrest (OHCA) by providing cardiopulmonary resuscitation (CPR)^{1–2} and using a publicly accessible defibrillator (PAD) before Emergency Medical Services (EMS) arrive.^{3–4} The proportion of patients receiving bystander resuscitation actions varies by area in the UK⁵ leading to potentially inequitable survival rates.

Measuring the impact on survival of interventions to increase the rates of bystander actions during an OHCA is challenging. The causal pathway between CPR training and survival is confounded by patient characteristics (the cause of cardiac arrest and survival

probability), event characteristics (whether the event is witnessed) and bystander characteristics (ability / willingness to use their skills). Efforts to increase bystander intervention rates focus on increasing the proportion of the population trained, as better rates of survival are associated with higher bystander intervention rates.^{4,6}

Bystander CPR rates for OHCA cases unwitnessed or bystander witnessed in England have risen from 55%⁷ in 2014 to 70% in 2020⁸ of the approximately 30,000 OHCA patients a year treated by the EMS. This rise is associated with initiatives such as the annual Restart a Heart (RSAH) campaign⁹ which aims to increase the proportions of members of the public trained in resuscitation skills.¹⁰ Rates of PAD use are low at 4.4% of all OHCA cases in 2020⁸ and need to be increased to improve survival rates.⁶

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Within these figures there is considerable regional variation in England. Some areas are of particular concern because of potential inequity in survival rates;¹¹ for instance, where the incidence of cardiac arrest is higher than average combined with a lower-than-average bystander intervention CPR rate (high-risk areas). These areas are characterised by deprivation, a higher proportion of residents from minority ethnic groups, greater population density and more people in routine occupations than the English national average.⁵ Only 29% of these areas had an EMS run RSAH Day event in 2019.¹²

Internationally other countries have identified similar high-risk areas but there has been little research into understanding why and what can be done to improve the situation. Addressing inequities in health and increasing survival from OHCA are policy imperatives in all four UK Nations and beyond.

Evidence suggests there may be inequity in the rates of bystander CPR for people from minority ethnic communities.¹³ A review of international evidence on barriers for bystander CPR only identified six studies specifically covering deprived communities, none explored issues for minority communities in deprived areas in England.¹⁴ There are few studies which have developed theoretically informed interventions for such neighbourhoods. The identifying High Arrest Neighbourhoods to Decrease Disparities in Survival (HANDDS) programme in Denver USA¹⁵ used the Health Beliefs Model of behaviour change and built on evidence from a qualitative focus groups study to design community based CPR interventions.^{16–17} They identified key factors for interventions 1) identifying lay people to serve as motivated leaders while targeting both senior citizens and school children to increase reach; (2) finding appropriate community-based locations for CPR training; (3) incentivising participation, and (4) identifying and addressing barriers to participation. In Scotland an intervention used individuals acting as Bystander Supporters to raise awareness in their local communities aiming to increase belief that people can and should perform CPR, demonstrating skills including planning to act, and sign posting to online resources and training.¹⁸ Whether these US and Scottish interventions would be useful in deprived English neighbourhoods with minority group populations is unknown.

This study, in collaboration with people from minority communities, aims to identify reasons for low bystander resuscitation rates in established ethnic minority communities (South Asian, Black African and Caribbean) living in English high-risk areas through literature and primary evidence synthesis. Then to develop, implement, and evaluate theoretically informed interventions.

Methods

Objectives

The study objectives are to 1) establish a community based public involvement advisory group to co-produce key aspects of the study; 2) to identify factors impacting whether or not CPR is performed or defibrillators used in high-risk areas through a realist evidence synthesis and develop theoretically informed interventions; 3) to prioritise interventions with community partners and other stakeholders for evaluation; to develop a realist informed evaluation framework and associated data collection tools; and 4) to conduct an implementation evaluation of the prioritised interventions with embedded feasibility study.

Study design

This study, Facilitating Bystander Cardiopulmonary Resuscitation Training in high-risk areas (FACT Study) is a collaborative realist enquiry, informed by the Theoretical Domains Framework¹⁹ and associated Behaviour Change Wheel.²⁰ It consists of three work packages (Work Packages) a realist evidence synthesis (Work Package 1), intervention development (Work Package 2) and an intervention implementation evaluation with embedded feasibility (Work Package 3).

Interventions resulting from this study are likely to be complex and produce different outcomes in different contexts. Realist informed enquiry is particularly useful for this investigation as it answers questions about *what works, for whom* and *under what circumstances*.

Approvals: The study is Sponsored by King's College London. The University of Warwick Biomedical and Scientific Research Ethics Committee approved Work Package 1 and Work Package 2 (reference BSREC 101/21–22). We will apply for approval for Work Package 3 once the interventions are developed.

Patient and public involvement (PPI)

Close collaboration with the community, means the research and interventions should be culturally acceptable and relevant, increase the chance of community action including the sustainability of intervention use and quality of outcomes.^{21–23} Collaboration with members of the public with knowledge and experience of minority community members with Black African or Caribbean and South Asian heritages, living in deprived areas include study team members and a Public Advisory Group (PAG).

Theoretical/conceptual framework

Initial realist programme theories, developed in the evidence synthesis will inform intervention development, in conjunction with formal behaviour change theory, specifically the Behaviour Change Techniques Taxonomy which contains 93 techniques mapping onto the domains of the Theoretical Domains Framework.²⁴ The Theoretical Domains Framework is a synthesis of 128 constructs from 33 theories of behaviour change which describes the determinants of behaviour change. The Behaviour Change Wheel combines mechanisms of action (modelled by the Theoretical Domains Framework) and behaviour change techniques to target those mechanisms including modes of delivery.

The Theoretical Domains Framework and Behaviour Change Wheel will help us identify important relationships between common features we find from diverse programmes identified in the evidence synthesis (Work Package 1) relevant to this study and study population. They will provide a structure for exploring both the mechanisms of change and the contexts in which they occur, breaking down change programmes' component parts to facilitate identification of behaviour change techniques within contexts that influence individuals' behavioural choices.

To inform intervention design (Work Package 2), we will use the Behaviour Change Wheel to map the Theoretical Domains Framework concepts identified in the initial realist programme theories (Work Package 1), onto the Behaviour Change Techniques Taxonomy. The Theoretical Domains Framework will inform our evaluation framework for the intervention implementation study (Work Package 3). Such a theoretical approach promotes interventions' effectiveness and sustainability.²⁵

Methods for each work package

Work package 1- evidence synthesis and program theory development

Work Package 1 is an evidence synthesis. It consists of a scoping review, primary data collection, a more targeted literature search, development of initial program theories and testing of these with stakeholders. The scoping review will identify factors that may contribute to lower bystander rates in minority communities in deprived areas. These will be used to identify theory areas and to inform an exploration, in up to 4 workshops in the West Midlands of England, of the experiences and views of people from minority backgrounds. Working closely with our PPI study team members and PAG group we will recruit approximately 10 people to each workshop. If necessary, we will consider advertising or contacting community groups directly.

Potential workshop participants will be provided with study information and given the opportunity to ask questions of the study team, before providing informed consent. We will provide language support at workshops as required.

In the workshops we will explore factors influencing whether bystanders perform CPR or use defibrillators and potential interventions that might address these factors. These data will be analysed, through the lens of the Theoretical Domains Framework and theory areas to start developing initial programme theories, which join up concepts within and across these theory areas. A second literature search informed by the scoping review, new topics identified in the workshops and the theory areas, will be conducted using databases from medicine and health care, psychology, education and social sciences (e.g. Medline, CINAHL, Embase, PsycInfo, Sociological Abstracts, Applied Social Sciences Index and abstracts (ASSIA) and Web of Science), from 2000. We selected 2000 as most work on disparities associated with survival outcomes from cardiac arrest has been conducted since the mid 2010s.^{16–17} We will include academic papers and other information on intervention programmes.

Documents for review will be selected based on relevance to testing the theory areas and initial programme theories. Titles and abstracts of search results will be screened for relevance to the theories and full texts of selected papers will be retrieved. Inclusion in the review will be determined by the researcher deciding whether the evidence is good and provides relevant data for the theories. The research team (JRM, Y-LL, CH) will discuss and resolve any issues concerning inclusion of particular papers.

Bespoke data extraction proforma based on the theory areas, will be developed, including usability testing with 2–3 papers by 2 researchers and subsequent revision. One researcher will complete extraction for the remaining articles, referring to the team to resolve any queries. Consistent with realist review principles, quality will be assessed for relevance and rigour.²⁶

Following an established process,²⁷ we will extract data to evidence tables organised around the theories. By identifying patterns across the evidence tables, researchers will identify emerging themes. We will seek confirming and disconfirming evidence and build up explanations that will refine the theories, which will be expressed as if-then statements.

These refined initial programme theories will then be tested by consulting participants from the first workshops at another 1–2 workshops to check if they align (or not) with their experience. The final

initial programme theories will be expressed as context-mechanism-outcomes (CMO).

Work package 2 – Intervention development

Work Package 2 consists of intervention development. The study team will identify and map the relevant elements of Work Package 1 work to the Theoretical Domains Framework domains, using the Behaviour Change Wheel onto the Behaviour Change Techniques Taxonomy. The taxonomy will help us identify potential techniques (active ingredients in interventions) to inform the intervention design. This process will ensure a clear theoretical basis to the interventions to facilitate their evaluation against anticipated mechanism producing outcomes in particular contexts. This evaluation against theory is important as it is difficult to directly measure impacts of interventions on CPR and defibrillation use rates.

We will present potential interventions to stakeholders at a Work Package 2 workshop. We will invite participants from the Work Package 1 workshops and from CPR campaigners and training providers, such as the RSAH initiative, engagement leads of first aid training organisations, community leaders from high-risk areas, representatives of professional organisations involved in raising awareness of cardiac arrest and providing or promoting resuscitation skills training in high risk or underserved population, to this workshop.

Participants will be asked to individually rate their first impressions of each intervention according to APEASE criteria (Affordability, Practicality, Effectiveness/cost-effectiveness, Acceptability, Side-effects/safety, & Equity)²⁸ and to write additional comments. Next, each intervention proposed by the study team will be considered in greater depth. After considering all the interventions, participants will individually rate each intervention according to the APEASE criteria again and write additional comments. Then participants at each table will rank the interventions together from the one most likely to change the target behaviour to the one least likely to do so. Each group's ranking will be presented to all the workshop participants to seek their overall recommendation for interventions to be taken forward.

Workshop discussions will be recorded, relevant sections where additional insights into the proposed interventions are discussed, transcribed and analysed using retroductive realist analysis informed, as appropriate, by psychological behaviour change theory.

The study team will develop the prioritized interventions and they will be implemented and evaluated in work package 3. We will develop an evaluation framework, informed by the theoretical work conducted when developing the interventions. The evaluation framework will be used to inform data collection, data analysis and the synthesis of findings.

Work package 3- implementation evaluation with embedded feasibility study

Work Package will involve implementing the intervention(s), in a mixed-methods realist evaluation with embedded feasibility study. The overall criteria used to assess the success of otherwise of the intervention implementation will be 1) whether the interventions can be run in different high-risk settings and 2) whether the interventions work as intended in all, some or none of the settings.

As interventions are unknown until developed in Work Package 2, we refer to them as intervention “events”. We will implement and evaluate the intervention(s) at up to six intervention events in three to four high-risk areas, selected for diversity of geographic location

in England. We will use the first two to assess whether delivery of the interventions, as proposed, and the associated evaluation data collection will be feasible. The findings will be used to refine both where necessary. The main study intervention events will then be conducted at up to 4 further sites.

To run and recruit to intervention(s) we will build on the networks established for Work Package 1 and through stakeholders invited to the Work Package 2 workshops to identify potential Work Package 3 contacts who would be willing to host intervention events and identify potential participants in locations known to have high risk areas in England.⁵

Although we do not know what the interventions for evaluation in Work Package 3 will be, we anticipate that training will form a component in interventions. If so, we will work with an appropriate training provider to deliver up-to-date core training in CPR and defibrillation skills. Language support will be provided to facilitate participation at events and data collection.

Feasibility study data collection

For the feasibility events our assessment will focus on event uptake rates, feasibility of running the events and collecting data as proposed (e.g. proportion of questionnaires completed, willingness to take part in follow up interviews). Findings will be used to inform revisions to data collection and the interventions if necessary.

Main study data collection

Data collection through tools designed by the team and further refined after the feasibility study will likely assess participation rates, participant characteristics and collect quantitative data from event participants in the form of a questionnaire. At each event, or shortly after it, up to 8 individual qualitative interviews will be conducted either in person, online, or by telephone, with both event participants and a key person involved in setting up the event. Interview topics will be informed by the evaluation framework and are likely to include the reasons for participation, views of the interventions, how they worked or need improvement, what impacts they made on the participant, whether participants would recommend interventions to others, satisfaction with the way ethical, spiritual, and moral aspects of resuscitation were covered as appropriate to the interventions. We will conduct follow up interviews after about three months with the key person involved in setting up the intervention to explore medium term intervention impacts of the intervention on themselves their families and communities.

Data analysis

A realist analysis of interview data, framed by the initial programme theories underpinning the interventions, will be conducted to explore participants views of the interventions, and their impacts on them, their families, and communities to assess how the interventions worked. The results will be used to refine the initial programme theories resulting in final programme theories for the interventions that have been tested in this study. This process will identify whether the interventions worked as intended or not, how they worked and in what circumstances. Suggested improvements may also emerge.

Data from sections of the qualitative interviews covering impacts on individuals, families and communities will be used to develop an intervention evaluation instrument (e.g. a self-completion questionnaire). Items will be included for recurring or insightful impacts identified in the interviews and from key intended intervention outcomes.

We will work with our PAG to refine the tool. It will provide future users of the intervention(s) with an evaluation tool.

A descriptive statistical analysis will summarise the characteristics (e.g. age, gender, ethnicity) of event participants, and assess the influence of these characteristics on the participants views of the intervention; regression analysis will be used if sufficient data are available. The proportion of event places filled will be used to assess the overall feasibility of the intervention. The statistical analysis will also be used to refine the initial programme theories, where appropriate. All analysis will be undertaken in R.²⁹

Results and findings from both quantitative and qualitative data will be synthesised using the initial programme theories to assess whether the interventions can be run in different high-risk settings and whether the interventions work as intended in all, some or none of the settings.

Dissemination

The study team and PPI partners will develop a dissemination plan and materials targeted to members of the public in high-risk areas. Findings will inform key dissemination messages. PPI partners will play key roles at stakeholder dissemination meeting(s) to share findings and seek advice on next steps at a dissemination event for participating community groups and stakeholders. If ready for use, stakeholders will be asked to contribute to ideas for disseminating interventions which will feed into the team's plan. Stakeholders at the event(s) will be similar to those invited to the Work Package 2 workshop.

We will make study results, intervention tools and implementation advice available on a website. We will use social media, engaging with our PPI partners networks and other PPI groups having links to both written and visual (e.g. YouTube video, infographics) summary results.

Dissemination for academics, clinicians, managers, stakeholders, and policy makers will include the study report, papers, conference presentations. Members of the study team have links with national and international resuscitation groups that develop guidelines, promote resuscitation training or make policy and so will be able to ensure evidence from this study is made known to these stakeholders.

Data sharing statement

Most data from this study will be qualitative or small sample quantitative data. Although the qualitative data will be pseudonymised, it is possible that with access to raw data individuals might be identifiable. Therefore, the data will not be suitable for sharing beyond what is contained within publications. Further information can be obtained from the corresponding author.

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CRedit authorship contribution statement

Claire A Hawkes: Conceptualization, Methodology, Funding acquisition, Supervision, Writing – original draft. **Sophie Staniszewska:** Methodology, Funding acquisition, Conceptualization, Writing - review & editing. **Ivo Vlaev:** Conceptualization, Methodology, Funding acquisition, Writing - review & editing. **Gavin D Perkins:** Conceptualization, Funding acquisition, Writing - review & editing. **Deska Howe:** Conceptualization, Funding acquisition, Writing - review & editing. **Elyas Khalifa:** Conceptualization, Funding acquisition, Writing - review & editing. **Yassar Mustafa:** Conceptualization, Funding acquisition, Writing - review & editing. **Nicholas Parsons:** Conceptualization Methodology, Funding acquisition, Writing - review & editing. **Yin-Ling Lin:** Methodology, Writing - review & editing. **Jo Rycroft-Malone:** Conceptualization, Methodology, Funding acquisition, Writing - review & editing.

Declaration of Competing Interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: CH, JRM, IV, GP SS and NP employers are in receipt of funding from the NIHR to conduct this study. GDP is a NIHR Senior Investigator and supported by the NIHR Applied Research Collaboration (ARC) West Midlands. GDP is also Editor in Chief of Resuscitation Plus but had no role in the review or decision making in relation to acceptance of this paper. JRM was the Programme Director of the NIHR HSDR Programme at the time this project was recommended for funding.

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