




BMJ Open Skill decay following Basic Life Support training: a systematic review protocol

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ABSTRACT

Introduction Survival from out of hospital cardiac arrest (OHCA) is lower in the UK than in several developed nations. Bystander cardiopulmonary resuscitation (CPR) is associated with increased rates of survival to hospital discharge following OHCA, prompting the introduction of several initiatives by the UK government to increase rates of bystander CPR, including the inclusion of Basic Life Support (BLS) teaching within the English national curriculum. While there is clear benefit in this, increasing evidence suggests poor retention of skills following BLS teaching. The aim of this systematic review is to summarise the literature regarding skill decay following BLS training, reporting particularly the time period over which this occurs, and which components of would-be rescuers' performance of the BLS algorithm are most affected.

Methods and analysis A search will be conducted to identify studies in which individuals have received BLS training and received subsequent assessment of their skills at a later date. A search strategy comprising relevant Medical Subject Headings (MeSH) terms and keywords has been devised with assistance from an experienced librarian. Relevant databases will be searched with titles, abstract and full-text review conducted independently by two reviewers. Data will be extracted from included studies by two reviewers, with meta-analysis conducted if the appropriate preconditions (such as limited heterogeneity) are met.

Ethic and dissemination No formal ethical approval is required for this systematic review. Results will be disseminated in the form of manuscript submission to a relevant journal and presentation at relevant meetings. To maximise the public's access to this review's findings, any scientific report will be accompanied by a lay summary posted via social media channels, and a press release disseminated to national and international news agencies.

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INTRODUCTION

In the UK, approximately 7%–8% of patients who suffer out of hospital cardiac arrest (OHCA) survive to hospital discharge.¹ This is a considerably lower rate of survival compared with several other developed countries.^{2,3} A recent report from the National Confidential Enquiry into Patient Outcome and Death demonstrates that in cases where bystander cardiopulmonary resuscitation

Strengths and limitations of this study

- Support from the University of Birmingham library team has been utilised in optimisation of the search strategy, to ensure all relevant studies may be identified for inclusion.
- The study methodology is robust, with clear protocol ensuring each title, abstract and full text is assessed by at least two reviewers.
- This protocol outlines clear methodology to assess the risk of bias and the strength of evidence, using validated scoring systems, hence ensuring inclusion of high-quality primary literature.
- Primary data underlying this study is likely to be heterogeneous in nature, leading to challenges with conducting meta-analysis.

(CPR) is commenced, survival to hospital discharge is increased.⁴ Overall, however, rates of bystander CPR remain low in the UK.¹ Increased availability of bystander CPR for patients in the UK has been set as a priority by the department of health to increase survival following OHCA.⁵

In order to accomplish this, the need for increased training in Basic Life Support (BLS) skill has been recognised, with BLS and first aid training a compulsory part of the English school curriculum since 2020.⁶ Alongside this mandated training there have also been several national and international initiatives aimed at increasing knowledge and skills in BLS, such as the international 'Restart a Heart Day'—a joint initiative of the UK Resuscitation Council, the British Heart Foundation, British Red Cross and St John's Ambulance.⁷

The problem

While there is undoubtedly value in increasing the number of people trained in BLS, there is growing evidence that retention of these skills is poor. Evidence from randomised controlled trials (RCTs) assessing skill retention in lay populations following BLS training demonstrates a considerable decrease in BLS skills, commencing as early as 6 months following

initial training^{8 9} In addition there is evidence of poor skill retention in junior doctors,¹⁰ medical students¹¹ and nurses.¹² This is despite the ability to adequately perform BLS being a requirement of the General Medical Council's 'Outcomes for Graduates'.¹³

Need for this study

As outlined above, there is growing evidence demonstrating poor retention of BLS skills over time among both lay people and healthcare students and professionals. As yet a comprehensive systematic review of this evidence has not been conducted. There is a need for such a review to be carried out to ascertain if and how skills decay, and over what time period this occurs. Such information will facilitate future research on how to best refresh BLS skills. In the long term, this should inform how improvements to refresher training programmes can best be implemented, with the overarching aim of improving rates of bystander CPR, and hence survival, from OHCA.

METHODS AND ANALYSIS

Research questions

- ▶ Is there evidence to support the hypothesis that BLS skills decay over time?
 - If there is evidence for skill decay, over what time period does this occur?
 - If there is evidence for skill decay, is there a difference in the way this manifests across different aspects of the BLS algorithm?
- ▶ What interventions have been implemented to address skill decay?
 - Is there evidence that these interventions are effective at addressing skill decay?

Search strategy

Published literature will be found through appropriate medical data sources, searched using relevant Medical

Subject Headings (MeSH) terms. Experienced professional colleagues within the University of Birmingham library services team have been consulted to optimise search terms and execution of the search, allowing all applicable articles and abstracts to be identified. The final search strategy is attached as online supplemental appendix 1. This has been piloted and found to function effectively. If required this may be altered in a minor way to fix any issues concerning syntax, spelling or grammar if discovered at a later date, or as needed to meet the requirements of each database searched. Any changes to the final search strategy will be outlined in the manuscript of the review itself.

The data sources to be searched will be OVID Medline, EMBASE, medRxiv, CINAHL, Google Scholar, NICE evidence search, the Cochrane Database and Science Direct. Reference lists of included articles will be analysed to allow any further potentially relevant articles to be found. These will then be assessed according to the inclusion and exclusion criteria (table 1) and included in the review if appropriate. Specific searches of the journals 'Resuscitation' and the 'Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine' will be performed given their importance in the field. Additionally, experts within the field of resuscitation research will be contacted regarding any unpublished work which may be relevant. If so, permission will be sought to access this so it may be included where appropriate. Finally, clinicaltrials.gov will be searched to identify any potentially relevant ongoing work.

Study selection

Records of studies will be managed using Zotero reference management software. The title of each study identified by search will then be screened independently by two reviewers who will omit studies which clearly do not meet inclusion criteria—completing form 'SR1—Title Screening' (online supplemental appendix 2). Any disagreements between

Table 1 Inclusion and exclusion criteria for primary literature

Inclusion criteria	Exclusion criteria
Study type: Systematic reviews, randomised controlled trials, observational studies (cross-sectional, case-control or cohort), consensus statements, case series, conference papers and proceedings, other reports.	Non-English language studies where translation is not possible or cost-effective
Population: Individuals who (1) have received training in BLS, and (2) whose skill retention has been assessed via any means. Includes: <ul style="list-style-type: none"> ▶ Lay individuals ▶ Healthcare professionals ▶ Healthcare students 	Low-quality studies will be excluded from the review following assessment using Critical Appraisal Skills Programme tool ¹⁶ and critical appraisal by at least two reviewers.
Intervention: refresher BLS training delivered via any method	Studies with severe methodological flaws such that results of the study are likely to be flawed
Outcome: Practical BLS skill performance assessed via any method	

BLS, Basic Life Support.

these reviewers will prompt consideration by a third (senior) reviewer, who will arbitrate and seek consensus. If consensus is impossible, the third reviewer holds the casting vote.

Following this stage, all remaining studies will then be screened based on their abstracts following the same process as for their titles—completing form ‘SR2—Abstract Screening’ (online supplemental appendix 3).

Following this, the remaining studies will then be independently read in full by two reviewers, and final decisions made regarding which studies to be included/excluded as described below.

Data extraction and synthesis

A bespoke database will be produced specifically for this project, using commercially available database software. Two researchers will independently extract data from the studies using a prespecified systematic review proforma—form ‘SR3—Full text Data Extraction’ (online supplemental appendix 4). This data extraction form has been piloted and found to work effectively. Once each reviewer has completed their proforma these will be compared. If in agreement, this data will be inputted into the review database. If there are disagreements between the two reviewers about one or more included data sources a third (senior) reviewer will seek consensus, and if necessary decide which data are inserted into the review database.

Where numerical data are collected, heterogeneity will be calculated using the I^2 statistical measure. Where appropriate, summary statistics will be generated to allow quantitative analysis and appropriate statistical comparisons to be performed. Statistical analysis will be performed using ‘R’ programming.¹⁴ If the level of heterogeneity is too great, or numerical results are either incomparable or absent, a narrative synthesis will be carried out.

Risk of bias assessment

The risk of bias in the studies will be assessed using the Cochrane collaboration risk of bias tool in the case of RCTs,¹⁵ and a critical appraisal will be carried out using the relevant Critical Appraisal Skills Programme tools for all study types.¹⁶ A study’s risk of bias will be recorded in their ‘SR3’ form. Risk of bias will thus be assessed by two reviewers, with a third (senior) reviewer holding a casting vote if consensus is not agreed. Studies with severe methodological flaws will be excluded from the final review if these flaws fundamentally undermine their results.

Strength of evidence assessment

The strength of the body of evidence will be assessed and reported using the Grading of Recommendations, Assessment, Development and Evaluations framework.¹⁷

ETHICAL REVIEW AND DISSEMINATION

Formal ethical approval for this study is not required as it is a systematic review using primary literature widely available within the public domain. The Preferred Reporting Items for Systematic Reviews and

Meta-Analyses¹⁸ format will be used when reporting the findings of this review. Following completion, results will be presented in the form of a written manuscript which will be submitted for publication to a relevant medical journal within the field of resuscitation, emergency care, critical care or anaesthesia. Results will additionally be submitted for presentation at relevant specialty meetings. To maximise the public’s access to this review’s findings, any scientific report will be accompanied by a lay summary posted via social media channels, and a press release disseminated to national and international news agencies.

DISCUSSION

While there has been a considerable increase in the availability of BLS teaching in recent years, it remains unclear how the skills acquired decay over time. This systematic review, therefore, aims to address this. The results from this review will provide clearer guidance on the optimal management of skill decay following BLS teaching, therefore, aiding the design effective ‘refresher’ training programmes in continuous professional development.

The study protocol is robust, and identifies a clear structure of study selection, data extraction and assessment of risk of bias and strength of evidence. Potential limitations which should be acknowledged include lack of identifiable studies, however initial scoping searches suggest sufficient literature to warrant the undertaking of a systematic review. Additionally, the complexity of the research question may limit analysis, as may the range of study types included. A further consideration is the potential for a high level of heterogeneity between included studies, which may limit any meta-analyses. This protocol accounts for this in that a narrative synthesis will be performed in this case, alongside any appropriate subgroup analyses.

In conclusion, while this review does have potential limitations, this is outweighed by the importance of the research question, and the potential for improvements in BLS education the review may, therefore have.

Contributors The project was conceived, designed and initialised by BS, JA, JH, AO, NC, EB, TB and HP. The protocol manuscript was initially drafted by BS, with supervision from JH, AO, JA and NC and then reviewed and amended by all authors. Final redrafting was completed by BS, AO, JA, JH and NC and approved by all authors. Adaptations and response to peer-review was completed by BS, with supervision from AO and JA. All authors have approved the final submission and are accountable for its accuracy.

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Appendix 1: Search Strategy

No.	Keywords [TIAB]	MeSH terms
1	(Basic Life Support OR BLS OR Basic Cardiac Life Support OR Life Support OR Resuscitation OR CPR OR Cardio Pulmonary Resuscitation) OR (Chest Compressions OR Compressions) OR (Rescue Breath* OR Mouth-to-mouth OR Expired Air Resuscitation OR Expired Air Ventilation OR EAV) OR (AED OR (Automated External) Defibrillator OR Defibrillation)	(Cardiopulmonary Resuscitation OR Heart Massage OR Respiration, Artificial OR Defibrillators)
2	Decay OR Loss OR Degener* OR Deterior* OR Impair* OR Atrophy OR Decline OR Decreas* OR Depreciat* OR Fade OR Fading OR Faded OR Reced* OR Rever* OR Relaps* OR Reduc* OR Wors*	n/a
3	Attain* OR Retention OR Retain* OR Increas*	n/a
4	Refresh* OR Retrain* OR Boost OR Update OR Renew OR Revise OR Reteach* OR Redo	n/a

To create search:

1. Combine Keyword [TIAB] and MeSH terms for each row using **OR**, and encapsulate in brackets ()
2. Combine rows 2, 3 and 4 using **OR**
3. Combine this search result with row 1 using **AND**
4. Apply limits

Limits: None

Appendix 2: SR1 – Title Screening Form

Tackling skill decay following Basic Life Support training – a systematic review

Date of screening	
Reviewer	Electronic form will have dropdown list of reviewer names
Study details Title, URL, citation	
Any conflicts of interest identified by the reviewer? Eg. Were they involved in the publication?	
Does the study title suggest it may meet the INCLUSION criteria:	Involves individuals who have received BLS training: <u>Y/N</u>
	Assesses BLS skill retention via any means: <u>Y/N</u>
English language copy available?	Yes
	No – refer to project supervisor to assess if commissioned translation is feasible
Comments / other information:	
Decision: (at this stage, only <u>exclude</u> reports which do not meet the inclusion criteria. Quality of reports will be assessed later)	Include / Exclude

Appendix 3: SR2 – Abstract Screening Form

Tackling skill decay following Basic Life Support training – a systematic review

Date of screening	
Reviewer	Electronic form will have dropdown list of reviewer names
Study details Title, URL, citation	
Any conflicts of interest identified by the reviewer? Eg. Were they involved in the publication?	
Does the study abstract suggest it may meet the INCLUSION criteria:	Involves individuals who have received BLS training: <u>Y/N</u>
	Assesses BLS skill retention via any means: <u>Y/N</u>
English language copy available?	Yes
	No – refer to project supervisor to assess if commissioned translation is feasible
Comments / other information:	
Decision: (at this stage, only <u>exclude</u> reports which do not meet the inclusion criteria. Quality of reports will be assessed later)	Include / Exclude

Appendix 4: SR3 – Full-text Screening & Data Extraction Form

Tackling skill decay following Basic Life Support training – a systematic review

1. Full-text screening

Date of screening	
Reviewer	Electronic form will have dropdown list of reviewer names
Study details Title, URL, citation	
Any conflicts of interest identified by the reviewer? Eg. Were they involved in the publication?	
Does full-text review of the study indicate it meets the INCLUSION criteria:	Involves individuals who have received BLS training: <u>Y/N</u>
	Assesses BLS skill retention via any means: <u>Y/N</u>
Comments / other information:	
Decision: At this stage, only <u>exclude</u> reports which obviously do not meet the inclusion criteria. Quality of reports will be assessed later. If excluding, do not complete data extraction section (to follow).	Include / Exclude

2. Quality of study assessment

Complete relevant CASP checklist for study type https://casp-uk.net/casp-tools-checklists/	Copy/paste questions and responses
RCT – complete Cochrane ‘Risk of Bias’ tool https://www.riskofbias.info/welcome/rob-2-0-tool/current-version-of-rob-2	Copy/paste questions and responses
Assess risk of bias, based on CASP checklist +/- Cochrane tool	Low / high
Is there methodological flaw so severe that the study should be omitted from review?	Yes, omit / No, do not omit – studies flagged for omission at this stage will be referred to senior review

3. Data extraction**a. Background**

Study Title	
Study Reference (Vancouver)	
Country where study conducted List all if multiple	

b. Methods

Study design	Randomised Control Trial
	Non-randomised interventional trial
	Observational (cohort/case-control)
	Commentary/Qualitative study
	Systematic review
	Literature/Narrative review
	Other
Population Identify Key characteristics of the population studied	
Intervention(s) If applicable – i.e. was refresher training delivered?	
Comparator If applicable	
Outcome measures used I.e. what did the authors state as the primary, and secondary outcomes?	
Study inclusion criteria	
Study exclusion criteria	
Study duration	
Number of participants	
Details of initial BLS training	
Time elapsed between initial BLS training and assessment of retention	
Was any retraining received by participants not as part of this study?	

Eg. As part of routine education, re-certification etc.	
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c. For studies where refresher training was delivered:

Was there a comparator? Eg. Placebo, another type of refresher training?	
If there was a comparator, how was allocation to groups conducted?	Randomised / non-randomised
If randomised, how was this done?	
Number of study arms Eg. If just one form of refresher training vs comparator, this is 2 arms.	

d. Participant information

Average age Specify statistic – mean / median	
Sex breakdown Specify % male, % female	
Loss to follow up (n, %)	
Differences at baseline Summarise any differences between the studied groups at baseline, before any measurement or intervention took place (if reported).	
Method(s) of recruitment to study Describe / state	
Other characteristics lay-people/healthcare workers, previous BLS experience etc	

e. Participant groups and their outcomes - complete one copy of table e. for each group if multiple interventions. Also complete a copy for the control / comparator group

Group name	
Description of group, including intervention What was done differently to this group than other participants?	
Number (%) allocated to group	
Method of BLS re-assessment Include any information concerning training of BLS assessors	
Time between training and re-assessment	
Outcomes: where possible use raw numbers in the following format: n(%)	CPR rate CPR depth CPR hand position CPR hands-off time Rescue breath success BLS algorithm completeness BLS summative assessment – ‘pass’ or ‘fail’
Other outcomes Give details of other outcome measures reported in the study. Where possible use raw numbers in the following format: n(%)	