

Institution: University of Lincoln		
Unit of Assessment: 03 – Allied Health Professions, Dentistry, Nursing and Pharmacy		
Title of case study: Development and Implementation of Pre-Hospital Outcome Measures		
Period when the underpinning research was undertaken: 2010 - 2019		
Details of staff conducting the underpinning research from the submitting unit:		
Name(s):	Role(s) (e.g. job title):	Period(s) employed by submitting HEI:
SIRIWARDENA Aloysius	Professor of Primary and Pre-Hospital Healthcare	23 Mar 07 to date
Niroshan	Senior Lecturer	13 Sep 11 to date
ASGHAR Zahid	Research Assistant	12 Sep 11 to date
PHUNG Viet-Hai	Research Assistant	4 May 10 – 31 Mar 13
TOGHER Fiona	Senior Lecturer	4 Jan 10 – 31 Aug 16
DAVY Zowie	Lecturer	29 Jul 20 to date
WHITLEY Greg	Professor of Medical Statistics	1 Feb 17 to date
LAW Graham		
Period when the claimed impact occurred: 2014 - 2020		
Is this case study continued from a case study submitted in 2014? N		
1. Summary of the impact (indicative maximum 100 words) <p>Research conducted by members of the Community and Health Research Unit (CaHRU), funded by £3.5 million in grant funding from the NIHR, NIHR CLAHRC East Midlands, Health Foundation and Falck Foundation, has led to measurable improvements in prehospital care nationally and internationally. This work resulted in a range of new indicators for ambulance services, demonstrably improving processes of care in services throughout England. There has also been an uptake of these measures internationally (in the US and Middle East) and they have been used to update quality indicators by the UK health regulator, the Care Quality Commission, used in all UK ambulance services.</p>		
2. Underpinning research (indicative maximum 500 words) <p>Context Ambulance services are providing more care for greater numbers of people with emergency conditions, which has led to a clinical and policy need to identify indicators of high-quality care which enable improvements in care and outcomes.</p> <p>Before we developed new outcome measures in 2009, ambulance services were largely measured on response times alone. Although appropriate as one measure of quality, for emergency conditions such as heart attack, stroke or cardiac arrest, they are not the only measure of care quality.</p> <p>Ambulance services have increasingly been responding to patients with a wider range of clinical conditions than emergency conditions, which constitute fewer than 10% of attendances. A wider range of quality measures was needed, and it therefore became an NHS research priority to measure the wider clinical care provided by ambulance services rather than just timeliness of response.</p> <p>Outline of underpinning research CaHRU have interdisciplinary research-based expertise in development and implementation of new quality measures (clinical indicators) to meet user, service and system need. The team led the development and evaluation of the first clinical indicators for ambulance services beginning</p>		

in 2007. In 2017 members of the team, with collaborators, completed a 5-year NIHR programme for applied research focussing on new, more patient-centred ways of measuring ambulance care services through co-produced research and collaborative implementation.

The research has provided, for the first time, information about the effectiveness, quality and outcomes of different types of ambulance care provided to large populations of patients and supported quality improvement, clinical audit and evaluation of future service changes. The group has conducted several related studies examining variations in care (e.g. in care of heart attack and stroke), gaps in care (e.g. pain management, patient experience) and potential methods to address these (development of new outcome measures such as care bundles for heart attack and stroke and methods to improve these). The research activity conducted by the CaHRU team is translational and has led to improved quality of care and outcomes

- Systematic reviews and consensus studies have prioritised potential outcome measures relevant to the NHS and patients.
- Epidemiological and cross-sectional and qualitative studies have identified current care quality, variations and gaps.
- Pilot and quasi-experimental studies evaluating the introduction of new measures and the effect on these of improvement initiatives.
- We created the first information dataset linking routine prehospital, hospital (episode statistics) and mortality data to build risk adjustment models for mortality and non-mortality outcomes: the models have been developed and assessed to determine how well they measure effectiveness and quality of ambulance service care and their practical use for quality improvement.

Research Findings Related to Impact

CaHRU led the development, pilot and evaluation of new clinical measures for ambulance services 2011 [3.1] and subsequently led an NIHR Programme for Applied Health Research (£2M), Pre-hospital Outcomes for Evidence Based Evaluation (PhOEBE 2011-2017), which developed new risk ambulance outcome measures [3.2]. The programme of research was undertaken in collaboration with ambulance services (East Midlands and Yorkshire Ambulance Service NHS Trusts), other higher education institutions (Sheffield and Swansea Universities) and patient groups (e.g. Sheffield Emergency Care Forum). The programme led to the publication of new ambulance measures, some of which have been adopted nationally in the UK.

Our study investigating patient perspectives of prehospital experience found that of fundamental importance to patients was a sense of feeling reassured and this was enhanced by the professional behaviour of staff, which instilled confidence in their care, good communication, a short wait for help; and improved continuity during the transfer to hospital. [3.3].

We also showed in the PhOEBE programme above that pain management was a high priority outcome for patients. CaHRU-led studies of pain management [3.4, 3.5] have shown that better prehospital treatment of pain is linked to more highly trained staff with greater access to higher potency pain relief.

CaHRU led a national study from 2009 to 2012, in collaboration with all the ambulance services in England, to identify, address and evaluate gaps in care based on novel outcome measures of care bundles for heart attack and stroke [3.6].

3. References to the research (indicative maximum of six references)

Impact case study (REF3)

- 3.1 Siriwardena AN, Shaw D, Donohoe R, Black S, Stephenson J. Development and pilot of clinical performance indicators for English ambulance services. *Emerg Med J* 2010; 27:327e331.
<https://doi.org/10.1136/emj.2009.072397>
- 3.2 Turner J, Siriwardena AN, Coster J, Jacques R, Irving A, Crum A, Gorrod HB, Nichol J, Phung VH, Togher F, Wilson R, O'Cathain A, Booth A, Bradbury D, Goodacre S, Spaight A, Shewan J, Pilbery R, Fall D, Marsh M, Broadway-Parkinson A, Lyons R, Snooks H, Campbell M. Developing new ways of measuring the quality and impact of ambulance service care: the PhOEBE mixed-methods research programme. *Programme Grants Appl Res* 2019;7(3).
<https://doi.org/10.3310/pgfar07030>
- 3.3 Togher FJ, O'Cathain A, Phung VH, Turner J, Siriwardena AN. Reassurance as a key outcome valued by emergency ambulance service users: a qualitative interview study. *Health Expectations* 2015; 18 (6), 2951-2961.DOI: 10.1111/hex.12279.
<https://doi.org/10.1111/hex.12279>
- 3.4 Siriwardena AN, Asghar Z, Lord B, Pocock, H, Phung VH, Foster T, Williams J, Snooks. Patient and clinician factors associated with pain treatment and outcomes: cross sectional study. *American Journal of Emergency Medicine* 2019; 37 (2): 266-271.
<https://doi.org/10.1016/j.ajem.2018.05.041>
- 3.5. Whitley G, Hemingway P, Law G, Wilson C, Siriwardena AN Predictors of effective management of acute pain in children within a UK ambulance service: a cross-sectional study. *American Journal of Emergency Medicine* 2020 38 (7): 1424-1430.
<https://doi.org/10.1016/j.ajem.2019.11.043>
- 3.6 Siriwardena AN, Shaw D, Essam N, Togher F, Davy Z, Spaight A, Dewey M. The effect of the Ambulance Services Cardiovascular Quality Initiative on prehospital care for acute myocardial infarction and stroke in England. *Implementation Science* 2014; 9:17.
<https://doi.org/10.1186/1748-5908-9-17>

4. Details of the impact (indicative maximum 750 words)

In summary, and detailed below, the research directly informed national UK policy and has been a key factor in improving ambulance care for emergency and other conditions by directly influencing care systems, regulatory indicators, ambulance services, paramedics, and service users throughout England and internationally. The research led directly to the development of new clinical quality indicators for ambulance services in England, to benchmarking of service quality, and supported initiatives to address gaps in care as detailed below. The work also featured in 'Universities UK 100+ ways universities have improved everyday life', in 'Relieving the pressures on the NHS through better training' [5.1].

CaHRU's director, Siriwardena, led the development of the first clinical indicators (e.g. recording of pain treatment and assessment before and after treatment) used by English ambulance services [3.1], and through meetings with the UK health regulator, several indicators were subsequently adopted by for their performance assessment of services, including the concept of care bundles for heart attack and stroke [3.6] which are still used currently in the national Ambulance Quality Indicators for England [5.2].

The research on indicator development [3.2] was featured in a national review of NIHR prehospital research and its impact, 'Care at the Scene', [5.3,pg 35, study 11] in which Derek Prentice, Chair of the Lay Group at the Royal College of Emergency Medicine stated "In striving for research based improvements and training for better outcomes we must always ensure that the primary focus remains the patient".

Siriwardena was invited by Dr David Williams of the Institute for Health Improvement in the US, to provide advice to which led directly to the group's work on indicators (3.1, 3.6) being used in the US and Middle East [5.4] to inform indicator development and quality improvement initiatives abroad during this REF period (pp 6, 7, 10, references 9, 12).

In Qatar, this led to adoption of a care bundle for patients with heart attack based on that developed for England, and a peer reviewed publication citing CaHRU's work, showed improvement during 2016 and 2017 in the bundle measure, from 39% pre-improvement activities to 76% post-improvement activities with sustained improvement at 12 months post implementation [5.5].

To engage patients in understanding the change in UK ambulance indicators, key findings from the Prehospital Outcomes for Evidence Based Evaluation (PhOEBE) programme [3.2] led by Siriwardena, were developed into an animation by and for patients and the public, which had over 2000 views within 6 months of its launch in November 2017 [5.6].

The findings also fed into the UK Ambulance Research Programme and informed new Ambulance Quality Indicators introduced in 2017. For example, rather than the previous 8-minute and 19-minute response time targets for ambulance services, they are now benchmarked using mean and 90th centile response times as a direct result of the PhOEBE programme [3.2]. Subsequently, these new indicators were adopted by all ambulance services in England [5.7], designed to benchmark and improve care and are now being used by the UK regulator as part of their assessment of ambulance care quality.

The findings on improvements in prehospital care were cited in a national report into building healthy cities [5.8], 'looking at how universities act as anchor institutions in their cities and regions: active, engaged institutions, taking pride in our community, tackling real-world challenges.' The report notes that "Although the research was initially undertaken with East Midlands Ambulance Service NHS Trust, it has since led to changes in the behaviour of ambulance service nationally" (pg 15-16).

An invited keynote presentation by Siriwardena at the North American EMS Physicians (NAEMSP) conference 2018 led to CaHRU's research informing quality measures in North America. The new EMS Compass measures [5.9] were introduced in 2019 and include (for example) the trauma pain indicator arising from our work, which involves two pain scores and a reduction in pain as an outcome measure.

Siriwardena was part of the faculty for the NAEMSP Quality and Safety course 2019-2020 (<https://naemsp.org/career-development/ems-quality-and-safety-course/>) and in this capacity provided advice, which sought to improve care, on EMS measures for ambulance services in North America, Canada and the Lebanon.

5. Sources to corroborate the impact (indicative maximum of 10 references)

- 5.1 100+ Ways Universities Have Improved Everyday Life
<https://www.universitiesuk.ac.uk/facts-and-stats/impact-higher-education/Documents/made-at-uni-breakthroughs.pdf>
- 5.2 Ambulance Quality Indicators.
<https://www.england.nhs.uk/statistics/statistical-work-areas/ambulance-quality-indicators/>
- 5.3 NIHR prehospital themed review 2016: CaHRU research featured in national review and video of NIHR prehospital research and its impact.
Care at the scene: <https://evidence.nihr.ac.uk/themedreview/care-at-the-scene-research-for-ambulance-services/>
PDF <https://content.nihr.ac.uk/nihrdc/themedreview-000827-CS/Care-at-the-scene-final-for-web.pdf>

Video: <https://www.youtube.com/watch?v=AVZOfu0ESRQ>
<https://content.nihr.ac.uk/nihrdc/themedreview-000827-CS/Care-at-the-scene-final-for-web.pdf>

- 5.4 Williams D. Improving prehospital care around the world. EMS World Feb 2 2015
<https://www.emsworld.com/article/12032139/improving-prehospital-care-abroad> .
- 5.5 Howard I, Castle N, Al Shaikh L, et al. Improving the prehospital management of ST elevation myocardial infarction: a national quality improvement initiative. BMJ Open Quality 2019;8:e000508.
<https://doi.org/10.1136/bmjopen-2018-000508>
<https://bmjopenquality.bmj.com/content/8/2/e000508>
- 5.6 Animation of the PhOEBE project on YouTube: <https://youtu.be/g2saLhBv9-U> [accessed 10-12-2017] and its development <https://vimeo.com/242717702/bfefeee9e2>
- 5.7 Ambulance Response Programme – Evaluation of Phase 1 and Phase 2 Final Report 2017. <https://www.england.nhs.uk/publication/arp-evaluation/> and new ambulance standards.
<https://www.england.nhs.uk/urgent-emergency-care/improving-ambulance-services/arp/>
- 5.8 Building healthy cities <https://www.unialliance.ac.uk/2016/02/25/building-healthy-cities-the-role-of-universities-in-the-health-ecosystem/>
- 5.9 EMS Compass Performance Measures approved for testing Sept. 20, 2016 - Version 10.3
<https://nasemso.org/projects/ems-compass/>