

Institution: University of Stirling		
Unit of Assessment: 3. Allied Health Professions, Dentistry, Nursing and Pharmacy		
Title of case study: Improving pre-hospital emergency care		
Period when the underpinning research was undertaken: 2016 - 2018		
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:
Edward Duncan David Fitzpatrick	Associate Professor Senior Lecturer	2004 - Present Dec 2017 - October 2020
Period when the claimed impact occurred: 2018 - 2020		
Is this case study continued from a case study submitted in 2014? No		
1. Summary of the impact		
<p>The University of Stirling's 16-year collaboration with the Scottish Ambulance Service (SAS) has improved practice including demonstrable national and international impact in two priority areas: hypoglycaemic emergencies (impact 1) and clinical handover (impact 2).</p> <p>Impact 1a. Stirling's hypoglycaemia emergency research improved UK Joint Royal College Ambulance Service Clinical Guidelines for paramedics attending hypoglycaemic emergencies (up to 95,000 people per annum) to take account of hypoglycaemia unawareness. Patients are now advised to follow-up their diabetes care to treat hypoglycaemic unawareness, reducing the number of further ambulance attendances individuals will require.</p> <p>Impact 1b. Stirling's hypoglycaemia emergency research improved third sector policy and service delivery. Our work influenced the way in which national third sector agencies developed their policies, making them more evidence-based, and delivered their care services.</p> <p>Impact 2. Handover of patient information is a vital patient safety task, Stirling's research has improved the quality and quantity of pre-alerts to emergency departments and reduced clinical information loss.</p> <p>This research has changed pre-hospital hypoglycaemia and handover practice across the United Kingdom, with clear evidence of our handover cards (Figure 1 below) also being adopted in the USA.</p>		
2. Underpinning research		
Improving care and services for people with hypoglycaemia.		
<p>Diabetes-related severe hypoglycaemia events account for between 48,000 and 98,376 UK emergency ambulance calls per year. We undertook a variety of pre-hospital hypoglycaemic emergency care studies to improve patient care (R1, R2, and R3). We initially developed and evaluated a behavioural change intervention to improve rates of individuals' attendance at diabetes care providers following a hypoglycaemic event (R1). Though the intervention was highly popular with staff (n=92) and patients (n=37), our linked data analysis indicated that this form of intervention was unlikely to make a significant difference to individuals following up their care. We then undertook a population-based data-linkage cohort study (n=23,763) (R2) aimed to ascertain whether there has been a temporal change in the incidence rates of hypoglycaemia requiring emergency medical services in people with types 1 and 2 diabetes. This study found that the absolute number of hypoglycaemic emergency incidents requiring emergency services were increasing, emphasising the need to support paramedics and technicians to deal with people who have this challenging and life-critical condition. We then undertook a sequential mixed-method study. This involved undertaking Scotland's first national survey of hypoglycaemia awareness among people who use the ambulance service and conducting a longitudinal qualitative semi-structured interview study (n=31) comparing experiences of people who had been attended by an ambulance due to hypoglycaemia, and those who experienced hypoglycaemia but had not required ambulance attendance (R3). The prevalence of impaired awareness of hypoglycaemia among those who require an ambulance following a hypoglycaemic event (65%) is more than twice that found in the general population of people with diabetes (25%). This explains why some people require an ambulance to assist with a severe hypoglycaemic event, while the majority do not.</p>		

Improving patient safety in the pre-hospital environment.

Our prehospital study (**R4**) is the first published study to investigate perceptions of handover between ambulance clinicians and prehospital critical care teams. Through a national cross-sectional survey (n=190), we identified a number of areas where pre-hospital handover could be improved. These include the development of a shared mental model through system standardisation across Scotland, the development of a simple aid-memoire (See Figure 1) to support information recording and delivery, and the clear identification at incidents of a handover lead. Mnemonics used must be carefully selected to ensure they explicitly contain the clinical variables perceived as being essential for prehospital handover; a pre-existing mnemonic (ATMIST) was identified as most appropriate for use by pre-hospital clinicians (paramedics, ambulance technicians and emergency medical doctors) in Scotland. The Scottish Ambulance Service attends approximately 540,000 emergencies each year. We used the findings from this study to develop and test a novel low-tech handover intervention, using a pre/post-test design with a historical control, for use whenever there is the need to handover a patient from one emergency team to another (**R5**). The intervention was highly acceptable to ambulance clinicians, improving their data recording and information exchange processes. Using our intervention improved 8/12 components of good quality clinical handover when assessed against in the delivery of 8/12 clinical variables provided during ambulance to emergency department pre-alert. The intervention was overwhelmingly perceived (by 92% (n=23) of respondents) to be useful to very useful.

Pre-alert **ATMIST Handover**

Age Gender M F Time (onset/incident) :

Mechanism/illness

Injuries suspected

Signs

RR SpO2 % HR BP /

GCS/AVPU

BM Temp

NEWS

ETA

Requirements?

Eye opening
4 Spontaneous
3 To voice
2 To pain
1 Nil

Verbal response
5 Orientated
4 Confused
3 Inappropriate words
2 Incomprehensible sounds
1 Nil

Motor
6 Obeys commands
5 Localises to pain
4 Withdraws from pain
3 Abnormal flexion
2 Abnormal extension
1 Nil

Use AVPU for medical/GCS for Trauma

Age First name

Time of onset/incident :

Mechanism/Medical complaint

Injuries/Information related to complaint

Signs/Symptoms

RR SpO2 % HR BP /

GCS/AVPU BM Temp NEWS

Key symptoms:

Treatment /Trends (ET, IV, Drugs/Improved/deteriorated)

Allergies Prescribed medication

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Version: V 2.5 / Nov 2017 Owners: Fitzpatrick, Maxwell & Steele

Figure 1: ATMIST Handover card

3. References to the research. (Stirling researchers in bold text)

Pre-hospital emergency care of hypoglycaemic emergencies:

- R1. Duncan, E. A., & Fitzpatrick, D.** (2016). Improving self-referral for diabetes care following hypoglycaemic emergencies: a feasibility study with linked patient data analysis. *BMC emergency medicine*, 16(1), 13. doi: [10.1186/s12873-016-0078-1](https://doi.org/10.1186/s12873-016-0078-1)
- R2. Wang, H., Donnan, P. T., Leese, C. J., Duncan, E., Fitzpatrick, D., Frier, B. M., & Leese, G. P.** (2017). Temporal changes in frequency of severe hypoglycemia treated by emergency medical services in types 1 and 2 diabetes: a population-based data-linkage cohort study. *Clinical diabetes and endocrinology*, 3(1), 7. doi: [10.1186/s40842-017-0045-0](https://doi.org/10.1186/s40842-017-0045-0)
- R3. Duncan, E. A., Fitzpatrick, D., Ikegwonu, T., Evans, J., & Maxwell, M.** (2018). Role and prevalence of impaired awareness of hypoglycaemia in ambulance service attendances to people who have had a severe hypoglycaemic emergency: a mixed-methods study. *BMJ Open*, 8(4), e019522. doi: [10.1136/bmjopen-2017-019522](https://doi.org/10.1136/bmjopen-2017-019522)

Handover:

R4. Fitzpatrick, D., McKenna, M, **Duncan, E.A.S.**, Laird C, Lyon R and Corfield A. (2018).

Critcomms: a national cross-sectional questionnaire based study to investigate prehospital handover practices between ambulance clinicians and specialist prehospital teams in Scotland. *Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine*, 26(45) doi: [10.1186/s13049-018-0512-3](https://doi.org/10.1186/s13049-018-0512-3)

R5. Fitzpatrick, D., Maxwell, D., Craigie, A. (2018). The feasibility, acceptability and preliminary testing of a novel, low-tech intervention to improve pre-hospital data recording for pre-alert and handover to the Emergency Department. *BMC Emergency Medicine*, 18(16). doi: [10.1186/s12873-018-0168-3](https://doi.org/10.1186/s12873-018-0168-3)

Grants

G1. Fitzpatrick D, Manser T, Duncan EAS, Morgan H, Corfield A, Teal G, Lindle P, Elders A Creating safe handover systems in pre-hospital care (GBP269,962) (2019-2020) Funder: Chief Scientist Office. Sponsor: University of Stirling.

G2. Leese G, Duncan EAS, Fitzpatrick D, Donnan P Impact of Hypoglycaemia on Healthcare Services (GBP76,061) Funder: Novonordisk 2014. Sponsor: University of Stirling.

G3. Duncan EAS, Entwistle V, Fitzpatrick D, Cheyne H, Paley J, Niven C, Frier B & Sullivan F Improving self-referral to primary care following hypoglycaemic emergencies: the development and initial assessment of a research-based intervention. Funder: Diabetes UK (GBP99,358). 2009-2010. Sponsor: University of Stirling.

4. Details of the impact

The time-lag for research findings influencing healthcare practice is commonly cited as being 17 years (Morris et al. 2011). Our clinical-academic partnership with the Scottish Ambulance Service (SAS) has enabled our research findings to be implemented into routine practice within two years across NHS Scotland, with rapid impact in pre-hospital care across the rest of the UK, and internationally.

Impact 1a. New national guidance improves pre-hospital emergency care of hypoglycaemia

Fitzpatrick was invited (January 2018) to join the guideline committee of the Joint Royal Colleges Ambulance Liaison Committee (JRCALC). The JRCALC produce the national clinical guidelines that are used by approximately 56,000 paramedics, and ambulance technicians throughout the UK when dealing with the 48,000 to 98,376 prehospital hypoglycaemic emergencies they attend each year. Our pre-hospital hypoglycaemia emergency research is included in the most recent JRCALC hypoglycaemic emergency guideline (July 2019) (**S1**). Specifically, the guideline adopted the recommendation to incorporate assessment of hypoglycaemia unawareness into ambulance clinician's assessment of patients who have had a severe hypoglycaemic emergency. Patients are now advised to follow-up their diabetes care to treat hypoglycaemic unawareness, reducing the number of further ambulance attendances such individuals will require.

Impact 1b. Impacting on third sector care delivery and policy development

The impact of our pre-hospital emergency care of hypoglycaemia is recognised by Diabetes UK for improving the care pathway for people with hypoglycaemia in Scotland and further afield:

“As Scotland Director at Diabetes UK, a key part of my role was working in partnership with research projects and ensuring the patient voice and a person centred approach. Prehospital hypoglycaemia is a critical issue for people living with diabetes and understanding the issues from all perspectives, and not just that of the healthcare professional team, is central to improving care and delivery of that care.” (**S2**)

This research has also developed and improved the policy and practice of two third sector agencies: Diabetes Scotland and Chest Heart and Stroke, Scotland. As Chest Heart and Stroke Scotland state:

“In the past I have turned down or removed the charity partnership from research work on the basis that it has not reflected this [person-centred] approach. In working with Dr Edward Duncan (Associate Professor of Applied Health Research, University of Stirling) and his team, it was clear to me that their approach fully embraced that person centred approach, backed up with academic rigour, and **the work of the project not only improved the care pathway in Scotland, and further afield, it also had an impact on how we as a charity considered prehospital hypoglycaemia and engaged with people with diabetes on this.** This included developing and improving our own service delivery based on the learning from the research. It has also included being more than happy to continue the research relationship in my current role of CEO of Chest Heart & Stroke Scotland.” (S2)

Impact 2. Improving Patient Safety through development and national implementation of a low-cost communication decision aid

Our handover research gained national publicity in media features on patient safety (S3a), was implemented across Scotland and internationally (see quote below on the use of the handover card in New England, USA). It has provided an evidenced-based approach to a highly challenging areas of patient safety. In 2018, senior SAS management decided to implement the intervention nationally, releasing a national bulletin advising all paramedics and ambulance technicians (n≈ 3,500) of the adoption of the intervention. SAS funded additional training on handover and use of the intervention to all trainee paramedics, as well as to qualified paramedics and technicians as part of their annual educational update (S3b). The handover cards (Figure 1) have now become embedded into SAS practice and are used on a daily basis across Scotland when handover is required. The research also led to Dr. Fitzpatrick contributing to the Royal College of Emergency Physicians online handover training for emergency physician trainees in the UK (S4).

Ambulance clinicians and doctors have provided insight into the positive impact of the handover cards. These views are valuable as they demonstrate that the intervention has been a positive safety addition for a range of clinicians.

“I think the concept is an excellent idea for minimising omissions. ... it’s just a bit more concise, to the point, I think so. More pertinent clinical information is included, rather than story-telling.” - Paramedic (Forth Valley) and National Patient Safety Manager (S5)

... “my thoughts on the card are that, I like them... it gives a structured handover, it allows the paramedics or the technicians to know what information to give and in what order, it means that we are much less likely to omit details ... and it... we receive the information in a sort of expected pattern and therefore it’s easier to ask for any follow up information.” - Consultant (doctor) in emergency medicine (Edinburgh) (S6)

The cards have had a positive effect on patient care, as explained by ambulance clinicians and paramedics:

“You could argue theoretically that ..., the handover is risky part of the process, isn’t it? Where information gets lost. So if we were handing over to each other ... you’re going to use your ATMIST to handover, you could argue in one sense that’s improving the patient care that we provide.” – Paramedic and Clinical Effectiveness Lead for Major Trauma for the SAS, FG ScotSTAR base (Glasgow) (S7)

“I think there’s two influences, I think one is about allowing us to start interventions earlier, if we’re getting more thorough information ... then we can plan for the patient and at handover we can start making sort earlier interventions. I think the other thing is about error. That we’re much less likely ... I believe now to have an important piece of information omitted ..., by simple error ... and therefore we are much less likely to sort of go down the wrong track with the patient or heaven forbid give the wrong treatment or something like that, because all the relevant information will be given.” - Consultant (doctor) in emergency medicine (Edinburgh) (S6)

Use of the handover cards have positively impacted on communication between different roles within the SAS:

... “I see more people pulling it out, eh certainly mostly we can come in contact with lots of different crews from lots of different areas so it’s quite good when you see someone pulling it out just to kinda get their handover ready for you know the hospital or they’re gonna call ahead ... obviously it’s quite well received so it’s quite good to see that other people are following the same structure as you and almost as a kinda aid memoir of what you should be including so yeah I definitely think so.” - Paramedic, Lanarkshire region (**S8**)

The handover studies are also impacting on how handover is conducted internationally, as in this example from New England, USA (a State with a population of almost 15 million people with over 40,000 registered emergency medical technicians):

“As you recall from our earlier conversation, your Critcomms study of 2018 was instrumental in identifying areas on which to focus in our evaluation of patient handover communication barriers in our own process. Similarly, your 2018 paper ...allowed us to focus our time and effort on simple and effective tools to help overcome our identified barriers... In short, your papers and your assistance has made a direct and tangible difference in the care that our system is able to provide to patients here in New England.” (**S9**)

5. Sources to corroborate the impact

Pre-hospital emergency care of hypoglycaemia

S1. Joint Royal Colleges Ambulance Liaison Committee Clinical Guidelines

S2. Testimonial from Chief Executive Officer of Chest Heart and Stroke Scotland (and formerly of Diabetes UK).

Handover

S3. a. National Standard article on patient safety, featuring a case study on the ambulance handover studies.

b. PowerPoint presentation on Basic Life Support update training given to paramedics and ambulance technicians in the Scottish Ambulance Service (See slides 42 & 43)

S4. Email to Dr Fitzpatrick inviting his contribution to the development of the Royal College of Emergency Medicine online handover training for emergency medicine trainees.

S5. Interview with the National Patient Safety Manager (also a practising paramedic)

S6. Interview with a consultant doctor in emergency medicine based at the Royal Infirmary Hospital in Edinburgh

S7. Focus group included an air ambulance paramedic, an anaesthetist (also a fellow with the EMRS), a paramedic response unit (PRU) and the Clinical Effectiveness Lead for Major Trauma for the SAS.

S8. Interview with paramedic based in Lanarkshire

S9. Testimonial email from Captain Rommie Duckworth, EMS Coordinator at the Ridgefield Fire Department, New England, United States of America.