Institution: Loughborough University

Unit of Assessment: D34 Art and Design, History, Practice and Theory

Title of case study: Reducing NHS costs and Improving patient care using Ergonomics to redesign ambulance vehicles and equipment

1. Summary of the impact (indicative maximum 100 words)

This research has already saved the NHS in excess of £2.5 million over 3 years through bulk purchasing. It was used by the National Ambulance Fleet Strategy Group to develop a national specification of emergency ambulances to reduce costs and improve patient care with 6 of 11 Ambulance Trusts in England purchasing from the national contract. The design and testing of a second tier of vehicles and equipment has supported new systems of work through a Community Urgent Response Environment (for on-the-spot treatment) and has been used in a tender specification by NHS Supply Chain to purchase replacement portable equipment.

2. Underpinning research (indicative maximum 500 words)

This case study describes ergonomics research into the design and use of ambulance vehicles and equipment. In 2001 Dr Hignett worked for East Midlands Ambulance Service on risk management for manual handling operations. Later in 2001 she joined Loughborough University and started the research programme with student projects **[3.1]** before receiving an EPSRC First Grant in 2003 **[G3.1]**. Subsequent funding from EPSRC **[G3.3**, **G3.6, G3.7]**, Dept. of Health and National Health Service **[G3.2, G3.5, G3.8]** and Health and Safety Executive **[G3.4]** resulted in a 10 year ergonomics and design research programme on emergency and urgent care vehicles and equipment.

The research started by comparing the design and use of ambulance loading systems **[G3.1, 3.2]** and equipment **[G3.3]** at 3 NHS Ambulance Services for musculoskeletal risks to paramedics **[G3.2, 3.3]**. It was extended to consider bariatric (obese) patient populations in 2006 **[G3.4, 3.4]** with national participation by 44% of acute Trusts, 25% of Primary Care Trusts (PCTs) and 56%of ambulance Trusts. Project **G3.5** brought the previous research together in collaboration with the Royal College of Art and 91 participants from NHS staff (management and operational), patient representatives and vehicle and equipment manufacturers to develop design recommendations (framed as 9 design challenges: access/egress; space and layout; securing people and equipment in transit; communication; security, violence and aggression; hygiene; vehicle engineering; patient experience) which were used in the national specification/contract **[3.5]** for emergency ambulances.

In 2007 the research programme shifted focus to the design of vehicles and equipment for pre-hospital (urgent, on-the-spot) care. The Smart Pods interdisciplinary collaboration (5 universities contributing ergonomics, design, sociology, operations management, academic emergency care) commenced at an EPSRC Sandpit **[G3.6, 3.6]** and involved 125 staff and 88 patients from 6 NHS Trusts (acute, primary care and ambulance). The outputs were a three level technology system for personal kit, assessment packages (and storage for other clinical treatment packages), and a clinical workspace in a mobile pod (vehicle). The research continued with knowledge transfer projects to develop new ergonomic ambulances and prototypes for carrying equipment/consumables with 2 manufacturers **[G3.7],** and as part of the procurement process for replacement equipment at Yorkshire Ambulance Service **[G3.8]**. Most recently (2012) a feasibility study **[G3.9]** has explored implementation of the mobile treatment unit for pre-hospital care as a low carbon vehicle with the Green Environment Ambulance Network (GrEAN) and National Ambulance Fleet Strategy Group.

Researchers at Loughborough University (dates of employment):

Sue Hignett (SH) Lecturer/Senior Lecturer/Reader (2002-current)
Mike Fray (MF) Lecturer (2011-current)
Paula Griffiths (PG) Lecturer/Senior Lecturer/Reader (2001-current)
Neil Mansfield (NM) Lecturer/Senior Lecturer/Reader (2000-current)
7 RAs/RFs: Anna Jones (2003-2010), Sandra Lee (2004-05), Ian Murdey (2004-05), Susan

Chipchase (2006), Amanda Tetley (2006-07), Mike Fray (2010-11), Emma Crumpton (2006))
2 PhDs: Anna Jones (2008), Yu Zhao (2011)

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

3.1. Ferreira, J. **Hignett, S.** (2005). Reviewing ambulance design for clinical efficiency and paramedic safety, *Applied Ergonomics*. 36, 97-105. DOI: 10.1016/j.apergo.2004.07.003 [IF=1.467]

3.2. **Jones, A., Hignett, S**. (2007). Safe Access/Egress Systems for Emergency Ambulances, *Emergency Medicine Journal* 24, 200-205. DOI: 10.1136/emj.2006.041707 [IF=1.477]

3.3. **Hignett, S., Griffiths, P., Murdey, I., Lee, S.,** (2007) Assessing Management of Musculoskeletal Disorders in the Ambulance Service, *Occupational Medicine.* 57, 4, 270-276. DOI: 10.1093/occmed/kqm007 [IF=1.431]

3.4. **Hignett, S. Griffiths, P**. (2009) Manual handling risks in the bariatric (obese) patient pathway in acute, community and ambulance care and treatment, *WORK. A Journal of Prevention, Assessment & Rehabilitation.* 33, 2, 175-180 DOI:10.3233/WOR-2009-0864 [IF=0.747]

3.5. **Hignett, S., Crumpton, E.,** Coleman, R., (2009) Designing emergency ambulances for the 21st century, *Emergency Medicine Journal* 26, 135-140 DOI:10.1136/emj.2007.056580 [IF=1.477]

3.6. **Hignett, S., Jones, A.,** Benger, J. (2011) Portable Treatment Technologies For Urgent Care, *Emergency Medicine Journal* 28, 192-196 DOI:10.1136/emj.2009.075010 [IF=1.477]

Grants competitively awarded to Dr S Hignett (PI)

Grant Title	**When** *and* **Value**	**Sponsor** *and* **Grant ref.**	**Key Researchers** *and* **Collaborators**
G3.1. Design and performance of ambulance stretcher loading systems (***3.1, 3.2***)	2003-04 £125,000	*EPSRC* EP/G040400/1	S EMAS, EAAS, TSAS
G3.2. An investigation of the Sign-Posting triage model for occupational health management of musculoskeletal pain in the Ambulance Service (***3.3***)	2004-05 £51,000.	*Dept. of Health (DH)*	SH, PG EMAS, EAAS
G3.3. Designing ambulance stretchers and carry chairs	2005-06 : £30,064	*EPSRC (RAIS)*	SH EMAS
G3.4. Risk assessment and process planning for bariatric patient handling pathways (***3.4***)	2006-07 £69,065	*Health & Safety Executive*	SH, PG National
G3.5. Designing Future Ambulance Transport for Patient Safety (***3.5***)	2006-07 £20,000.	*DH/National Patient Safety Agency*	SH National
G3.6. Smart Pods to reconfigure urgent healthcare delivery (***3.6***)	2007-10 £414,253	*EPSRC* EP/F002920/1	SH EMAS, GWAS, UHL, UHB, BrisDoc, LCRPCT
G3.7. CURE. Community Urgent Response Environment	2010-11 £86,917	*EPSRC (KTP)*	SH, NM NHS: GWAS, WAS, Openhouse
G3.8. CURE-RAPID. Evaluation of portable bag systems	2011-12	*NHS*	SH, MF YAS, Openhouse
G3.9. FEVA: Future Electric Vehicles as Ambulances	2012	*LU*	SH, NM LU, Nissan, GrEAN

Collaborators:

BrisDoc, Bristol Primary Care Trust
DH, Dept. of Health
EAAS East Anglia Ambulance Service
EMAS, East Midlands Ambulance Service
GrEAN, Green Environment Ambulance Network
GWAS, Great Western Ambulance Service
HSE, Health and Safety Executive
LCRPCT, Leicester County and Rutland Primary Care NHS Trust
LU, Loughborough University
RCA, Helen Hamlyn Research Centre Royal College of Art
TSAS, Three Shires Ambulance Service
UB, University of Bath
UHB, University Hospitals Bristol
UHL, University Hospitals of Leicester
UP, University of Plymouth
UWE, University of West of England
WAS, WAS Vehicles (UK) Limited
YAS, Yorkshire Ambulance Service

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

Standardised Ambulance Design [G3.1-G3.5]

Reach and Significance: Before 2006 NHS Ambulance Trusts produced their own vehicle specification resulting in over 40 different designs of emergency ambulances in the UK. This presented an increased risk to patient safety as the location of equipment and consumables, and interior layout varied in each vehicle which impacted on safe systems of work and the efficiency of clinical care. In 2005 the Dept. of Health set out a vision for the provision of future ambulance services by 2010 to increase the range of quality mobile healthcare services for patients with urgent and emergency care needs. It was identified that the demand for ambulance services was rising by about 7% per annum (approximately 250,000 extra calls) and that the role of the ambulance service was changing, with only 10% of calls relating to life threatening emergencies (many of the residual 90% having primary care or social needs).

The results of **G3.1-G3.5** were presented to the Chief Executive Officers of the UK ambulance Trusts and used to develop the national specification for emergency ambulances. Six of the 11 NHS Ambulance Trusts in England now purchase ambulances to this specification: '*achievement of the single specification ambulance…. was as a result of a very successful collaboration and I was delighted to note that over £2.5 million has been saved over the past 3 years'* (Chair National Ambulance Fleet Strategy Group **5.1**; **5.2, 5.3, 5.4**).

The outputs of **G3.1-G3.5** have also informed manual handling guidance for staff and patient safety at national **[5.5]** and international **[5.6]** levels through an ISO TR (International Standards Organisation Technical Report). Dr Hignett was the first academic member to be invited to join the National Ambulance Fleet Strategy Group.

Standardised Community Urgent Response Kit [G3.6-G3.9]

Reach and Significance: In May 2004 the Department of Health commissioned a strategic review of NHS ambulance services in England, focusing on how the ambulance service could shift from providing resuscitation, trauma and acute care towards "*Taking healthcare to the patient: transforming ambulance services in the community".* The aims were for patients to receive improved care by consistently receiving the right response, first time, in time and that more patients would be treated in the community, resulting in more effective and efficient use of NHS resources. Emergency and urgent care services were faced with the triple hurdle of delivering a service that was more responsive, more resource efficient, and that also used the latest medical technologies. In 1999 the role of emergency care practitioner (ECP) was introduced with training but with no new technology to support the changes in clinical services.

The designs and prototypes were developed and tested with The WAS Group (Europe's leading supplier of ambulances, **5.7**) and Openhouse Products Ltd (UK preferred supplier to the Emergency Services and Health Sector**, 5.8**) and Yorkshire Ambulance Service in an EU procurement process **[5.9]**. Dr Hignett has recently been invited to join the NHS Supply Chain Mobile and Relief Clinical Services Consultation Group.

Beneficiaries of Impact

Public Services

- NHS, contributing to a reduction in the number of people transported to A&E departments, Minor Injury Units and other community treatment centres (supporting other initiatives).
- General public, by more closely matching care to individual needs and allowing people to be treated closer to their homes.

Economic Prosperity and Policy Making

- Cost savings to public purse through procurement efficiency savings (£2.5 million)
- The NHS, with enabling technologies that directly support the urgent treatment and care delivery initiatives implemented in the last 5 years and which form the basis of policy developments.
- Manufacturers, by providing a robust research base on which to design and develop products and vehicles for the delivery of care

Education

- Provision of ergonomic working environments for paramedics trained in new and expanded roles to deliver pre-hospital urgent care and treatment.

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

Media outputs for Smart Pods included invited participation in the EPSRC Pioneers exhibition and NHS Innovation Expo (Excel Centre, London). The Smart Pods project was reported in 4 national exhibitions**,** 11 media outlets, including BBC and CNN, several regional newspapers and 2 national newspapers (Evening Standard, Daily Mail).

The following sources of corroboration can be made available at request.

5.1. Letter from National Ambulance Fleet Strategy Group (Chair).

5.2. BBC News Online (8 April 2009) http://news.bbc.co.uk/1/hi/health/7986460.stm

5.3. CNN.com (2 July, 2007) http://edition.cnn.com/2007/TECH/science/06/29/future.ambulances/

5.4. Daily Mail (6 April 2009) http://www.dailymail.co.uk/sciencetech/article-1167968/Pictured-The-futuristic-ambulance-thats-equipped-Bond-style-ejector- seats.html

5.5. Health and Safety Executive Report RR573 http://www.hse.gov.uk/research/rrhtm/rr573.htm

5.6. *Technical Report for ISO/CD 12296 'Ergonomics - Manual handling of patients in the healthcare sector'* for ISO/TC 159/SC 3/WG 4 'Human physical strength – Manual handling and force limits'. http://www.arjohuntleigh.com/News.asp?NewsPageNumber=425&PageNumber=219

5.7. Letter from WAS UK Ltd (http://www.wietmarscher.de/index.php?id=27&L=1 b.

5.8. Letter from Openhouse Products Ltd.

5.9. Yorkshire Ambulance Service Operational Update 2013