Evidence-based review:

First contact emergency care models for rural and dispersed populations

Commissioned by: United Lincolnshire Hospitals NHS Trust & Lincolnshire East Clinical Commissioning Group

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‘Sparklers’ is a pioneering service that helps East Midlands health organisations synthesise research from multiple sources, providing the evidence on which to build rapid service improvements.

The project, is funded by the East Midlands Academic Health Science Network (EMAHSN) and coordinated by the EMAHSN Translating Research into Practice workstream, which is hosted by Nottingham University Business School’s Centre for Health Innovation, Leadership and Learning (CHILL). The aim of the Sparklers service is to provide support where member organisations need to compile evidence based reviews but don’t have capacity to pull together and summarise research from the many available sources.

In addition to the commissioning agency, Sparklers are available to all our East Midlands member organisations – helping the EMAHSN in its key aim of translating proven research into practice, spreading innovation widely and quickly and underpinning rapid improvements in healthcare for the East Midlands’ 4.5m residents.

Sparklers – which stands for ‘Spreading Applied Research and Knowledge – Longer Evidence Reviews’ provide fuller reports on a particular and detailed element of healthcare. They are created using rigorous academic methodology and are written for practice audiences with the aim of synthesising key evidence for impact and evidence based decision making.

Sparklers are not a systematic review and are not written for an expert academic audience or to advance theory development, instead they are an independent presentation of the evidence that exists designed for the managers and clinicians responsible for making the decisions on a day to day basis in our health and social care systems. They provide a summary of “what is out there” which may be sufficient or may trigger a further investigation using the information in the Sparklers as a start. At all times we advise that these are read in conjunction with the relevant NICE guidance at http://www.nice.org.uk/

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We are happy to take commissions from all organisations providing NHS funded care for both formats. To find out more contact the EMAHSN Project Team at emahsn@nottingham.ac.uk

The Sparklers remains the property of EMAHSN and will be widely circulated and available to download from the EMAHSN website: www.emahsn.org.uk

Authors: Sue Russell and Emma Rowley
1. Background

A series of meetings and telephone calls between Oluwode Adeyemi (United Lincolnshire Hospitals NHS Trust), Gary James (Lincolnshire East CCG) and Emma Rowley (East Midlands AHSN’s Translating Research into Practice workstream) resulted in the focus of the Sparkler being agreed. The Sparkler focuses on first contact emergency care models for rural and dispersed populations.

The request was received in early May 2014, with the scope agreed on 15th June 2014. Summary updates were sent to all parties at regular intervals, to provide an update on the work being undertaken. The final report was delivered on 15th August 2014. The total turnaround time (from agreement to delivery) was nine weeks.

2. Our approach

As agreed between all commissioning parties, we have concentrated on first contact emergency care models for rural and dispersed populations.

A series of search terms were identified and checked with Oluwode Adeyemi and Gary James.

Literature searches using the using CINAHL and MEDLINE databases were conducted, using the following search terms:

- Emergency care models
- First contact
- Front door hospital
- A&E
- Emergency Department
- Access to emergency care
- Access to healthcare
- Triage
- Rural
- Dispersed
- Countryside

Selection criteria

- International papers given the likelihood of important transferrable lessons from other western-style healthcare systems from Europe, Northern America and Australia
- English language
- Peer reviewed, research papers
- Published from 2008 onwards (to ensure appropriateness to contemporary healthcare context) unless papers are considered to be important to be included (i.e. cited by many other authors)
- Relevant ‘policy’ style documents from sources including Department of Health, NHS England and NHS Trusts

Search strategy

- Search engine: CINAHL and MEDLINE
- Search models: Boolean / Phrase

Search results

The initial searching returned over 7000 papers, including:

- Emergency care models (69)
- First contact (230)
- Front door hospital (7)
- Access to emergency care (639)
- Emergency / dispersed (1377)
- Ambulance / dispersed (146)
- Ambulance / time (199)
- Emergency services / remote population (2)
- Emergency services / rural (131)
- Emergency services / time (3669)
- Trauma / remote (1)

After detailed filtering and screening, the following report draws directly on 87 references.
3. Executive summary

- Emergency care use is rising, and compared to primary care based provision, is vastly more expensive
- Rural populations are more likely to delay seeking help
- Rural populations are likely to present with more serious medical conditions or injuries than their urban counterparts
- Rural populations are likely to experience greater numbers of Road Traffic Accidents, and are likely to receive more severe injuries
- The distance to ‘definitive care’ location tends to be greater for those in rural communities
- Incidence of trauma is quite limited (less than 15% of all injuries), and in many cases ‘over-triage’ leads to costly and sometimes unnecessary deployment of helicopter emergency medical services
- A tiered response model with greater use of non-medically trained clinicians throughout the emergency services potentially offers many advantages for rural/dispersed versus urban care locations
- The current use of NHS Pathways for 111 calls could be extended to 999 calls (three NHS ambulance trusts have already done so)
- Rigid triage protocols are not necessarily suitable for rural populations, as they do not take into account conditions specific to the local area
- When a 999 response is required, ambulance call-out times tend to be longer. For time critical conditions and trauma incidents, this puts rural populations at a disadvantage
- Development of the extended paramedic practitioner role has shown capable of meeting further demand
- Better deployment of staff resources only using the most highly skilled paramedics (and/or physicians) where necessary for emergency callouts; ‘ordinary’ paramedics already suitably qualified for urgent ‘see and treat’ missions
- Where distance is reviewed (predominantly in Australian and Canadian studies) evidence suggests it is not so much time before ambulance arrival, but time from on-scene arrival and final arrival at definitive care location that is an important consideration for the patient’s long-term wellbeing
- Transformations in pre-hospital care are very largely a result of emergency medical services moving from transfer to treatment models, which has required increased professionalisation and upskilling of providers
- Highly qualified personnel and expensive equipment are not required in all instances. For example, telephone-based advice giving reduces call outs without jeopardising patient welfare
- Improved public education and the deployment of community based paramedics can reduce the imbalance in rural populations’ access to urgent care
- Community paramedics, located in GPs surgeries, are not only available for emergency call outs but are able to assist with minor injuries and health promotion activities within GP surgeries. This is particularly useful in small one GP rural style practices which often need to have two surgeries to cover their geographical area. An in situ paramedic means that there is someone available at both sites/surgeries
- Rural communities are increasingly reliant on voluntary emergency service provision. These services have been shown to improve response times and patient outcomes
- Having people on-scene as early as possible remains the best predictor of full recovery for patients in need of emergency care; CFRs and AEDs can save up to 10% of cases
- Much of the UK evidence on road v helicopter emergency medical services responses is derived from general studies with no specific reference made to rurality
- For distances less than 100km between on-scene and hospital-based emergency care, ground based responses (i.e. road ambulance) are as safe as airborne responses, and are quicker and more cost effective
- The twin tyrannies of time and distance, and the lack of the means to overcome them, means that access to urgent or emergency care is fundamentally less equitable for rural/dispersed populations
4. First contact emergency response models: Headline considerations

A&E attendance rates continue to rise.

70% of the increase since 2003 in overall A&E attendance is due to increased use of emergency facilities such as Walk in Centres and Minor Injury Units (called Type 3 A&E departments).

Figure 1: A&E attendance by type I, II and III (Source NAO, 2013).

Many people lack an understanding regarding the most appropriate service to attend, which leads to attendance at major A&Es remaining the default option (NHS England, 2013).

Injury rates and transport distances to A&E vary considerably according to geographical region. Figures for the last week of April 2014, show that of all attendances at a major A&E department (called Type 1) the admission conversion rate for England was 26.64% and for United Lincolnshire Hospitals NHS Trust was 22.03% (NHS England, 2014).
Evidence-based review: First contact emergency care models for rural and dispersed populations

First contact emergency care models of emergency care involve personnel and equipment being transported to the scene of an incident and subsequent rapid transport of the patient to definitive care location.

Emergency Medical Services (EMS) involve the evaluation and management of acute, traumatic or medical conditions in an environment outside the hospital (termed ‘pre-hospital’) (FiCEMS, 2012).

International models of emergency medical response systems can be summarised by two main models: the Franco/German system and the Anglo/American system. The fundamental difference between them is that in the Franco/German model, pre-hospital care tends to be dominated by emergency physicians supported by paramedics, with the underlying concept being that the hospital goes to the patient. In the Anglo/American model, paramedics dominate pre-hospital care, supported as necessary by physicians and the patient is taken to the hospital.

The delivery of first response pre-hospital emergency care, whether delivered by individuals or teams of various professional or voluntary groups, remains very largely reliant upon EMS provided by the 10 NHS ambulance trusts in England.

Three factors can improve a patient’s chances of survival:
- A fast response
- Receiving high quality care from highly skilled ambulance clinicians
- Being taken to a hospital that is appropriately skilled and equipped to deal with their emergency

To varying degrees, these factors apply to all emergency and urgent care situations, but are interrelated particularly when incidents occur in remote or rural locations.

When considering first contact emergency care models, there is no ‘one size fits all’ model (Goudie and Goddard, 2011). Best practice will depend upon the severity of presenting condition or injury, and with specific regard to rural and dispersed populations, access to and accessibility of services.

Access is the ability of populations to obtain appropriate services in response to need for care; it may be realised and expressed as use of health services, or it may be unrealised and expressed as unmet need for care. Accessibility, on the other hand, describes the nature of the health services whose location, organisation or cost allow, facilitate, or impede the ability of a wide range of potential patients to seek and obtain care.

(Haggerty et al., 2014:93).

Table 1: Response to 999 calls (March 2014 data)

<table>
<thead>
<tr>
<th></th>
<th>All England N (%)</th>
<th>East Midlands Ambulance Service (EMAS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emergency calls resolved by telephone advice</td>
<td>35,170</td>
<td>2,726</td>
</tr>
<tr>
<td>Emergency calls that receive a face to face response from the ambulance service</td>
<td>552,282</td>
<td>49,766</td>
</tr>
<tr>
<td>Patients discharged after treatment at the scene or onward referral to an alternative care pathway and those with a journey to a destination other than a Type 1 or 2 A&amp;E</td>
<td>199,292 (36.1%)</td>
<td>16,273 (32.7%)</td>
</tr>
</tbody>
</table>

Three influential reports act as a contextual backdrop for this review:

- Transforming NHS Ambulance Services (NAO, 2011)
- Taking Healthcare to the Patient (DH, 2012)
- High Quality Care For All, Now and for Future Generations: Transforming Urgent and Emergency Care Services in England (NHS, 2013)

These reports propose various improvements to address the issue of increasing demand on emergency healthcare resources, particularly attendance at A&E and emergency admissions.

Three emergency response models dominate the evidence base:

**“Hear and Treat”**
- Also known as ‘Stay and play’, ‘Treat and discharge’ or ‘treat and refer’
- Call resolved without need to despatch
- Ability to link need with demand and refer as appropriate.
- Supported through NHS Pathways via 111 + 999.
- Availability of suitably clinically qualified personnel within call centres.
- Clinical risk of ‘under triage’.

**“See and Treat”**
- Also known as ‘Scoop and run’, or ‘drip and ship’ ‘Treat and transport’
- Calls attended and despatched to but without need for onward conveyance
- Ability to treat and discharge at scene, thus reducing inappropriate use of more costly resources.
- Need for adequately trained personnel with appropriate decision making skills to overcome risk averse behaviours of first responders.
- Clinical risk of ‘over triage’.

**“See and Convey”**
- Calls attended to and conveyed to emergency or urgent care provider.
- Ability to convey to the most appropriate treatment centre (A&E, Minor Injuries Unit etc. or refer onwards).
- Conveyance to A&E for most dependent cases only.

Each approach has explicit implications for rural populations. However common to all three models is the need for better resource allocation to reduce the inequitable urgent and emergency healthcare available to rural and dispersed populations.

For the system to function in the best interests of patients, irrespective of their geographical location, a combination of all three models is required.
Evidence-based review:
First contact emergency care models for rural and dispersed populations

5. What is a rural dispersed population?

Urban and rural areas cover approximately 21% and 79% respectively of the land area of England (ONS, 2011). However, population figures are virtually the opposite of this: 81% of the population lives in urban areas and 19% in rural areas. Rural areas are further classified as being either ‘Town & Fringe’ or ‘Village, Hamlet and Isolated Dwellings’ (ONS, 2011). Each geographical area is further subdivided into sparsely populated and less sparsely populated. The ‘level of sparseness’ is based on population size, population concentration and remoteness as modelled on distance and time taken to travel to other settlements.

Table 3: Population spread across England and Wales (ONS, 2010/11)

<table>
<thead>
<tr>
<th>Wider area type</th>
<th>Narrower area type</th>
<th>Mid-2009 population (thousands)</th>
<th>Percentage of total population</th>
<th>Percentage of total land area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban</td>
<td>Urban - Less sparse</td>
<td>42,071</td>
<td>81.2</td>
<td>20.5</td>
</tr>
<tr>
<td>(Population greater than 10,000)</td>
<td>Urban - Sparse</td>
<td>114</td>
<td>0.2</td>
<td>0.4</td>
</tr>
<tr>
<td>Rural</td>
<td>Town &amp; Fringe - Less sparse</td>
<td>4,424</td>
<td>8.5</td>
<td>16.1</td>
</tr>
<tr>
<td></td>
<td>Town &amp; Fringe - Sparse</td>
<td>220</td>
<td>0.4</td>
<td>2.1</td>
</tr>
<tr>
<td></td>
<td>Village, Hamlet &amp; Isolated Dwellings - Less Sparse</td>
<td>4,573</td>
<td>8.8</td>
<td>47.7</td>
</tr>
<tr>
<td></td>
<td>Village, Hamlet &amp; Isolated Dwellings - Sparse</td>
<td>407</td>
<td>0.8</td>
<td>13.2</td>
</tr>
</tbody>
</table>

Lincolnshire is a predominantly rural county. The most sparsely populated area (shown in dark green in Figure 2) lies within the East Lindsey district, and has a population density of <99 people per square kilometer. As such, using ONS criteria, it can be defined as an area with a remote and dispersed population.

Figure 2: East Midlands local or unitary authority - Rural and Urban Area Classification
Evidence suggests that over 66% of all trauma incidents occur in densely populated areas; less than 6% occurring in remote rural regions (Morrison et al., 2013). However, the actual figure for specific geographies or localities will vary – for example, the above figure of 66% refers to data collected in Scotland, and so would be expected to differ in other areas.

There is wide clinical variation in which conditions require emergency medical service response, and where the incidents are located. An American study of road traffic accidents (RTAs) found that 11% of rural crash victims were classified as major trauma cases, compared to only 5.8% of urban crash victims (Gonzalez et al., 2009). A comparison of metropolitan versus rural major trauma incidents in Western Australia found that rural patients were younger, were included in a larger percentage of RTAs and had higher trauma severity scores (Fatovitch et al., 2011).

However, whilst risk of death as a result of major trauma is more than double in rural and remote areas of Western Australia, if patients did survive until they reached a Tertiary Referral Centre (the equivalent of a major trauma centre) then mortality outcomes were the same as for those living in metropolitan areas (Fatovitch et al., 2011).

Specifically regarding RTAs, Australian evidence shows that accident rates in metropolitan areas are twice that of rural areas, yet mortality rates are reversed (Danne, 2003). It would appear therefore that it safer to drive on urban roads in terms of likelihood of death or serious injury. Comparable UK data is shown in Table 4, and shows that over 60% of total fatalities for car users occur on rural roads.

### Table 4: Road Casualties (UK wide)

<table>
<thead>
<tr>
<th>Road type</th>
<th>All Road Traffic Casualties</th>
<th>Slight Injury</th>
<th>Serious Injury</th>
<th>Fatalities</th>
<th>Fatalities (as % of all fatalities)</th>
<th>Serious injury and fatalities (as % of each road type total casualties)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rural</td>
<td>49,364</td>
<td>40,308</td>
<td>8,010</td>
<td>1,046</td>
<td>60.43%</td>
<td>18.34%</td>
</tr>
<tr>
<td>Urban</td>
<td>98,550</td>
<td>86,216</td>
<td>11,762</td>
<td>572</td>
<td>33.04%</td>
<td>12.53%</td>
</tr>
<tr>
<td>Motorway</td>
<td>6,500</td>
<td>5,719</td>
<td>668</td>
<td>113</td>
<td>6.53%</td>
<td>12.02%</td>
</tr>
<tr>
<td>All roads</td>
<td>154,414</td>
<td>132,243</td>
<td>20,440</td>
<td>1,731</td>
<td>100.00%</td>
<td>14.35%</td>
</tr>
</tbody>
</table>

Source: ROSPA (2011)

The East Midlands has highest rate in England for combined deaths and serious injury as a result of RTAs (50.8 per 100,000 population, compared to the all England rate of 44.3) (Public Health England, 2014a).

In Lincolnshire, the rate of admissions due to RTA injury is almost twice as high as the national average (99.9 per 100,000 population, rather than 51.9) (Public Health England, 2014b).

Although Stroke and Trauma account for 20% of all emergency admissions, their high visibility in the literature may be related to research interest in patient outcomes. By the nature of their injuries/condition, both Trauma and Stroke patients will require prolonged hospital admissions and costly long term rehabilitation. However, timely interventions that can reduce deterioration at the outset is perhaps more crucial for these groups of patients.

The NHS Trauma Networks are a relatively new concept, with an overall evaluation of the benefits in terms of patient outcomes and costs in terms of resource allocation and skills requirements yet to be published.

Most trauma care protocols are based on data relating to the urban environment where transport times are short. However in rural locations, if potentially lifesaving techniques are to be used on-scene (due to longer times before reaching definitive care), EMS personnel require appropriate training, skills and experience (Smith and Conn, 2009).
Evidence-based review: First contact emergency care models for rural and dispersed populations

Advanced Trauma Life Support (ATLS) training recognises three peaks of death following severe trauma (Somers, 1999):

- In 50% of cases intervention is not possible as deaths occur within minutes.
- In 35% of cases death occurs within 1-3 hours after the initial event (often described as the golden hour/period).
- In 15% of cases, death occurs days or weeks later and it is this phase where complications subsequent to initial injury take effect.

Evidence from military research shows that 90% of injuries are ‘unsalvageable traumas’, with personnel dying within minutes of wounding. However, for survivors of the first peak, transport times of up to two hours are shown to be acceptable, as long as intensive care level treatment is received during transportation (Parker, 2007). However, other research has found no difference in survival rates compared to the presence of practitioners with/out ATLS skills (Stiell et al., 2008). Stiell et al. found that system wide implementation of full ATLS programmes neither decreased mortality or morbidity for major trauma patients. Due to the severity of injuries suffered, even if paramedics were skilled in on-scene intubation and insertion of intravenous lines, when trauma cases were involved, mortality increased.

Much of the literature concerning trauma network provision is provided from US and Australian studies. Although distances to definitive care in urban trauma centres are potentially much greater in the USA or Australia than in the UK, the principles underlying the networks are broadly similar: if an incident occurs more than 45 minutes away from a trauma centre, patients will be taken to an alternative facility. In the Australian tiered system, this may still be a similar distance to those encountered in more remote areas of England. Where the difference lies is that in the USA or Australia, if a patient is taken to a trauma centre, it is more likely to be as a secondary or even tertiary transfer, and as such, the methods of transport and skill levels of accompanying personnel necessary will be different.
7. Time and distance

Whilst 100% of patients living in urban areas live less than 4kms from their GP, for patients living in rural areas, the figure is less than 70% (RSN, 2013). Similarly, whilst the mean distance from hospital to home for an emergency admission throughout England is 8.7km, as Figure 4 demonstrates, there is significant variation over the country.

Figure 4: Relationship between population density and distance travelled to hospital

- 47% of emergency admissions were more than 20km from a patient’s home
- The mean distance travelled for 10% of all trauma emergency admissions was 10km
- 5% of all trauma patients being admitted more than 30km away from their homes

A 10km increase in straight line distance between hospital and incident is associated with a 1% absolute increase in mortality (Nicholl et al., 2007). Approximately 20% of the population of England lives in rural areas where accidents, and subsequent mortality rates, are worse than in urban areas.

The relationship between distance and time and its effect on patient outcomes is a complex one. As the development of trauma networks has illustrated, longer distances become acceptable when ensuring that best care (in terms of specialist resources) is provided (Roberts et al., 2014). The converse view is that the benefits of centralisation need to be balanced against increased risks associated with ill patients having to travel further (Goudie and Goddard, 2011) – which the College of Emergency Medicine (2008) define as more than 20km.

ONS data uses the population density measurement of <99 people per km² and this equates with 1 person per hectare as used in the illustration above.
For incidents occurring some distance from hospital, patient outcomes are heavily dependent on resources available: at/ near the incident, when transferring the patient and at site of definitive care.

In the Anglo/American model, the aim at the scene is to prevent secondary injury without necessarily diagnosing and treating the primary injury (Danne, 2003). However in England, this approach is increasingly being challenged with the system moving closer to Franco/German model of ‘taking the hospital to the patient’.

The Australian model of a centralised system that is supported by local facilities is also under transformation. Despite a population of only 23.3 million, Australia has 265 licensed doctors and specialists per 100,000 population. In the UK there are 372 licensed doctors per 100,000 population (RRHA, 2012; ABS, 2013; GMC, 2014). Australia’s population is spread over vast areas, however like England, the majority live in ‘urban’ areas. Less than 12% of Australia’s population live in ‘outer regional or remote’ areas and of those, only 1% live in remote outback areas.

People living in non-urban areas receive a smaller proportion of overall health spending; there are fewer GPs or other health care professionals and there is less access to specialist services (RRHA, 2012). In order to address this inequity, Australian policy has focused on reducing the need for conveyance to hospital through legislation and public awareness campaigns to reduce accidents, and the development of the extended care paramedic/emergency practitioner role to support GPs.

There is no linear relationship between distance, time on-scene and time taken to receiving definitive care. Each case will depend on the individual patient, the urgency of their condition and the options available.

However, evidence from the USA demonstrates that the impact on mortality is affected by whether incidents occur in rural or urban environments (Gonzalez et al., 2009). An analysis of the effect of time on patient mortality in rural RTAs found increased mortality rates associated with longer pre-hospital time (taken as an aggregated measure of distance before arrival on-scene, on-scene time and travel time to hospital) (Gonzalez et al., 2009).
Evidence-based review: First contact emergency care models for rural and dispersed populations

Table 5: Differences in response and outcomes according to rural/urban location (Gonzalez et al., 2009).

<table>
<thead>
<tr>
<th></th>
<th>Rural n= 34,341</th>
<th>Urban n = 11,422</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fatalities</td>
<td>Survivors</td>
</tr>
<tr>
<td>Time to arrival on-scene (minutes)</td>
<td>10.67 8.54</td>
<td>6.50 6.01</td>
</tr>
<tr>
<td>On-scene time (minutes)</td>
<td>18.87 14.81</td>
<td>10.83 12.42</td>
</tr>
<tr>
<td>Transport to hospital (minutes)</td>
<td>12.45 14.14</td>
<td>7.43 10.26</td>
</tr>
<tr>
<td>Total pre-hospital time (minutes)</td>
<td>42.0 37.5</td>
<td>24.8 28.7</td>
</tr>
</tbody>
</table>

Patients living in rural areas are more likely to have to travel in excess of 20km in order to attend A&E and hospital appointments.

Although an important consideration, distance alone is not generally deemed to be the determinant of care provision. However, there is need for caution when projections are made for estimating EMS response times or distance to provision estimates.

Wallace et al. (2014) compared the linear arc or ‘as the crow flies’ measurement of distance between departure and arrival location and two GIS based methods, and found that transport time estimation most accurate using Google Maps and least accurate using a linear arc method. They concluded that relying on best conditions estimates risks underestimating access times for populations more than 20 minutes away from acute care. This is especially important for time-sensitive medical incidents such as emergency medical responses (Wallace et al. 2014).
Equity of response

Equity of first response provision is a complex and sensitive issue.

Figure 6 shows a wide variation in the emergency admission rates across the country, with rural areas in general having higher rates, including the East Lindsey area.

Population age differences are an additional factor when considering access and service provision. Outward migration of young working age adults increases in rural areas, whilst at the same time, inward migration of older retirement age people increases.

21% of Lincolnshire’s population is estimated to be over retirement age (Source: ULH NHS Trust). The older a population becomes, the greater the likelihood of increased medical conditions and health care needs. Yet in rural locations, local services are not as plentiful as in urban locations, meaning a patient will have to travel to access services.

Source: NAO (2014)
If not A&E then where?

Recent estimates suggest that at least 1 million people currently taken to A&E could be treated on-scene (NHS, 2014).

There is growing concern regarding the increase in rate of Ambulatory Care Sensitive Conditions (ACSC; see Appendix 1 for definitions) emergency admissions, which are rising faster than the rate of population growth (Cheema and Berry, 2014).

- Between 2001/2002-2012/2013, the proportion of ACSC emergency admissions (of total emergency admissions) rose from 18% to 20%.
- This represents an increase in numerical terms of 48% (704,153 to 1,043,913 admissions).
- Over the same time period, emergency admissions for non-ACSCs only rose by 34%.

However, there is no evidence that degree of rurality alone increases A&E attendance rates for ACSCs (Hossain and Laditka, 2011).

ACSCs are generally seen as avoidable emergency admissions which could be suitably addressed in primary care settings, Walk in Clinics or Minor Injury Units.

However whilst the latter provide an alternative to A&E, there is a fear that they will create a supply-induced demand, to the extent that the question has been raised regarding how far increased access in primary care will deal with unmet need, or whether it will stimulate additional use of services that would not otherwise have occurred (Rosen, 2014).
Walk in Centres
Walk in Centres, originally nurse led, are increasingly becoming GP led facilities for people either not registered with, or unable to get a GP appointment, or for other minor injuries that do not require full A&E facilities. In contrast, Australian rural hospitals act as Walk in Centres; they are staffed by nurses, who are supported by the GPs who often have emergency medicine qualifications and experience.

Little evidence is available regarding the use of Walk in Centres and Minor Injury Units by rural dwelling patients in terms of rates attendance / admission or clinical outcomes.

The sector regulator for health services in England, Monitor, was unable to determine the exact level of provision nationally, due to no central repository of data. They reported ‘we estimate there to be in the region of 185 Walk in Centres nationally of which 50 are nurse led and the remainder GP led’ (Monitor, 2014).

Monitor (2014) concluded that overall variation in spread and levels of provisions seen is due to confusion regarding who should be responsible for determining levels of Walk in Centre provision. Whilst NHS England is responsible for Urgent Care, and CCG commissioners are responsible for Primary Care, Walk in Centres are seen to bridge both urgent and primary care provision, and as such fall into a commissioning gap between the two groups.

Figure 8: Location of Walk in Centres

Primary care
Research conducted in the East Midlands found that the larger a GP practice is and the further away it is from a hospital, the lower the rate of emergency admissions (Bankart et al., 2011). Another UK study examining patient reported access to the GP and self-referred rate of A&E visit, found that patients who were provided more timely access to primary care made fewer self-referred visits to A&E (Cowling et al., 2013). However, the same study found that the two variables with the greatest impact on A&E visits were: 1) rural v urban location, and 2) the Index of Multiple Deprivation (IMD) score for practice populations. Rural patients had 15% fewer visits than urban practice patients, whilst the higher the IMD score, the greater the likelihood that patients would self-refer to A&E.

The National GP Patient survey found that 12.9% of patients who were unable to see a GP subsequently self-referred to A&E or walk-in centres (MORI, 2012). 41% of patients who wanted to be able to see or speak to a GP on the same day, 36% actually achieved this (MORI, 2013).

Satisfaction with GP services is greater in practices with a lower number of registered patients (Cowling et al., 2013). However for practices in rural areas, patients aged 65+ account for 25% of patients, as opposed to 15% in urban practices. This potentially impacts on practice workloads, as older patients are known to be higher utilisers of care due to their often complex, and comorbid health problems.

Recruitment and retention of GPs generally, but particularly rural GPs, is an international problem (Sullivan et al., 2008; RCGP, 2014). Rural practice lists tend to be smaller, cover more dispersed areas, have a static or declining general population whilst also having an increasingly ageing population and GP work load is acknowledged as increasing, with longer hours worked in dealing with more complex cases (Kings Fund, 2013).
Evidence-based review: First contact emergency care models for rural and dispersed populations

Rural practices struggle to provide the levels of out-of-hour cover possible in larger urban practices. Similarly, locum cover which can be provided in house in larger urban practices is not always possible in rural ‘one man’ practices. Consequently, GPs being ‘out on call’ leaves surgeries unattended for use by regular non-emergency patients. These issues were described by a contributor to a Royal College of General Practitioners report (2014):

…sadly what you describe in Wales holds very true here in Lincolnshire – struggle to recruit; no one wants a real GP job anymore – no funding for staff – dispensary is a struggle with category M no appreciation of the cross subsidy – I worked out last night that my entire practice PMS income goes on paying staff; none of it comes to me anymore so I’m left with QOF and enhanced services so end up earning less than average. Sadly if I could escape right now I probably would but then we are struggling to get another GP as our salaried one is off to Australia. GPs may be the answer to the crisis but only if we are funded properly – I never get home before 10pm, have to work most weekends and have only managed 5 days leave in the past 12 months – locums are horrendously expensive and just not available. 

(Anon GP, Lincolnshire)

Telemedicine

Telemedicine is encouraged on the basis that it delivers improved patient outcomes more effectively and efficiently and can assist in delivering clinical education and health and social care delivery (RSN, 2013).

Telephone consultations appear to reduce the number of visits made to GP surgeries, without increasing the number of A&E attendances (Bunn et al., 2004). Similarly, evidence suggests that telephone access can be effective in managing urgent care in out of hours services. However, telemedicine does not make access to care geographically equitable:

Currell et al.’s (2000) review of telemedicine suggested that the use of video for long distance consultations could address issues surrounding equity of access to healthcare in rural and dispersed populations. This appears not to have been researched in relation to emergency care access for rural and dispersed populations, but is gaining attention in other healthcare settings/conditions (for example, Neufeld et al., 2012).

111 and 999

Access to first response models of emergency care is granted through a single point of access for all urgent needs: the 999 and 111 call systems.

In addition to more traditional telemedicine services, pre-hospital triage during calls to NHS 111 or 999, where decisions are made whether to ‘hear and refer’ or to ‘see and treat’, are also forms of telemedicine. Telemedicine can also occur at the scene of the emergency, when decisions are made regarding whether to ‘see and treat’ or ‘see and convey’ to hospital.

The majority of ambulance trusts use the Advanced Medical Priority Dispatch System (AMPDS) and Criteria Based Dispatch (CBD) protocols. These systems guide non-clinically trained call handlers to reach an assessment of the priority and level of response required. If at any point in the NHS Pathway a trigger is set off to alert an emergency ambulance response, this will be generated immediately. Additionally, the NHS Pathway system allows for callers to be passed over to clinically trained nurses/paramedics who may then advise patients on treatment options without the need to visit other facilities. May 2014 figures show that for the East Midlands Ambulance Services (EMAS), 5% of calls were resolved through telephone as opposed to face-to-face contact. Additionally, the ‘recontact’ rates were lower than average at under 8% (NHS, 2014).
An international comparison of Emergency Medical Services (EMS) found that telephone triage and advice from nurses was not only safe for non-urgent calls, but also provided a cost effective method for avoiding ambulance call-outs (Pickering et al., 2009). Use of the ‘in-built’ directory of services enables call handlers to identify which providers/facilities are available, in order to inform the caller of the most appropriate action to be taken. In principle there may be more than one option available.

However, the ranking of these is determined by local needs and resources. Directories of services require regular updating, and include GPs surgeries, Walk in Centres, Minor Injury Units and other local charity specialties.

The risk for ‘under triage’ (when a call requiring an 8 minute response is erroneously assigned a lower priority which may subsequently affect patient outcome) is estimated to be about 10% (Turner et al., 2008). In contrast, ‘over triage’ is estimated to be as high as 30%.

Risk adverse behaviours may affect triage at scene. An audit of helicopter mission data from the USA concluded that the criteria used in decisions for Helicopter Emergency Medical Services (HEMS) deployment were inadequate, as over 70% of patients for whom HEMS were dispatched had only ‘minor’ injuries or Injury Severity Score (ISS) scores <15 (Cudnik et al., 2011).

The extent of trauma injuries may not initially be clear at the scene of injury, and as a result, trauma teams may be activated more often than necessary (EMTN, 2014). However, the sensitivity of dispatch systems has also been questioned (Pickering et al., 2009). The ongoing development and use of triage assessment and patient priority protocols has produced equivocal opinions. Evidence suggests overall they are safe but doubts have been raised, for example, concerning the reliability of AMPDS to detect serious conditions that do not have clear clinical signs, with resultant over triage ‘just in case’ (Turner, 2008).

The impact of ‘see and refer’ or ‘see and treat’ protocols are also demonstrated in the increasing number of calls responded to face-to-face, but not conveyed to A&E. Data shows that 28% of patients were discharged on-scene, of whom only 5.6% recontacted EMS within 24 hours (NHS, 2014).

Overall ‘treat and refer’ protocols, plus developments in telephone triage, are believed to have contributed to a reduction in conveyance rates, down from 90% in 2000 to 58% in 2012 (Snooks et al., 2013). Looking specifically at rural populations, evidence shows that high population density areas have higher ambulance call out rates than less sparsely populated areas, irrespective of deprivation levels or age of patients (Peacock and Peacock, 2006) and that in urban areas, ambulances are considered to be ‘over-used’.

Accuracy of dispatcher’s assessment of call priority was found to vary according to rural/urban location. Subsequent assessment on-scene found more severe and greater priority incidents than had been allocated by the dispatchers for rural incidents (Beillon et al., 2009). Rural patients were found to have better social support networks and thus make more complex decisions before calling EMS, whereas urban populations take a more ‘consumerist’ approach (Beillon et al., 2009).

- In urban areas, 18% of patients request an ambulance themselves, whereas only 10% do in rural areas.
- In urban areas, 20% of calls are made by medical professionals, yet in rural areas, this figure rises to 31% of all calls.

(Source: Peacock and Peacock, 2006).

2See Appendix 2 for details of Injury Severity Score (ISS) scales

Voluntary sector provision

Sitting firmly within the ‘see and treat’ model of emergency care is voluntary sector involvement. England has no ‘Good Samaritan’ legislation, yet the likelihood of litigation following a poor patient outcome is rare. This has facilitated confidence in volunteering (Colquhoun et al., 2008).

Volunteers may work individually or as teams called on an ad hoc basis. In most instances, even if equipment or staff are provided by charities, costs are still incurred by the statutory services (training of volunteers, etc.).

Community First Responders (CFRs) live within the communities they serve; as such, patients can be attended to rapidly and given immediate lifesaving support (oxygen and defibrillation) until the arrival of the ambulance. In 2009-10, non-medically trained CFRs attended over 111,000 incidents in England (DH, 2011).

Very few CFR schemes offer a 24/7 service; for example, most individual CFR schemes attend 10 - 20% of Spontaneous Cardiac Arrest incidents in their area. Although ambulances are dispatched concurrently with the call to CFRs, the benefit of CFRs is considered greatest in rural areas where response times are unlikely to be met (DH, 2007). Unlike EMS responses where patient condition determines priority and type of response, CFRs are only deployed to situations within their capabilities or competencies.

Public access Automated External Defibrillators (AEDs) were first introduced during the 1990s as a result of pressure from the British Heart Foundation. They were later introduced in high risk locations (such as train stations and supermarkets).

AEDs are designed for use without the need for medical experience, as a voice and screen messages guide users through the process. Success relies heavily on voluntary participation, either members of the public or volunteers such as CFRs. AEDs are almost 10 times more effective in saving lives than CFR schemes alone (Community Heartbeat, 2014).

3A list of Category A calls to which a CFR may be dispatched is included as Appendix 3.
Evidence-based review: First contact emergency care models for rural and dispersed populations

However, due to a lack of reliable outcome data, it is only possible to state that on-site and portable AEDs are used with differing levels of frequency and success (Colquhoun et al., 2008). Police and fire crews trained with Basic Life Support (BLS) and defibrillation skills can be effective in improving both response times and clinical outcomes (Pickering et al., 2009).

Voluntary sector services, such as LIVES (Lincolnshire Integrated Voluntary Emergency Service), are independent charities. Trained volunteers work alongside statutory services; the crews are directly tasked by the ambulance control centre and provide immediate (rapid response) in life threatening situations and respond to conditions on-scene until arrival of EMS personnel. Volunteers may either act as CFRs with BLS or as medically trained volunteers with Advance Life Support (ALS) skills.

The scheme responds to around 1500 emergency calls a month.

As members live within the communities they serve, they have a particular value in rural areas.

A more specialist voluntary scheme is East Midlands Immediate Care Scheme. Doctors fully trained in trauma work attend emergency incidents at the request of and in support of staff from the EMAS. They have their own support vehicles and carry a wide range of specialist equipment necessary for dealing with serious trauma and other emergencies they might encounter. The timely service they provide is said to be particularly valuable in supporting patients in more rural areas (EMAS, 2014).

A highly visible level of voluntary service provision are the Helicopter Emergency Medical Services (HEMS).

HEMS are charitable organisations which receive varying levels of government funding; for example, in Australia the actual cost of each retrieval trip is reimbursed to include staff costs, fuel etc. In England, with the exception of the London HEMS which is fully NHS funded, only the cost of clinical crew members are supported through central government.

Clinically trained crews generally include paramedics with ALS and/or Critical Care skills, plus physicians trained in emergency care. As with standard ground based deployment criteria, HEMS are dispatched according to severity of patient clinical condition. For example the recently formed Trauma Networks, who respond to patients identified as having ISS scores> 12, rely heavily on HEMS.

- In England, 18 air ambulance charities support 32 helicopters
- HEMS cover is provided to more than 19,000 incidents a year
- Each mission costs in the region of £1,200

(Source: Lo, 2011)

It is estimated that approximately 40% of HEMS missions are for acute medical illnesses and 60% for trauma, the majority of which are in response to Road Traffic Accidents (RTAs) (Booz et al., 2003; Lyon et al., 2013).

HEMS services cannot respond to all calls. Nutbeam et al. (2012) found that in 30% of RTAs involving serious injuries which occurred more than 45 minutes travelling by road from the major hospital, HEMS could not be deployed. 97% of the time, this was because the incidents occurred during the hours of darkness. The issue around night flying is not so much that helicopters cannot fly in darkness; night vision technology is installed and locally to the East Midlands, all HEMS crews are trained in it use. The problem is with identifying suitable landing sites in unknown terrain in the dark. When a HEMS crew cannot be deployed, it means that the only remaining option is road-based transport which entails either transportation of patient to the nearest trauma unit for stabilisation, or a much longer transport time to definitive care, with the less than optimum situation of paramedics or emergency physicians working in the back of a fast moving ambulance. Both of these scenarios potentially disadvantage patients in more remote or rural areas.

The Lincolnshire/Nottinghamshire HEMS carries out over 1000 missions a year. Recent tweets from the East Midlands Major Trauma Centre show the frequency of HEMS attendance.

East Midlands MTC @EastMidsMTC

In June we had 154 Major Trauma Calls. 16% of these were received via Air Ambulance. goo.gl/MZCFqr #savetimeandlives @LNAACT

East Midlands MTC @EastMidsMTC

Last week we had 38 Major Trauma Calls in our ED. 9 of these patients (23%) arrived via Air Ambulance @nottmnhospitals @NUHCharity
Evidence-based review: First contact emergency care models for rural and dispersed populations

Around 70% of EMS crews are paramedics who are supported in two man response vehicles by emergency care assistants with BLS skills. Paramedics’ professional training enables them to triage and treat patients utilising an increasingly wide range of drug therapies. A much smaller percentage of EMS personnel (5%) are Advanced Practitioner Paramedics (APP) who can work as solo responders in rapid response cars. APPs are trained to a much higher level, can conduct specialist diagnostic testing which enables them to treat patients at home or if necessary to refer onwards to specialist units, hence by-passing A&E. There is no consensus on what an ideal staff level/grade mix should be. The use of APPs alongside paramedics however, is not considered to be maximising the potential to reduce conveyance rates (DH, 2011).

Extended roles for specialist paramedics

Increasing skills and professionalisation of the paramedic role, in addition to greater knowledge and experience, have enabled broader, more specialist roles to be undertaken (O’Meara et al., 2012).

Critical Care Paramedics (CCP) primarily escort critically ill patients during secondary/tertiary transfers. They have advanced airway management skills and although Rapid Sequence Intubations (RSI) are generally carried out by doctors/anaesthetists, CCPs can manage failed intubations. Whilst the provision of CCPs frees up acute based clinicians, ‘skills fade’ is problematic for CCPs, as especially in England, the volume of secondary and tertiary transfer work is low (Jashapara, 2011).

A Canadian model of good practice that overcomes this problem exists in the High Acuity Response Team (HART) concept4. In the Canadian model, supernumerary emergency and/or intensive care nurses and a registered respiratory therapist are deployed when necessary from the regional hospital at which they routinely work. This flexible deployment of staff resources results in the HART team being hospital based approximately 70% of their time, with the remaining time being dedicated to rural hospital support and emergency transfers. Maintenance of the required levels of skills is ensured and undue pressure on other rural medical services providers is removed. The HART teams work in collaboration with existing EMS providers, with respiratory therapists accompanying the nurses to approximately 38% of incidents. From a patient’s perspective the added advantage is that once admitted to the hospital, the HART team members are available to support them in the critical phase of their illness/injury thereby facilitating continuity of care for patients (Brayman et al., 2012).

In Australia, Rural Expanded Scope of Practice paramedics support rural GP practices, working alongside other health professionals as the first point of contact. They provide health education, screening and treatment of minor injuries. Their emergency response capacity is maintained, whilst at the same time, patient care and the general health of rural communities are improved (Stirling et al., 2007).

A systematic review of the role of Emergency Care Practitioners (ECP) – nurses and paramedics qualified to conduct initial assessment of patient status and then either deliver simple treatments or refer to appropriate clinical teams - found that patients’ perceptions of the quality of care received was as good as existing services (Hill et al., 2013). The effectiveness of ECPs at reducing A&E attendance varied across different settings; when comparing variation in treatment at scene rates, ECPs were found to treat 28% of patients on scene versus 18% for ‘ordinary’ paramedics (Hill et al., 2013). Furthermore, patients of ECPs were more satisfied than those not seen by an ECP.

ECPs increase community response capacity not only through linking communities closer to ambulance services, but by raising community awareness of the opportunity for first aid training and other volunteer services (Evans et al., 2013). Whilst providing benefits to the system as a whole, perhaps most importantly, ECPs offer greater benefits for rural patients in that care closer to or at home enables support from friends and family, not least in avoiding long distances travelled to visit whilst an inpatient, elimination of long travel times for follow up appointments and continuity of care by community based staff. This is not only a matter of patient convenience, as outreach service providers have expressed concerns over the time taken to travel to rural locations and how this impacts upon patient contact time (Swansea, 2010).

The Australian service model relies on a tiered system hospital provision. The aim is to deliver first responses from within community resources, which are then supported by either ‘remote advice’ or transfer to the most appropriate hospital for the patient’s needs. In addition to relaying information to Tertiary Referral Centres (TRC; the English equivalent of trauma centres) in advance of a patient’s arrival, and the sending of diagnostic images, vital signs etc. for use in later treatment, surgeons and anaesthetists in the TRC can view, via video link, the resuscitative processes and give ‘live’ advice on the clinical management of the patient to those caring for them in small regional hospitals. For example, if there is an urgent need for emergency cranial surgery, neurosurgeons routinely based in large urban hospitals, will fly out with the retrieval crews but during the flight will be in radio contact with the doctor at the rural hospital. Thus in time critical situations, surgery can be commenced even before arrival of the surgeon (Danne, 2003).

4HART in the Canadian context should not be confused with HART in the English context: Hazardous Area Response Teams that are specially recruited ambulance service personnel trained to an enhanced level, to provide response to major incidents, with highly specialised equipment and vehicles they typically respond to 50 or 60 incidents per month (EMAS, 2014).
HEMS or EMS: what has the greater impact on patient outcomes?

To determine if HEMS or EMS are most impactful requires a consideration of staffing levels/grades, intubation rate, time on-scene and time/distance of transfer to definitive care (Butler et al., 2010). Additionally, clinical factors must be acknowledged; for example, evidence shows that in-transit critical events such as mechanical ventilation and haemodynamic instability, occur in up to 1 in 15 urgent road-based transports (Singh et al., 2014).

Unless return of spontaneous circulation can be achieved in out of hospital cardiac arrest, the benefit of speed provided by HEMS is outweighed by the poor cardiopulmonary resuscitation possible during air transport (due to the noise, vibration, lack of space, etc.) (Lyon et al., 2013). A Scottish study researching HEMs’ on-scene time and critical care intervention use concluded that a significant relationship existed between total on-scene time and level of intervention delivered to patients (Corfield et al., 2011). Likewise, a review conducted to inform national policy regarding the development of a dedicated HEMS in Ireland, concluded that:

The clinical case for ‘tertiary response’ HEMS is relatively robust and substantially stronger than that for ‘primary response’ HEMS. The literature indicates that the clinical case for ‘primary response’ HEMS is not unequivocal and the debate about cost effectiveness continues (Booz et al., 2003).

Galvagno et al. (2013) concluded that whilst helicopter transport for some patients may be beneficial, there is no definitive advantage to HEMS over ground-based transport.

The majority of evidence for HEMS is based on trauma incidents; however more specifically with regard to emergency response for remote populations, evidence from Australia shows that HEMS response within 100kms from base neither improves time to definitive care nor mortality rates (Shepherd et al., 2008). However, air transport was significantly faster beyond 100kms. A distance of 100kms is generally agreed upon as equating to 45 minutes HEMS travelling time (Nutbeam et al., 2012), whereas depending on road conditions, 45 minutes by road falls between 32-65kms.

Table 6 shows distances and travelling times to various points within a rural region such as Lincolnshire from main ambulance station hubs. It demonstrates that it is highly unlikely road-based transport will achieve Ambulance Quality Indicator category A (defined as: immediately life threatening) response times (target: 8 minutes).

<table>
<thead>
<tr>
<th></th>
<th>Skegness</th>
<th>Mablethorpe</th>
<th>QMC Nottingham</th>
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</thead>
<tbody>
<tr>
<td>Boston</td>
<td>34km = 36 mins</td>
<td>50km = 50 mins</td>
<td>101km = 85 mins</td>
</tr>
<tr>
<td>Scunthorpe</td>
<td>103km = 95 mins</td>
<td>91km = 87 mins</td>
<td>113km = 88 mins</td>
</tr>
<tr>
<td>Lincoln</td>
<td>64km = 64 mins</td>
<td>67km = 67 mins</td>
<td>72km = 62 mins</td>
</tr>
<tr>
<td>QMC Nottingham</td>
<td>135km = 121 mins</td>
<td>135km = 121 mins</td>
<td>~</td>
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</tbody>
</table>
Evidence-based review: First contact emergency care models for rural and dispersed populations

In the USA, Category A response times vary according to geographical remoteness. For example, in urban areas, the target response time is 8.59 minutes, whilst in rural areas; it is 15 minutes (OSHA, 2009). Local data / distances are shown in Table 7.

Table 7: As the crow flies or arc line distances from various points in local area (Data generated by Geodistance and rounded to nearest 5kms).

<table>
<thead>
<tr>
<th></th>
<th>Skegness</th>
<th>Mablethorpe</th>
<th>QMC Nottingham</th>
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</thead>
<tbody>
<tr>
<td>Boston</td>
<td>30km</td>
<td>45km</td>
<td>75km</td>
</tr>
<tr>
<td>Scunthorpe</td>
<td>80km</td>
<td>65km</td>
<td>75km</td>
</tr>
<tr>
<td>Lincoln</td>
<td>60km</td>
<td>55km</td>
<td>50km</td>
</tr>
<tr>
<td>QMC Nottingham</td>
<td>100km</td>
<td>100km</td>
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A comparative study based on 5,275 HEMS missions in the West Midlands, examined physician versus paramedic crews, on-scene time, clinical interventions used and decision making, and found that interventions conducted by HEMS doctors had no significant effect on on-scene time. The use of complex drug therapies, insertion of chest drains or RSI took no longer than ‘conventional’ paramedic management. However, patients treated by doctors were more likely to be discharged on-scene, or for those patients with a Glasgow Coma Scale score of 3, there was a greater likelihood that treatment would cease and patients would be pronounced dead on-scene (Roberts et al., 2009). As a result of on-scene management and enhanced decision making ability, fewer patients were likely to be transported to and admitted into the hospital. Consequently, the presence of doctors on HEMS missions increased the availability of HEMS resources for other incidents (Roberts et al., 2009).

Further evidence confirms that improved outcomes as a result of HEMS involvement is likely to be because of the presence of highly trained trauma specialists, as opposed to the advantage of the speed of travel (Butler et al., 2010). Whilst flying times are undoubtedly faster than road times for the same distances travelled, time to definitive care is greater when HEMS teams are deployed, due in part to their deployment to cases of prolonged extrication in more serious incidents, which results in more on-scene intervention. Additional factors include delayed deployment whilst awaiting clinical information from scene, the identification of a suitable landing site and the subsequent movement of patients to/from the helicopter.

An alternative model is the Dutch Helicopter-Transported Medical Teams (HMT). HMTs are specially trained physicians and paramedics who are transported to the scene of injury to provide additional skills and experience to the ground-based ambulance teams. However, the helicopters are rarely used to subsequently transport patients to the hospital due to the disadvantages of noise, patient disorientation and limited working space. This approach would appear to offer the best of both worlds: timely access to emergency first response and safer road transport once patients are stabilised. Additionally, expensive resources such as emergency consultants and helicopters become free to attend other incidents more quickly.

When examining the benefits in terms of costs alone, US research concluded that there was ‘over use’ of HEMS based services (Cudnik et al., 2011). However a large Australian study found that physician-staffed HEMS, whilst an expensive resource, become more cost effective the more serious the injuries were, and were particularly cost-effective for patients with traumatic brain injury (Taylor et al., 2012).

Whilst advanced levels of care can be provided on-scene, within an urban environment with short transport times/distances, pre-hospital interventions beyond those required for basic stabilisation of patients are not effective and may even be detrimental to patient outcomes (Smith et al., 2009). Similarly, a Cochrane review on the impact of ALS training for ambulance crews concluded that there was no available evidence to suggest that for severely injured patients (those with an ISS score>12) higher skills levels either cut death rates or decreased the likelihood of longer term disability (Jayarman and Sethi, 2010).
Evidence-based review: First contact emergency care models for rural and dispersed populations

For seriously injured patients, transfers taking up to 60 minutes and going directly to definitive care location are preferable to stopping off “en route” if the skill levels of accompanying paramedics are high enough (McDonnell et al., 2009). An Australian study found that remote/rural situations, lack of resources and use of rarely needed skills and knowledge were strongly correlated with negative outcomes (Price et al., 2012).

However, it is not only an issue of skills being high enough but also of them being maintained (Price et al., 2012). Maintenance of emergency skills is dependent upon access to appropriate equipment and regular attendance at incidents. A Norwegian study concluded that whilst RSI is a vital intervention, risks associated with its use only become acceptable in the pre-hospital setting when performed by experienced clinicians who carry out the procedure regularly (Nakstad et al., 2011).

HEMS and EMS are both examples of good practice, to the extent that it is not possible to definitively state the best skill mix for either air or road based transport, or whether one form of transport is “better” than the other in terms of either clinical outcomes or costs. Much will depend upon the context. What is important is that the most appropriately skilled personnel attend an incident and that the most appropriate type of vehicle is deployed (EMAS, 2013a).

Across the East Midlands, ambulance stations are to be restructured to provide nine super hubs, three of which to be located in Lincolnshire, (Lincoln, Boston and Scunthorpe). These will be supported by 19 standard stations, with an additional 108 community stations based at existing NHS facilities (EMAS strategic annual plan 2013/2014).

East Lindsey is an area with a higher than average incidence of RTAs (Public Health England, 2013), and research shows that response times to RTAs can be improved in rural areas by optimal location of ambulances particularly when based on geographical data of high incidence areas for RTAs (Gonzalez et al., 2011). For the rural population of Lincolnshire, the proposed ambulance station changes offer the potential to improve access to first response emergency care compared to current provision.

5See Appendix 4 for details.
Evidence problematised

Whilst peer reviewed literature can provide evidence from research, lessons learnt from experience and good practice guidelines are equally important.

Since April 2013, monthly Ambulance Quality Indicators have provided response time and system and clinical outcome data. However, relying solely on statistical data produced by statutory organisations can be problematic. Even where data collecting systems are in existence, data are not always adequately collected or collated. For example, USA EMS data capture and sharing was found to be lacking (FiCEMS, 2014), whilst in England, a review of Urgent and Emergency Care in the South of England concluded that:

The data do not explain the problem… We found significant problems with data availability and quality and there are questions about whether the right data are being collected to allow the system to be effectively managed.

(Kings Fund, 2013:4)

Data is decontextualised and cannot account for geographical variations, such as the experiences of rural and dispersed populations.

Aggregated ambulance call response data indicate high percentage target response time achievement but this was weighted by the high levels of good response time in highly populated areas. The less satisfactory response times in rural areas are lost in the aggregated data… targets have led to the unintended consequence of particularly long response times in rural areas due to services being focused in urban areas, where the majority of activity occurs (RCGP, 2014).

As previously noted, RTAs in Lincolnshire are twice that of the all England rate. However, to demonstrate the effect of how aggregated data can be misleading, the variation between Lincoln (an urban area) and East Lindsey (rural exemplar), in comparison to All England rates, is provided in Table 8.

Table 8: Injury rates standardised per 100,000 population

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Area</th>
<th>2010 (n)</th>
<th>Rate</th>
<th>England mean rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>All road casualties</td>
<td>Lincoln</td>
<td>362</td>
<td>403.7</td>
<td>354.9</td>
</tr>
<tr>
<td></td>
<td>East Lindsey</td>
<td>779</td>
<td>550</td>
<td></td>
</tr>
<tr>
<td>Children &lt; 16 years injured on roads</td>
<td>Lincoln</td>
<td>31</td>
<td>204.9</td>
<td>175.8</td>
</tr>
<tr>
<td></td>
<td>East Lindsey</td>
<td>72</td>
<td>328.2</td>
<td></td>
</tr>
<tr>
<td>Hospital admissions due to motor vehicle accidents</td>
<td>Lincoln</td>
<td>87</td>
<td>94.1</td>
<td>51.9</td>
</tr>
<tr>
<td></td>
<td>East Lindsey</td>
<td>97</td>
<td>70.8</td>
<td></td>
</tr>
<tr>
<td>Road deaths and serious injuries</td>
<td>Lincoln</td>
<td>98</td>
<td>36.9</td>
<td>44.3</td>
</tr>
<tr>
<td></td>
<td>East Lindsey</td>
<td>275</td>
<td>65.1</td>
<td></td>
</tr>
<tr>
<td>Years of Life lost due to land vehicle accidents</td>
<td>Lincoln</td>
<td>308</td>
<td>10.0</td>
<td>14.3</td>
</tr>
<tr>
<td></td>
<td>East Lindsey</td>
<td>1,276</td>
<td>44.1</td>
<td></td>
</tr>
</tbody>
</table>

• In Lincoln, out of a total of 362 casualties, 98 were deaths or serious injuries (death/serious injury rate being 36.9 per 100,000 population). 87 casualties were admitted to hospital (an admission rate of 94.1 per 100,000).
• In East Lindsey, out of a total of 779 casualties, 275 were deaths or serious injuries (death/serious injury rate being 65.1 per 100,000 population). However, only 97 casualties were admitted to hospital for treatment (an admission rate of 70.8 per 100,000).
• When considering rate of years of life lost due to all land vehicle accidents, in Lincoln this was expressed as 10 years of life lost per 100,000 population; for England as a whole as 14.3 years of life lost per 100,000 population, but for East Lindsey, the rate was 44.1 years of life lost per 100,000 population.

These data clearly demonstrate that for rural or dispersed populations, emergency care outcomes are not equal to those for urban populations.

Whilst patients registered in rural practices have a 15% lower rate of A&E attendance than patients from urban practices (Cowling et al., 2013), this does not necessarily imply that their need is less. However, it does confirm that rural patients place less demand on acute sector provision. Whether this is due to better support in their communities or because rurality is a barrier to accessing care, is uncertain.

A qualitative examination of the perceptions surrounding distance to hospital and healthcare facilities as a barrier to healthcare concluded that the importance of distance was relative to health status and urgency of need (Buzza et al., 2011). Census data shows that 47.2% of people in England describe themselves as being in very good health. However, the figure for East Lindsey was much lower at only 38.2%. Conversely the percentage of the population perceiving their health as bad or very bad for England overall was 5.9%, and was much higher for East Lindsey (8.3%) (ONS, 2011). That these were figures for perceived as opposed to actual health status is still important, for research into care seeking behaviours found an association between travel time and patients decisions regarding where to access care (Cowling et al., 2013).

A Swedish study examining factors associated with ambulance use in sparsely versus densely populated areas found that rural patients requiring ambulances were often more severely injured or unwell, as the tendency was to self-treat or go to GP. The use of drug interventions by ambulances crews was greater in rural areas and emergency service crews felt patients in rural areas made more appropriate ambulance call out/usage (Beillon et al., 2009).

An evaluation of regionalised emergency and critical care systems found that for those living in rural areas, disparities in access to speciality care may disproportionately affect clinical outcomes (Cairns et al., 2012). ‘The inverse care law’ (Hart, 1971) may therefore still be applicable: those with the greatest need are not those who place the greatest demand on services, whilst those with the least, possibly do (Gainsbury, 2008).

Whilst the situation regarding access to urgent and emergency care may not be equitable for rural and dispersed populations, achieving equity in first response emergency care models is a complex one which is unlikely to be resolved in the near future.

There is evidence that longer ambulance journey distances reduce the chances of survival for some incidents, but there are no hard-and-fast rules to say at what point patient outcomes are significantly compromised. Consideration of how distance impacts on patient convenience, safety or reassurance needs to be offset by a range of other factors that influence choices about hospital facilities, such as whether there are enough staff to provide a safe service, how training is organised and whether sufficient support facilities for major A&E departments are available. There are also some hard questions about what services can be afforded in the current economic climate.

(Roberts et al., 2014:7)
12. Concluding summary

Due to the twin tyrannies of time and distance, access to urgent or emergency care is less equitable for rural and dispersed populations. Rural populations are more likely to delay seeking help, meaning that when they do present at healthcare premises for treatment, their injuries or illnesses are likely to be more serious. Rural populations have a greater numbers of Road Traffic Accidents, and are likely to receive more severe injuries from these, compared to their urban counterparts. For rural or dispersed populations, emergency care outcomes are not equal to those for urban populations.

Emergency medical services are built upon the principle that appropriate resources and care must be delivered to the patient’s location in an appropriate time, and when necessary, deliver them to the most appropriate destination. However, there is no ‘one size fits all’ model, and no conclusive evidence regarding what a definitive best care model for first response emergency care would be for a dispersed, rural population such as that in East Lindsey.

For the system to function in the best interests of patients, irrespective of their geographical location, a combination of ‘hear and treat’, ‘see and treat’ and ‘see and convey’ models is required.

Rigid triage protocols are not necessarily suitable for rural populations, as they do not take into account conditions specific to the local area. What is important is that the most appropriately skilled personnel attend an incident and that the most appropriate type of vehicle is deployed.

Possible options for a more equitable urgent care response for a rural and dispersed population include:

- An extended paramedic practitioner role
- Community paramedics, located in GPs surgeries - an in situ paramedic means that there is someone available at both sites/surgeries
- A tiered response model with greater use of non-medically trained clinicians
- The deployment of community based paramedics
- Improved public education regarding when and where to seek urgent care

Having people on-scene as early as possible remains the best predictor of full recovery for patients in need of emergency care. Increasingly, care models are taking the hospital to the patient. The change from transfer to treatment models of urgent and emergency care requires increased professionalisation and upskilling of urgent care practitioners.
Evidence-based review: First contact emergency care models for rural and dispersed populations

13. Appendix

Appendix 1
Ambulatory Care Sensitive Conditions (ACSC)
The 19 ambulatory care-sensitive conditions measured by NHS Institute for Innovation and Improvement, are listed in descending order according to the number of emergency admissions per 100,000 population.
1. Influenza and pneumonia
2. Pyelonephritis
3. Chronic obstructive pulmonary disease (COPD)
4. Iron-deficiency anaemia
5. Ear, nose and throat infections
6. Dental conditions
7. Convulsions and epilepsy
8. Gangrene
9. Dehydration and gastroenteritis
10. Hypertension
11. Diabetes complications
12. Perforated/bleeding ulcer
13. Asthma
14. Pelvic inflammatory disease
15. Congestive heart failure
16. Other vaccine preventable
17. Cellulitis
18. Nutritional deficiencies
19. Angina

Appendix 2
a) Abbreviated Injury Scale (AIS); b) Injury Severity Score (ISS)
a) Abbreviated Injury Scale (AIS).
The AIS is taken from a catalogue listing types of injury and describes the severity of injury to one defined body region:
1. Minor
2. Moderate
3. Serious
4. Severe
5. Critical
6. Maximal (lethal injury)
b) Injury Severity Score (ISS).
To calculate an ISS for an injured person, the body is divided into six regions. These body regions are:
1. Head and neck including cervical spine
2. Face, including facial skeleton
3. Thorax, thoracic spine and diaphragm
4. Abdomen, viscera and lumbar spine
5. Extremities including pelvic skeleton
6. External soft tissue
Being based on the AIS, where A, B, C are the AIS scores of the three most injured body regions, an ISS is calculated using the equation: ISS = (A² + B² + C²).
The ISS takes scores from 0 to 75 (i.e. AIS scores of 5 for each category). If any of the three scores is a 6, the score is automatically set at 75. Since a score of 6 (“unsurvivable”) indicates the futility of further medical care in preserving life.
Within the wider literature there appears to be lack of consensus regarding what ISS score constitutes a major trauma, a range from 12 to 16 has been reported. However, within the NHS trauma network, a major trauma is defined by a patient having an injury severity score (ISS) of 12 or greater (EMTN website).

Appendix 3
Category A calls to which a CFR may be dispatched.
1. Cardiac arrest
2. Unconscious and collapsed patients
3. Chest pains (e.g. heart attacks and acute angina)
4. Breathing difficulties (e.g. asthma, acute on-set bronchitis/emphysema)
5. Diabetic emergencies (e.g. hypoglycemia)
6. Fitting or convulsions (e.g. epilepsy)
7. Stroke (CVA) Anaphylaxis (allergic reaction)
8. Choking patients.
Appendix 4
Glasgow Coma Scale (GCS) (Teasdale and Jennett, 1974).

<table>
<thead>
<tr>
<th>Score</th>
<th>Best Eye Response</th>
<th>Best Verbal Response</th>
<th>Best Motor Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>No eye opening</td>
<td>No verbal response</td>
<td>No motor response</td>
</tr>
<tr>
<td>2</td>
<td>Eye opening to pain</td>
<td>Incomprehensible sounds</td>
<td>Extension to pain</td>
</tr>
<tr>
<td>3</td>
<td>Eye opening to verbal command</td>
<td>Inappropriate words</td>
<td>Flexion to pain</td>
</tr>
<tr>
<td>4</td>
<td>Eyes open spontaneously</td>
<td>Confused</td>
<td>Withdrawal from pain</td>
</tr>
<tr>
<td>5</td>
<td>Orientated</td>
<td>Localising pain</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>Obeys Commands</td>
<td></td>
</tr>
</tbody>
</table>

The GCS is scored between 3 and 15; 3 being the worst and 15 the best. It is composed of three parameters: Best Eye Response, Best Verbal Response, and Best Motor Response.

It is generally considered important to break the figure down into its components, i.e. E3V3M5 = GCS 11.

A Coma Score of 13 or higher correlates with a mild brain injury, 9 to 12 is a moderate injury and 8 or less a severe brain injury.

Appendix 5
The Trauma Audit and Research Network

With regards to the completeness of data taken directly from TARN website:

“The number of injured patients submitted to the Trauma Audit & Research Network database is compared to the number of patients with a primary diagnosis of ICD10 S00-T75 contained in HES (Hospital Episode Statistics). The TARN inclusion criteria is translated into an algorithm to allow specific comparisons to HES. We would expect a figure of more than 80% (GREEN) of injured patients to have been submitted by the Trust. Figures of less than 80% show that fewer than the expected number of injured patients have been submitted by the Trust. Process and outcome measures should therefore be reviewed with this in mind. Data completeness is currently only shown for 2012 owing to the unavailability of HES data for 2013 onward. This page will be updated to include 2013 and 2014 completeness figures when data becomes available”.


The table below shows local levels of data completeness:

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<tr>
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<th>2011</th>
<th>2012</th>
<th>2013</th>
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<tr>
<td>Chesterfield Royal Hospital NHS Foundation Trust</td>
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<tr>
<td>Nottingham University Hospital</td>
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<tr>
<td>Sherwood Forest Hospitals NHS Foundation Trust</td>
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<td>King’s Mill Hospital</td>
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<td>United Lincolnshire Hospitals NHS Trust</td>
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<td></td>
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<tr>
<td>University Hospitals of Leicester NHS Trust</td>
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<td>Leicester Royal Infirmary</td>
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</tbody>
</table>
14. References


Evidence-based review: First contact emergency care models for rural and dispersed populations


East Midlands Regional Trauma Network. (EMTN). Accessible via http://www.nuh.nhs.uk/media/12077/ED%20Trauma%20management%20summary%20Aug%202011.pdf


Evidence-based review: First contact emergency care models for rural and dispersed populations


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TARN Accessible via, https://www.tarn.ac.uk


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