Evaluation of the Emergency Medical Retrieval Service
The views expressed in this report are those of the researcher and do not necessarily represent those of the Scottish Government or Scottish Ministers.
CONTENTS

1 EXECUTIVE SUMMARY 1
  Introduction 1
  Background 2
  Literature review 2
  Performance of the pilot 2
  Demand assessment 4
  Options development and short-listing 4
  Cost and value for money assessment 4
  Risk assessment 5
  Overall conclusions and recommendations 6

2 INTRODUCTION 8
  Method overview 8

3 BACKGROUND TO EMRS 11
  Rationale and current operating model 12
  EMRS Team 13
  Geographic coverage 14
  Aircraft, facilities and equipment 15
  Operating model 16
  A note on primary retrievals 17

4 LITERATURE REVIEW 19
  Introduction and literature review methods 19
  Rationale for air retrieval 20
  Retrieval times 23
  Clinical outcomes 24
  Staffing profile 24
  Costs 25
  Literature review conclusions 26
  The Scottish situation 27

5 PERFORMANCE OF THE WEST OF SCOTLAND PILOT 37
  Activity 38
  Quantitative evidence of clinical outcomes 50
  Qualitative assessment 55
  Quality Adjusted Life Years (QALY) 64
  Conclusions 69

6 DEMAND ASSESSMENT 72
  Demand by health board area 74
  Drivers of future demand 76
  Conclusions 77

7 OPTIONS DEVELOPMENT AND SHORT LISTING 79
  Introduction 79
  Developing the long list of options 79
  Reducing the long list 81
  Short-listing 88

8 COST AND VALUE FOR MONEY ASSESSMENT 91
  Costing of options 91
CONTENTS OF TABLES

Table 1.1 Number of cases and costs for each option
Table 3.1 EMRS staff composition
Table 3.2 Geographic coverage of EMRS in the West of Scotland pilot
Table 5.1 EMRS Average (Median) Response Times
Table 5.2 Average (median) retrieval times (call out to final destination) by aircraft type
Table 5.3 Age Profile of EMRS Users
Table 5.4 Level of Interventions carried out by different staff
Table 5.5 Apache II, SAPS II, ISS and TISS scores for EMRS patients
Table 5.6 Predicted mortality rates for EMRS retrievals
Table 5.7 Summary of the consultation programme
Table 5.8 QALYs under Estimate 1
Table 6.1 Scope of coverage of EMRS delivery options
Table 6.2 Demand estimates by health board area
Table 7.2 Summary of option components and rationale for inclusion
Table 7.2 Summary of retained options for scoring and weighting
Table 7.3 Options used for the scoring and weighting exercise
Table 7.4 Criteria and weighting
Table 7.5 Guidance notes for scoring the options
<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.6</td>
<td>Scoring of the options</td>
</tr>
<tr>
<td>8.1</td>
<td>Caseload for options</td>
</tr>
<tr>
<td>8.2</td>
<td>Staff costs</td>
</tr>
<tr>
<td>8.3</td>
<td>Medical facilities costs</td>
</tr>
<tr>
<td>8.4</td>
<td>Accommodation, equipment and associated costs</td>
</tr>
<tr>
<td>8.5</td>
<td>Drugs and consumables costs</td>
</tr>
<tr>
<td>8.6</td>
<td>Seminar and training costs</td>
</tr>
<tr>
<td>8.7</td>
<td>Cost of EMRS air transport provision 01/06/08 to 30/09/09</td>
</tr>
<tr>
<td>8.8</td>
<td>Estimated annual cost of EMRS air transport provision</td>
</tr>
<tr>
<td>8.9</td>
<td>Additional Costs and Savings</td>
</tr>
<tr>
<td>8.10</td>
<td>Total costs</td>
</tr>
<tr>
<td>8.11</td>
<td>Cost per case</td>
</tr>
<tr>
<td>8.12</td>
<td>Incremental costs</td>
</tr>
<tr>
<td>8.13</td>
<td>Incremental costs per case</td>
</tr>
<tr>
<td>8.14</td>
<td>Incremental costs per score</td>
</tr>
<tr>
<td>8.15</td>
<td>Costs per QALY</td>
</tr>
<tr>
<td>9.1</td>
<td>Risk matrix for Option A</td>
</tr>
<tr>
<td>9.2</td>
<td>Health boards involved in the questionnaire</td>
</tr>
</tbody>
</table>
1 EXECUTIVE SUMMARY

Introduction

1.1 The Scottish Government Directorate of Health Care Policy and Strategy commissioned a consortium, led by DTZ and including the Centre for Rural Health and Dr. Alasdair Munro, to evaluate the current pilot EMRS in the West of Scotland, and appraise a range of future delivery options. The findings of this evaluation are intended to inform the decision on future development of EMRS.

1.2 The research ran from March 2008 to November 2009 and was overseen by the Emergency Medical Retrieval Service (EMRS) Project Board.

1.3 The pilot started on 1st June 2008 and the evaluation considered its operation for one year (i.e. up to 1st June 2009)\(^1\).

1.4 The core elements to the research programme were:

- a literature review covering development of the Service in Scotland and available reports and evaluations on similar international air transfer and retrieval services.

- Analysis of activity data from the EMRS database, quantitative data from NHS ISD (Information & Services Division), and cost data from Greater Glasgow & Clyde Health Board; and

- a primary research programme involving interviews and focus groups with NHS Boards, clinical staff, management staff and patient representative groups.

1.5 The methodology followed is consistent with the principles outlined in the HM-Treasury Green Book for Appraisal and Evaluation in the Public Sector\(^2\). The key steps in this process are as follows.

- Identification of EMRS rationale, aims and objectives.

- Evaluation of EMRS against objectives set for it and in terms of its outcomes using a mixture of quantitative and qualitative data.

- Development of a long list of all possible options to meet rationale and objectives.

- Elimination of infeasible options and scoring and weighting of the long list according to a range of key service drivers to prioritise a short list of feasible options.

- Detailed appraisal of short listed options, including cost benefit analysis.

---

\(^1\) The pilot itself is continuing until March 2010.

• Risk assessment of these options.
• Recommendation of preferred option.

Background

1.6 EMRS is designed to improve care and survival of acutely ill and injured patients in remote and rural Scotland.

1.7 EMRS was initially set-up as a voluntary service covering Argyll & Bute in 2004 and, as part of the process to develop a sustainable framework for remote and rural healthcare, time limited funding was provided by Scottish Government to ensure ongoing provision of the service, prior to the establishment of a formal pilot, covering the West of Scotland. This pilot started in June 2008.

1.8 EMRS is consultant led and delivered and focuses on ‘secondary retrievals’, i.e. retrieving patients from a referring rural medical facility to a place of definitive care. It is an air-based service operated by a team of 20 staff, including 14 consultants, that provides 24/7 cover between two shifts.

Literature review

1.9 Air-based emergency retrievals differ around the world and are not directly comparable. There is also an absence of rigorous, prospective randomised studies of these services.

1.10 Although needing to qualify findings for these reasons, the literature indicates that initial medical care can improve patient outcomes; level of medical expertise is very likely to affect outcome; the relationship between retrieval time and outcome is complex, and affected by the level of intervention at referral facility and during transport; and retrieval services are very likely to operate within acceptable cost-benefit boundaries.

1.11 An EMRS-type service for Scotland has been proposed in the last four to five years to improve patient outcomes in rural areas.

1.12 The results of the initial Argyll & Bute pilot were positive in terms of improved support and advice for rural practitioners; optimal triage for patients; and improvement in patient outcomes.

Performance of the pilot

1.13 There were 222 retrievals (203 secondary and 19 primary\(^3\)) over the evaluation period, slightly higher than expected. There were also 187 advice only calls.

---

\(^3\) Secondary retrieval involves the dispatch of a retrieval team to a referring rural medical facility and retrieval to a place of definitive care. Primary retrieval refers to dispatch of a retrieval team to the scene of an accident and retrieval to a place of definitive care, avoiding the initial transfer to a local rural medical facility.
1.14 Patients are referred from across the West of Scotland with Stornoway and Stranraer having the highest numbers, but areas such as Tiree and Islay having proportionally higher numbers of retrievals in terms of relative population.

1.15 Patients were transferred to final delivery centres across Scotland although the Glasgow Southern General Hospital had the largest intake.

1.16 Medical acuity was high among patients and medical conditions varied. As a result of high levels of acuity, many advanced medical interventions were carried out during transfer. Many of these patients did require senior medical escort to ensure safe transfer.

1.17 EMRS response times were relatively good compared to the original Argyll & Bute service.

1.18 Although the large majority of cases needed critical care, 17% of retrievals attended were assessed as not requiring critical care.

1.19 In the primary research, there was a generally good understanding of EMRS and its rationale, although actual contact with the Service was rare.

1.20 The Service was generally well-received and was thought to have a number of benefits, especially in improving patient outcomes and helping to take pressure of local staff from having to deal with acute emergency cases.

1.21 Some concerns were expressed, notably about retrieval times, inappropriate referrals, increased future demand for the Service and the impact that this may have on local provision.

1.22 All consultees wanted EMRS to continue in some form. Generally, they wanted the Service to also cover the North of Scotland, although there was concern in the West that this may weaken their existing service.

1.23 There was no consensus on the number of centres required to deliver EMRS or whether the Service should undertake primary retrievals or join-up with other specialist retrieval services.

1.24 Quality Adjusted Life Years (QALY) is a commonly used outcomes measure for health services and interventions. QALY estimation takes into account differences between treatment methods in terms of the number of years that a patient may live and the quality of these years, from best to worst possible health. Overall, a range of 0.47 to 3.5 per patient additional quality adjusted life years (QALYs) is estimated for the EMRS pilot. This gives an estimated cost per QALY of £1,500 to £11,600. Although this is a broad range, even under the most cautious scenario the cost per QALY is still well within National Institute for Clinical Excellence (NICE) guidance that a cost of £20-30,000 per quality-adjusted life year gained from treatment represents good value for money.
Demand assessment

1.25 Drivers of demand include demography, level of local service provision, incidence of accidents, tourism, provision of alternative transport, local geography and weather.

1.26 There were 222 retrievals during the EMRS pilot period. It is estimated that extending EMRS to cover all of remote and rural Scotland would increase the number of retrievals to between 317 - 345.

1.27 The number of retrievals as a proportion of the population was highest in Argyll & Bute, where the Service is longer established. If this rate was reflected across the country in the same timeframe, demand could increase to about 360 cases over five years as EMRS becomes better known.

1.28 There were 10 incidents of simultaneous retrievals, affecting 20 patients, in the current model that could increase to 20-40 incidents (affecting 40-80 cases) if the Service was extended.

Options development and short-listing

1.29 The options development and short-listing process followed HM-Treasury Green Book guidance and much discussion with the EMRS Project Board, NHS Boards, health professionals and patient representatives.

1.30 A long-list of options was initially developed. These options were reduced after discussion, e.g. some were removed for being impractical. Key criteria for EMRS were agreed with the Project Board and weighted according to their ranking and importance. The options were then scored and weighted by these key criteria.

1.31 Further analysis produced a short-list of five options for the full economic appraisal.

- Option A - No EMRS
- Option B - Current model covering the West of Scotland
- Option C - An augmented team covering all of remote and rural Scotland
- Option D - Two clinical teams in the West covering all of remote and rural Scotland
- Option E - Two centres covering all of remote and rural Scotland.

Cost and value for money assessment

1.32 Option C was split into three sub options as the costs for this option were dependent on the number of simultaneous retrievals, for which there were a range of estimates. We derived high, medium and low versions of this option called C1, C2 and C3.
1.33 We assumed the following number of cases and costs for each option.

**Table 1.1 Number of cases and costs for each option**

<table>
<thead>
<tr>
<th>Option</th>
<th>No. of cases</th>
<th>Cost</th>
<th>Cost per case</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0</td>
<td>£100,000</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>207</td>
<td>£1.4 million</td>
<td>£6,679</td>
</tr>
<tr>
<td>C1</td>
<td>302</td>
<td>£1.8 million</td>
<td>£5,934</td>
</tr>
<tr>
<td>C2</td>
<td>287</td>
<td>£1.8 million</td>
<td>£6,165</td>
</tr>
<tr>
<td>C3</td>
<td>272</td>
<td>£1.7 million</td>
<td>£6,422</td>
</tr>
<tr>
<td>D</td>
<td>332</td>
<td>£2.2 million</td>
<td>£6,719</td>
</tr>
<tr>
<td>E</td>
<td>332</td>
<td>£2.7 million</td>
<td>£8,025</td>
</tr>
</tbody>
</table>

1.34 Analysis of incremental costs (total, per case, and per score from the scoring and weighting exercise) favours extending the Service to Option C or Option D as the incremental costs against benefits are similar. However, it also concludes that extending the Service to Option E represents poor value for money.

1.35 In terms of cost per QALY, Option C appears to offer the best value for money, although there is not a sizeable difference between Options B, C and D under the high and medium QALY scenarios.

**Risk assessment**

1.36 Of all of the options, Option B would appear to have the least risks with implementation as the pilot has not highlighted any serious risks that could not be handled.

1.37 There are clearly substantial risks for Option A, especially in terms of patient outcomes. To mitigate against these outcomes, it is also likely to require additional investment in local and ambulance services.

1.38 Option C presents significant risks that, if adopted, would require to be addressed, particularly around the issue of simultaneous retrievals and the knock-on impacts of this in terms of the ability to deliver an effective service. A majority of the current EMRS consultants do not believe that Option C is deliverable given that they believe it is likely to lead to over utilisation of the Service and damage to its reputation if the Team is not able to attend a large number of calls. SAS also believes that any national service option requires additional air ambulance resources.

1.39 Options D and E are able to deal with many of the downsides of Option C by expanding the capacity of the Service, with the exception of additional resources for SAS. However, their main risks will be around staff recruitment and the likely under utilisation of the Service, which means that it is likely that there will be inefficient utilisation of key hospital staff unless steps are taken to explore extending the Service into other areas. The higher level of annual funding required for both of these larger service options is also likely to be a key risk in terms of acquiring or maintaining funding for an EMRS at this kind of level, particularly given the likely tighter public sector financial settlement in Scotland in the next few years.
Additional data

1.40 Additional data, gathered since the end of the evaluation period (over five months), suggests that the rate of retrievals and simultaneous retrievals have increased sizeably. If reflected over a one-year period, demand in the West of Scotland would have been 250 (instead of the 225 from the evaluation) and 384 across remote and rural Scotland (instead of the high end assessment of 345 for the evaluation period). Simultaneous retrievals have also reached an actual level for one year (November 2008 to November 2009 of 25), compared with the 18 implied by the evaluation period figures.

1.41 The reasons for the increase are not clear and it was outside the scope of the evaluation to undertake further analysis on the new data. It may be a blip, but it may also indicate the Service is becoming established more quickly than it did in the Argyll & Bute pilot.

Overall conclusions and recommendations

1.42 The Service appears to have a clear rationale in terms of providing emergency care to critically ill or injured people in remote and rural parts of Scotland.

1.43 In terms of the overall evaluation of the Service, the results are, generally, very positive.

1.44 There appear to be a few areas in which improvements could be made. However, one particular area requiring improvement was highlighted throughout the primary research. There are a number of non critical care retrievals and, although relatively small in number, they may represent a very expensive way of getting expert care to a patient who does not particularly require it. It may be a concern to local health professionals that EMRS is also undertaking non critical work. We therefore recommend that the Service draws up revised guidance and training material that takes account of these concerns, which is not overly prescriptive, but informs local health professionals of the circumstances in which EMRS should be called.

1.45 It seems clear from our analysis that a number of the shortlisted options can now be discounted.

- **Option A.** This option would see the disbandment of a well-received Service that appears to have a clear rationale. It is also unlikely to represent a significant cost saving as investment in alternative provision is likely to be required if patient outcomes in remote and rural areas are not to worsen significantly.

- **Option E.** The costs of this option appear prohibitive and it offers poor overall value for money.
1.46 This leaves us with the remaining options, which all seem to offer value for money.

- **Option B.** Although the current model has operated effectively, the rationale for the Service implies that it should also be made available for the north of Scotland, where there appears to be a level of need. However, if the current clinical team are unable to staff the Service to operate at Option C and/or Option C or D are not currently affordable, the Service should at least be retained at the pilot level.

- **Option C.** This option appears to offer the best value for money, but has significant risks to delivery. It could be considered on a time limited basis but remain subject to review as more data becomes available on the future rate of retrievals and simultaneous retrievals.

- **Option D.** This option probably offers the greatest value in terms of meeting clinical needs. However, there are concerns about whether the Service would be fully utilised. In our estimate, the caseload required to justify two clinical teams is around 360-380 cases. This could not be supported from the evidence gathered during the pilot although more recent statistics provided by the EMRS team suggest that this level could be met. Further work, outside the scope of this review, would be required to validate the more recent data. The cost is also around £800,000 more than the current pilot and this may not be affordable in the current economic climate.

1.47 Given the importance of the issue of simultaneous retrievals, attempts should be made to develop a reliable statistical model for any future monitoring and viability work.

1.48 There is not a straightforward conclusion here. On the balance of the evidence, our recommendation is that the Service should continue. Our current advice would be that the Service be scaled up to Option C (a national model) for a time limited period (six months or one year) while establishing whether sufficient demand exists for two clinical teams or whether the number of simultaneous retrievals and workload for the consultants makes this option unviable in the medium term. At the same time, avenues should continue to be explored to examine the possibilities of expanding the scope of the Service through integration with other air emergency and retrieval services, or through covering other rural parts of Scotland. This may lead to an expansion in the number of cases to a level where a second team is justified and Option D can be implemented. This should also tie-in with the SAS retendering of Air Ambulance provision in 2011 to ensure optimal continued provision.
2 INTRODUCTION

2.1 The Scottish Government Directorate of Health Care Policy and Strategy, on behalf of the Remote and Rural Implementation Group (RRIG), commissioned a consortium led by DTZ and including the Centre for Rural Health and Dr. Alasdair Munro to evaluate the current pilot EMRS in the West of Scotland, and appraise a range of future delivery options. The findings of this evaluation are intended to inform the decision on future development of the Service.

2.2 The main objectives of this report are outlined below.

1. To assess the operation of the EMRS pilot
2. To assess the impact of the EMRS pilot
3. To assess the financial costs and opportunity costs of the pilot and the proposed national roll-out
4. To assess the requirements for a national EMRS covering the whole of remote and rural Scotland
5. To consider the feasibility of a national EMRS covering the whole of remote and rural Scotland
6. To consider the most efficient and cost effective way of providing a national EMRS.

Method overview

2.3 The research ran from March 2008 to November 2009 and was overseen by the EMRS Project Board, which included representation from the Scottish Government Health Analytical Services and Directorate of Health Care Policy and Planning, the EMRS Team, the Scottish Ambulance Service (SAS), the Remote and Rural Implementation Group (RRIG), and management and clinical staff from the West of Scotland pilot area as well other parts of remote and rural Scotland. The Research Team also reported to RRIG at occasional intervals. Details of members of the Project Board and RRIG are included in Appendix D.

2.4 Given the complexity of the appraisal exercise, three health experts were engaged under the direction of DTZ. Professor David Godden and David Heaney of the Centre for Rural Health advised on all clinical and medical aspects of the appraisal, while Dr. Alasdair Munro of the Health Economics Research Unit (HERU, University of Aberdeen) advised on assessing cost effectiveness and value-for-money methodology.

2.5 The EMRS pilot started on 1st June 2008 and the evaluation considered its operation for one year (i.e. up to 1st June 2009). The pilot, in its current form, will continue until March 2010.
2.6 There were three core elements to the research programme.

1. **Quantitative data gathering.** Monitoring data was captured by the EMRS Team for each patient attended and each advisory call taken during the period 1\textsuperscript{st} June 2008 to 1\textsuperscript{st} June 2009. This was supplemented and benchmarked using available NHS ISD (Information & Services Division) and Scottish Ambulance Service (SAS) data.

2. **Primary research programme.** Focus groups and telephone interviews were held with clinical and management staff and with patient representative groups across the pilot area. Additional consultations were held with clinical and management staff in health board areas currently outside the pilot area. The chief executives in each participating health board area were also sent a detailed questionnaire to gather health boards’ views of the Service and its future.

3. **Literature review.** Core policy and service documents were provided by members of the Project Board. DTZ’s information service also identified available reports and evaluations for similar international air transfer and retrieval services to supplement the research. The Centre for Rural Health led the production of the literature review.

2.7 The methodology followed is consistent with the principles outlined in the HM-Treasury Green Book for Appraisal and Evaluation in the Public Sector. The key steps in this process are as follows.

- Identification of EMRS rationale, aims and objectives.
- Development of a long list of all possible options to meet rationale and objectives. This includes assessment of a de minimis option.
- Elimination of infeasible options and scoring and weighting of the long list according to a range of key service drivers to prioritise a short list of feasible options. This process was undertaken in cooperation with the Project Board based on the available evidence for long list options.
- Detailed appraisal of short listed options, including cost benefit analysis.

2.8 Each section of this report contains a detailed overview of the approach adopted, together with the key findings.

2.9 This remainder of this report is structured as follows.

- Section 2 provides a background to the Service
- Section 3 presents results from our literature review
- Section 4 presents a quantitative and qualitative assessment of the EMRS pilot
- Section 5 presents results from a demand assessment for taking EMRS forward
• Section 6 outlines the option development and short-listing process
• Section 7 is our cost and value for money assessment
• Section 8 is our risk assessment
• Section 9 presents our final conclusions and recommendations.

2.10 Due to the length and complexity of the report, box summaries are presented at the start of each section, which outlines the work in a particular section and its key findings.
3  BACKGROUND TO EMRS

- EMRS is designed to improve care and survival of acutely ill and injured patients in remote and rural Scotland.
- The Service was set-up as a voluntary service covering Argyll & Bute in 2004 and has been run as a pilot, covering the West of Scotland, since June 2008.
- The Service is consultant led and delivered, and focuses on ‘secondary retrievals’, i.e. retrieving patients from a referring rural medical facility to a place of definitive care.

3.1 This section sets EMRS in context. More details on the Service’s development are provided in Section 3 after the discussion of other models in the literature review.

3.2 EMRS is a consultant led, consultant delivered, air retrieval service that aims to improve the care and survival of seriously ill and injured patients in remote and rural areas of Scotland.

3.3 The EMRS Team provides an advisory service if requested by the local medical professional, assessing the appropriate care model and need for subsequent transfer or retrieval. If required, the EMRS Team then undertakes retrieval of these patients from rural facilities to urban centres with definitive care capabilities. This represents a ‘secondary retrieval’ accompanied by an EMRS consultant.

3.4 The key milestones in the development of the Service are provided below.

- **Oct 2004** – EMRS set up by a group of clinicians as a service in Argyll & Bute Health Board collaboratively with SAS.
- **2005** – *Delivering for Health* identified the need to develop safe and sustainable health services for remote and rural Scotland, and to review and, if necessary, enhance EMRS. The then Scottish Executive established the Remote and Rural Steering Group (RRSG) to produce a report on sustainable remote and rural health services.
  - **2007 - The final report of the RRSG Delivering for Remote and Rural Healthcare**, identified the need for patients with a health emergency or crisis to have access to the appropriate response, i.e. the appropriate form of emergency care as quickly as possible. The EMRS sub-group of the RRSG review reached the following conclusions.
    - NHS Scotland should establish an EMRS to support the care of seriously ill and injured people in remote and rural Scotland.
This service would retrieve patients with life threatening injury or illness, where advanced medical intervention is appropriate, to optimise safe transfer.

The service would be additional to that currently provided by SAS air ambulance and would only be deployed if the consultant staff determine that medical intervention is required.

The service should be established in a phased manner, building on the successful pilot that had been running for the past three years within Argyll & Bute. Phase 1 was to be implemented to cover the west coast of Scotland, covering three rural general hospitals, 13 community hospitals and a number of remote general practitioners.

During this first phase, independent evaluation of the requirements for the whole of remote and rural Scotland would be undertaken, including examining: the clinical requirements for the Northern Highlands and Northern Isles; the implications for the air ambulance service; a health economic assessment; and the impact on the areas where the service has been implemented.

Following completion of the review, assuming a positive evaluation, the service should be rolled out across all remote and rural Scotland.

- **June 2007** - The Cabinet Secretary for Health and Wellbeing agreed to underwrite an 18-month pilot of EMRS.
- **June 2008** – Start of the West of Scotland pilot.

### Rationale and current operating model

The main aim of EMRS is to promote equality of access, therefore improving outcomes, in remote and rural areas. The core rationale and components of EMRS to meet this aim are as follows.

- Air retrieval and the central triage model offers consistent and equal access to definitive care. Remote and rural health facilities vary in terms of their model of local provision and capacity to respond to emergency and critical cases. This can include differences and potential disadvantage in:
  - the type of facility, i.e. a rural general hospital, a community hospital or a GP practice;
  - the grade and expertise of staff available, particularly consultants;
  - the provision of Accident & Emergency (A&E) services and lack of on-site Intensive Care Unit (ICU) beds and equipment; and
  - the availability of alternative transport modes to definitive care.
Consultant led retrieval allows more advanced on-site medical support and on-board procedures than a regular SAS transfer staffed by a paramedic. This maximises the opportunity to improve clinical outcomes. This distinguishes the Service as a ‘retrieval’ service, as opposed to a ‘transfer’ service.

Secondary retrieval only involves patients who are already at an initial point of care with a healthcare professional. Patients with life-threatening illness/trauma are initially transported from the accident scene by SAS land/air ambulance to local rural health care facilities. Provision of a consultant led advisory service (and dispatch of consultants to rural facilities to aid stabilisation) maximises the opportunity to retain patients at these local facilities, enhancing local delivery.

EMRS requests originate from healthcare professionals based at rural facilities. Consultant led EMRS advice and case review means that an initial judgement has been made as to the severity of the case and requirement for consultant led retrieval, as opposed to regular SAS transfer or retention at the local unit. This joint clinical judgement prioritises cases and should avoid unnecessary dispatch, therefore achieving appropriate targeting of the service to optimise outcomes.

Emergency response is not programmable activity and, therefore, guaranteed response requires a dedicated team, similar to, for example, the fire service. In addition, retrieval medicine involves specific health and safety considerations, and requires specific training and expertise. Therefore, a dedicated team offers an advantage over informal provision by local consultants to meet the objective of equal access.

3.6 The following sub sections profile the current EMRS arrangements for the West of Scotland pilot.

**EMRS Team**

3.7 The EMRS Team currently provides 24/7 cover between two shifts. The day shift (0800 to 1800 hours) is fully staffed by the team based at the SAS helipad in Glasgow. The night shift uses an on-call rota. Table 3.1 summarises the composition of the team.

### Table 3.1 EMRS staff composition

<table>
<thead>
<tr>
<th>Level</th>
<th>Number of WTEs</th>
<th>Number of people providing cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consultants</td>
<td>5.2</td>
<td>14</td>
</tr>
<tr>
<td>Registrars</td>
<td>4.0</td>
<td>4</td>
</tr>
<tr>
<td>Audit Paramedic</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Administrator</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>11.2</strong></td>
<td><strong>20</strong></td>
</tr>
</tbody>
</table>

Source: EMRS Team
Geographic coverage

3.8 The current pilot for EMRS covers remote and rural areas in the West of Scotland. Table 3.2 and Figure 3.1 summarises the health board areas and local medical facilities within the pilot’s catchment.

Table 3.2 Geographic coverage of EMRS in the West of Scotland pilot

<table>
<thead>
<tr>
<th>Health Board Area</th>
<th>Geographic Medical Facilities</th>
<th>Population (of remote &amp; rural area)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Highland</strong> (Argyll &amp; Bute Community Health Partnership)</td>
<td>Oban • Bute • Campbeltown • Dunoon • Islay • Lochgilphead • Mull</td>
<td>63,497</td>
</tr>
<tr>
<td><strong>Highland</strong> (Mid Highland Community Health Partnership)</td>
<td>Fort William Broadford • Acharacle • Applecross • Eigg • Lochaline • Mallaig</td>
<td>32,576</td>
</tr>
<tr>
<td><strong>Dumfries &amp; Galloway</strong> Wigtown - Stranraer</td>
<td>- • Maivaig • North Harris • Pairc • South Harris</td>
<td>29,700</td>
</tr>
<tr>
<td><strong>Western Isles</strong> Western Isles - Stornoway</td>
<td>• Barra • Benbecula</td>
<td>26,502</td>
</tr>
<tr>
<td><strong>Arran</strong> • Cumrae - Arran • Cumbrae</td>
<td>- • Arran • Cumbrae</td>
<td>6,492</td>
</tr>
<tr>
<td><strong>Tayside</strong> Kinloch Rannoch</td>
<td>-</td>
<td>944</td>
</tr>
</tbody>
</table>

Source: EMRS Team and DTZ
Aircraft, facilities and equipment

3.9 The SAS is the main provider of aircraft to the EMRS Team. It currently operates four aircraft from bases in:

- Aberdeen (Fixed Wing);
- Glasgow (Fixed Wing);
- Glasgow SECC (Helicopter); and
- Inverness (Helicopter).
3.10 In cases where all suitable SAS aircraft have been tasked to alternative transfers, the EMRS Team can also make use of Coastguard, Ministry of Defence (MoD) and Police aircraft, although the latter is very much a ‘grace and favour’ arrangement for EMRS and it is not obligatory for the police to provide their helicopter.

3.11 At present, the EMRS team is based in a number of cabins beside the SAS base at the Glasgow SECC helipad.

Operating model

3.12 The EMRS Team is engaged in advice and retrieval for two distinct groups.

- **Medical retrievals** – cases that are already in-patients/out-patients at rural hospitals, community hospitals or GP practices, but require EMRS retrieval to reach definitive care

- **Trauma retrievals** – accidents transferred to the nearest hospital by SAS, which then require further EMRS retrieval to definitive care.

3.13 The following diagram illustrates the key stages in the EMRS operating model, with EMRS involvement highlighted in blue.

**Figure 3.2 EMRS operating model**
A note on primary retrievals

3.14 During the pilot, the EMRS Team has undertaken a small number of primary (or pre-hospital) retrievals due to the assessed need. This refers to immediate EMRS dispatch to the scene of an accident and retrieval to definitive care, avoiding the initial transfer to a local hospital.

3.15 The EMRS Team was engaged for these cases through a call from the scene by an attending local professional or road paramedic, judging that the patient would require subsequent secondary transfer and therefore avoiding a delay by routing via the local hospital; or referral from the initial SAS 999 call based on a preliminary assessment of severity.

3.16 This gives rise to a number of potential issues, which we summarise below.

Perceived advantages

- It avoids two transfers for the same patient: the initial primary transfer by SAS to the local hospital, then the subsequent EMRS secondary retrieval to definitive care. With efficient primary tasking criteria, EMRS would only be dispatched to primary retrievals for cases where a secondary retrieval would certainly be required. This means that the current trauma retrievals are simply collected at the accident scene, rather than an initial local medical facility. Overall activity for EMRS should not change.

- Early correction of physiological derangement could potentially improve clinical outcomes for patients, reaching definitive care faster by avoiding initial care points.

- It could avoid sub-optimal use of SAS aircraft and ambulances, e.g. air transfer from the accident to the initial care provider, followed by subsequent dispatch of a second aircraft.

- Compliance with National Confidential Enquiry into Patient Outcome and Death (NCEPOD) trauma report *Who Cares?*

Perceived issues

- It could reduce the involvement of local hospitals with patients’ emergency care. This potentially acts against the core EMRS rationale to enhance local service provision.

- It may remove the local medical professionals from the retrieval decision. The decision to dispatch could be based on the initial 999 call without on-site assessment. Without efficient tasking criteria at Emergency Medical Despatch Centre (EMDC), this may result in unnecessary dispatches, thus inefficient use of EMRS and SAS resources.

3.17 Following discussion with the EMRS Project Board and the RRIG, and given the uncertainty surrounding these issues, it was agreed that primary retrievals would be excluded from the scope of this evaluation. However, the EMRS Team was still permitted to undertake such retrievals should capacity allow.
3.18 The EMRS Team continues to undertake occasional primary retrievals when these are referred by the SAS. However, in these cases, EMRS dispatches is at the consultants’ own discretion and are undertaken when it is assessed that such a retrieval will not impede the ability of EMRS to respond to secondary retrievals.
4 LITERATURE REVIEW

- Air-based emergency retrievals differ around the world and are not directly comparable. There is also an absence of rigorous, prospective randomised studies. Evidence that is available therefore needs to be qualified.

- The literature review suggests that:
  - initial medical care can improve patient outcomes;
  - the level of medical expertise is likely to affect outcomes;
  - the relationship between retrieval time and outcome is complex and affected by the level of intervention at the referral facility and during transport; and
  - retrieval services are likely to operate within acceptable cost-benefit boundaries.

- An EMRS-type service for Scotland has been proposed in the last four to five years to improve patient outcomes in rural areas.

- The results of the initial Argyll & Bute pilot were positive in terms of improved support and advice for rural practitioners; optimal triage for patients; and improvement in patient outcomes.

Introduction and literature review methods

4.1 As part of the evaluation into EMRS in remote and rural Scotland, it was important to examine experience from the rest of the world to highlight examples of best practice and to inform, where possible, future configuration of a Scottish service. A literature review was therefore carried out to identify any previous and similar evaluations of EMRS-type services.

4.2 The emergence of an EMRS in Scotland has its roots in early experience in the West of Scotland and in recent policy for rural health in Scotland. The initial expectation was that this Service would primarily cater for secondary retrieval of ill or injured patients who had received initial treatment at a local facility (health centre, community hospital, or rural general hospital) but were thought likely to benefit from greater critical care expertise at a larger facility. This, rather than primary retrieval, is the main focus of this evaluation and therefore of the literature review, although, inevitably, the literature often does not make such a clear discrimination and studies focussing purely on inter-hospital transfers are relatively sparse.
4.3 Two main data sources were used.

1. DTZ information scientists ran a literature search on all their major databases including Idox, Ingenta and Web of Science. Key words included: ‘helicopter emergency ambulance services’, ‘health outcomes’, ‘costs’, ‘benefits’, ‘ambulance’, ‘trauma’, ‘emergency medical services’; ‘emergency treatment’; ‘advanced life support (ALS)’; and ‘triage’. Each document was reviewed for its content and its bibliography. The bibliographies were used to identify key documents on the subject and, in cases where the bibliographies were hyperlinked, were used to access wider material.

2. The EMRS Team also provided articles relating to emergency services across the world and from numerous different sources that they had collected in the process of designing, delivering and reporting on their services. Topics covered included trauma, inter-hospital transfer, critical care transfers, rural health and air medical transfers.

4.4 A first draft of the literature review was prepared by DTZ. This was then reviewed and redrafted by CRH, who provided expertise in clinical medicine and health services organisation.

4.5 This review draws on international literature to discuss the rationale for an EMRS-type service, the importance of retrieval times, clinical outcomes, staffing profile and costs. It then discusses the Scottish model in the context of that literature, before providing some conclusions and a bibliography.

Rationale for air retrieval

4.6 The use of air based emergency medical retrieval is common around the world. However, each service operates in a different geographic and demographic context and, as a result, each has its own aims and requirements. Some services focus on primary retrieval, i.e. retrieval from the site of an incident or accident; some on secondary retrieval, i.e. onwards transfer from a local healthcare facility to a larger facility; and some carry out both roles. An overview by Lackner and Stolpe (1998) outlined the development of such services internationally.

4.7 Three examples have been highlighted below. These do not necessarily directly compare with the EMRS operating in Scotland, but they give an indication of how services have developed in other parts of the world. The examples are:

- Red Cross Flying Doctors Service (South Africa)
- Royal Flying Doctors Service of Australia (RFDS)
- Critical Care Air Transport Program (USA).
The Red Cross Flying Doctors Service in South Africa

4.8 The South African Red Cross Air Mercy Service (AMS) is a non-profit organisation, with three operational bases in Cape Town, Kimberley and Durban, that provides an air ambulance network, outreach and emergency rescue services to metropolitan areas and remote rural communities of South Africa.

4.9 South Africa is a large and diverse country with high levels of infectious disease, significant social problems and an uneven distribution of health services. To help address this, the South African Red Cross AMS and the South African Department of Health teamed up and began a program providing medical care and air transport to rural communities across rural South Africa.4

4.10 The Service has three helicopters, one designed specifically to accommodate pre-hospital emergency retrievals, and two helicopters equipped to deal with inter-hospital transfers of critically ill patients. Between 15,000 and 20,000 patients a year are attended to by the AMS doctors in the KwaZulu-Natal (KZN) and Northern Cape provinces and the Service is staffed by medical volunteers.

4.11 The Service has been successful in reaching patients in poor, remote areas of South Africa and a roll-out of the service throughout the nine provinces of South Africa is planned.

The Royal Flying Doctors Service of Australia

4.12 The Royal Flying Doctors Service of Australia (RFDS) is a not-for-profit charitable service providing aeromedical emergency and primary health care services together with communication and education assistance to people who live, work and travel in regional and remote Australia.

4.13 The Service provides:

- primary healthcare clinics at remote sites;
- radio and phone consultations;
- communication via RFDS radio bases;
- deposition of medical chests containing medicines for the remotest communities; and
- inter-hospital transfers.

4.14 Established in 1928, and developed on a national basis in the 1930s, RFDS provides a highly sophisticated and well organised network across Australia. It has 47 aircraft, provides a 24-hour emergency service and has over 700 members of staff at 21 bases.

4.15 The RFDS provides aeromedical retrievals and inter-facility transports that are conducted from RFDS Bases. RFDS retrieval staff are available to respond to calls 24 hours a day, seven days a week. RFDS is mainly concerned with primary responses and, but does undertake transport of patients between health facilities. Australia also has some specialist transfer services that deal with interhospital transfers of seriously ill patients, including Careflight in New South Wales and Queensland, and Medflight, operating across South Australia.

4.16 The medical staffing of retrievals and transports will differ depending on the patient's clinical condition. Some will be attended by both a medical officer and flight nurse, while others will be attended by a flight nurse only. In a single year, around 35,000 aeromedical evacuations are carried out (this includes hospital transfers as well as pre-hospital retrievals). This amounts to 96 cases daily.5

The Critical Care Air Transport Program (USA)

4.17 The Critical Care Air Transport Team (CCATT) program is a component of the U.S. Air Force Aeromedical Evacuation system, which has its roots in World War I and II. During the 1980s and early 1990s, the Service developed capability for the rapid, effective stabilisation and transport of casualties.

4.18 Under the CCATT program, teams were developed consisting of a critical care physician, critical care nurse and respiratory therapist with supplies and equipment necessary to provide a critical care environment that would move with the patient during evacuation. The concept of the CCATT is to manage stabilising casualties, i.e. those who had undergone initial resuscitation but who remained critically ill. A physician was included on the team to give the patient continuous access to medical decision-making so that therapies could be titrated to the patient’s condition, and new therapies started if required without interrupting transport.

4.19 This capability was developed to support rapidly mobile surgical teams with high capability for damage control resuscitation and limited capacity for post resuscitation care. The critical care air transport team permits rapid evacuation of stabilising casualties to a higher level of care.

4.20 The critical care air transport team capability has been used successfully in a range of settings including transport within the United States, disaster response, and support of casualties in combat.

5 The Royal Flying Doctors Service of Australia Website, http://www.flyingdoctor.net
Retrieval times

4.21 The Association of Air Medical Services (AAMS), an international association of air medical providers, produced a position paper in 1990 that supported the concept of a ‘Golden Hour’ of trauma (a period in which outcomes from rescue might be optimal) and extended this to a range of non-traumatic medical conditions (Association of Air Medical Services, 1990). The paper argued that time affected survival and concluded that air transport should be used when it optimised time to medical care. It should be recognised that this refers to primary retrieval. The concept of the ‘Golden Hour’ has now been challenged on the basis that a sudden fall off in outcomes does not occur immediately after that first hour, but the general principle that outcomes are affected by speed of response is not contested. However, once a patient is under medical care, then the relationship between speed of transfer to definitive care and outcome becomes more complex and depends, to some extent, on the quality and level of the local care setting. Moreover, when retrospective observational data are used, then interpretation of relationships between transfer times and outcomes becomes even more complex.

4.22 A retrospective comparison of air and ground transport for cardiac patients in rural USA in the 1990s showed that a more rapid retrieval by helicopter than ground ambulance, with additional treatment en route for the helicopter group, resulted in reduced pain on admission and shorter hospital stays (Berns et al, 2001). However, another retrospective study (Belway et al, 2008) of interhospital transfers to an ICU in Canada found that, for patients surviving the episode of illness or trauma, the longer time from the call to arrival of paramedics at the referring hospital was associated with shorter ICU/CCU stay at the major receiving hospital. In addition, a longer time spent by paramedics at the referring hospital was associated with a shorter overall hospital stay. The authors speculated that this might be due to patients being better prepared prior to the journey, but there may clearly be other confounders in this study such as, severity of condition/injury.

4.23 Another retrospective study in Australia (McMonagle et al, 2007) has suggested that a surgically supported retrieval improves outcome by reducing the time to urgent surgery. However, the numbers of patients requiring early surgical intervention was small (0.4%), raising questions about the logistics and operational issues in providing such a service.

4.24 Finally, Falcone et al (1998) retrospectively examined patients transferred directly by air from the scene of incident to definitive care compared with those taken initially to a local facility and then transferred in rural USA. While the mean time to definitive care was six times faster in the directly transferred patients, the outcome differences in the two groups were minimal, although, again, confounding by severity by illness/injury may have occurred.

4.25 In conclusion, while time to delivery of initial care is clearly important for ill and injured patients, it is less easy to demonstrate a clear relationship between time taken to transfer from a local facility to definitive care and outcome. However, this is much influenced by severity of the illness or injury and the level of care available at the local facility.
Clinical outcomes

4.26 Several studies are highlighted as providing evidence on clinical outcomes. In general, clinical outcomes are thought to be improved through quick and targeted retrieval services. Clinical outcome is determined by a number of factors including the severity of initial injury or illness, time taken to initial treatment and circumstances and facilities for retrieval (including the retrieval crew and staff as well as the transport used).

4.27 Clinical outcome studies are subject to the same constraints as the retrieval time literature discussed above, namely, the complex nature of the process of retrieval of acutely ill patients and the lack of prospective randomised trials that, in this setting, would be difficult, if not impossible, to undertake. Once again, we have to rely on retrospective reviews and on natural experiments, such as the initiation or withdrawal of a service allowing before and after or parallel study designs. The issues are carefully argued in a paper (Thomas and Biddinger, 2003), which reviews papers published in 2001-2. The most compelling evidence for an EMRS-type service cited relates to emergency air medical services for transfer to a major centre in the rural state of Oregon (Mann et al, 2002). Here, four referring hospitals in one area lost access to Helicopter Emergency Service (HEMS) transport, whereas four referring hospitals in the adjacent region retained HEMS capability. Not surprisingly, inter-facility transport times became significantly prolonged in the region without HEMS. More compelling were the mortality results. In the period before HEMS transport was lost in one region, trauma mortality for the two regions was virtually identical. After the HEMS capability was lost, however, the region without HEMS access experienced a four-fold increase in trauma mortality, whereas mortality remained unchanged in the region with continued HEMS service.

4.28 Hotvedt et al (1996) used a different approach. They employed expert panels, to assess 370 cases of helicopter evacuation from the region around Tromso in northern Norway. The case mix included children and adults with a wide range of medical conditions, who were mainly subject to primary retrievals. 11% of patients were judged to have benefitted from the air transfer and most of the life years gained were attributed to children.

4.29 As discussed previously, Berns et al (2001) demonstrated reduced chest pain in cardiac patients transported by air compared to those transported by ground transport. This was attributed to greater intervention rates during transfer in the former group.

Staffing profile

4.30 Many studies have examined the use of different professional experts in emergency retrievals, but there remains no definitive consensus on the benefits of specialists’ inclusion in transport teams. Much of the literature comprises case series, retrospective reports and opinion pieces. A systematic review (Belway et al, 2006) identified a large number of papers addressing the topic, but only six met the criteria for final inclusion in the review. Furthermore, it was impossible to pool the evidence even from those six due to variations in
setting and study design. Again, this reflects the differing nature of services reported and the configuration and training levels of retrieval staff. For example: randomised trials are absent; some studies relate primarily to primary retrievals; and the level of training of nurses, paramedics and medical staff may vary significantly between studies and between countries. Other factors, such as provision of medical equipment, may also affect the clinical outcome of patients.

4.31 In Belway’s review (2006), only one paper (Bellingan et al, 2000) demonstrated improved outcomes by involving specialist personnel, but Belway’s main conclusion was that definitive studies were not available. Burney et al (1991 and 1994) reported on one prospective study in Michigan that demonstrated no difference in outcome between transport by physician/nurse (P/N) or nurse/nurse (N/N) transport teams. However, there are several possible explanations for their lack of effect. Their patients were coming mainly from an emergency department (~60%) or hospital ward (~34%), with only a few from scene of event (~6%). It is not clear what level of care might be available in these facilities, but it is possible that patients were already ‘well packaged’ and prepared for the journey by the local physicians. The authors did not specify the geographic area covered but the mean (SD) flight time between facilities was only 22 (19) minutes by helicopter, so most journeys were short. There was some element of selection with P/N combinations going out to the most complex cases, so the patient groups were not entirely comparable. Finally, it is not stated what level of training their nurses had undergone; it may have been quite advanced. The findings, therefore, are not directly comparable with a Scottish EMRS, but it does raise the question, in relation to our rural general hospitals, that if the patients obtain suitable treatment there, they might be able to cope with less highly trained escorts for transfer.

4.32 Cameron (1999), in an editorial accompanying a paper by Garner et al (1999), accepts that, for primary retrieval of blunt trauma, the presence of a physician in the helicopter transport can improve outcomes in Australia, while the paper by Bellingan et al (2000), referred to above, indicated that use of a specialist transfer team for secondary retrievals in the UK could improve outcomes. However the latter was, again, a retrospective study with the associated limitations that implies.

Costs

4.33 Costs of emergency medical retrieval services in the UK and overseas has been covered to some extent in the literature. As with the clinical literature, many papers relate to wider issues of pre-hospital emergency services. Where cost information on secondary retrievals is available, direct comparisons with the Scottish EMRS should be treated with caution as services differ in terms of staff resources, operational functions and geographical areas served. Despite this, it is useful to draw on other emergency service cost information in order to identify ranges in costs.
4.34 The Scottish EMRS pilot was initially estimated at £1.1m for a single centre based at Glasgow in 2006\(^6\), this approximated to £3,715 per patient (Hearns et al, 2006). In comparison, McMonagle et al (2007) in New South Wales reported an average cost per retrieval for an inter hospital transfer service of AUD$7,000 (about £3,300), while Bruhn et al (1993) in Massachusetts reported a cost benefit analysis model that identified 1991 costs of $4,475 (about £7,300) per completed mission for ground ambulance secondary responses and $2,811 (about £4,600) per completed mission for a helicopter service. The latter study, albeit based on modelling, challenges the commonly held view that helicopter based services are necessarily more costly than ground based systems in this setting. However, as these are all different types of services from EMRS, we cannot use cost comparators in any strict sense.

**Literature review conclusions**

4.35 The literature relating to EMRS-type services gives some insights into the factors associated with effective delivery, although the absence of rigorous, prospective randomised studies means that the evidence will always remain subject to interpretation and challenge. It is acknowledged that, given the nature of this type of service, the diversity of patients attended and their circumstances, and the variable geography in which services are delivered, it is unlikely that conventional randomised trials will ever be performed, therefore, we have to rely on retrospective case series, opportunistic before and after studies, and other less rigorous studies. Furthermore, the overlap between primary and secondary retrieval services further complicates interpretation of the data.

4.36 Despite these limitations, some general conclusions can be drawn.

- For primary retrievals (not specifically the focus of this review), there is evidence that time to initial medical care is important, and that expertise of the attending healthcare professional affects outcome. For example, including a doctor in the team can improve outcome, although this may result in overprovision at some scenes of less serious injury or illness.

- For secondary retrievals, the level of expertise available at the sending facility becomes important, and the relationship between retrieval time and outcome is more complex, affected by the level of intervention possible at the sending facility and during transport. For Scotland, this may mean, for example, that the ‘added value’ of EMRS may vary depending on whether the patient’s initial management is taking place at health centre, community hospital or rural general hospital. The advice service and upskilling offered by the EMRS to remote sites may be important in this respect, although this is not an area addressed in the international literature.

- The composition of the retrieval team, types of practitioner involved and level of expertise available is very likely to affect outcome, although it is

---

\(^6\) Report to EMRS Project Board, Scotland’s Emergency Medical Retrieval Service, 2006
difficult to prove this from existing literature due to variability in the scenarios described above.

- There is relatively limited cost effectiveness data, but what is available suggests that an EMRS is likely to operate within acceptable cost-benefit limits. In addition, some limited information from the literature suggests that retrieval of sick children is likely to further improve cost-benefit figures, due to their more favourable potential cost per QALY outcomes.

4.37 In general, air medical retrievals are effective where they are provided in a timely manner, are directed to the appropriate facility and are appropriate to the type of patient and situation.

The Scottish situation

4.38 We examine, in this sub-section, the literature on the use of air emergency programmes in Scotland, considering the types of service and outcome measures (where assessed). This sub-section helps to clarify the development and rationale for EMRS in Scotland.

4.39 In total, we outline the main findings from six key research documents (see Figure 4.1).

Figure 4.1 The key papers from the Scottish literature

- Proposal for the Development of an Inter-Hospital Transfer Service
- Emergency Medical Journal: Aeromedical Retrieval to a University Hospital Emergency Department
- EMRS: Establishing a Rural Emergency Medical Retrieval Service
- EMRS: Scotland’s Emergency Medical Retrieval Service
- EMRS: A Rural Emergency Medical Retrieval Service: The First Year

Proposal for the Development of an Inter-Hospital Transfer Service

4.40 This paper sets out the Scottish Ambulance Service’s proposals to establish a dedicated Inter Hospital Transfer (IHT) Service, for patients transferring between hospitals in NHS Scotland, in response to Delivering for Health (Scottish Executive 2005).

4.41 At the time of this review, there were 73,000 inter-hospital transfers each year, 10% classified as emergency, but two-thirds of which were carried out by front-line emergency services. By December 2005, SAS had intended to prepare proposals for a dedicated inter-hospital transfer service that would:

---

• free paramedics and other practitioners in the emergency service to develop their emerging role as providers of mobile health care in the community;

• improve performance on front-line emergency and non emergency ambulance services;

• improve integration of national, regional and local services; and

• support NHS Boards as they redesign hospital services in accordance with the National Framework for Service Change.

4.42 The review argues that:

“...a high quality transfer service is associated with better clinical outcomes for transfer patients, especially for critically ill patients. Additionally, the new service would improve emergency cover, especially in rural areas. A further rationale behind the programme included help to ‘future proof’ NHS Scotland: within a couple of years, the new service would establish an infrastructure for inter hospital transfers. This would provide a platform to support further developments in health care provision in NHS Scotland, such as the development of a medically led adult retrieval service.”

4.43 When fully operational, in Year 3 of the implementation programme (2008/09), the IHT service would require 373 operational staff and 74 transfer vehicles, dedicated to the new service. It would cost £14 million in annual running costs (at 2005/06 prices). The Kerr Report and the Service’s 2010 Vision hospital@home envisaged a growing role for paramedics and technicians as mobile health care resources in the community: an integral part of the multi-disciplinary primary care team, helping patients to manage chronic conditions and stay out of hospital.

4.44 The report makes the following conclusions.

• A new, dedicated inter-hospital transfer service is a strategic requirement for NHS Scotland and for the SAS. The new service is required to support the implementation of Delivering for Health and to support the implementation of the SAS’s corporate strategy, the 2010 Vision.

• There is an urgent need to approve and implement the project now if NHS Scotland is to successfully implement these strategies: a high quality inter-hospital transfer service is a pre-requisite both for successful implementation of change in the provision and distribution of hospital services, and for the successful freeing up of front line ambulance resources to fulfil their new roles and deliver high performing emergency ambulance services.

• The new service would offer significant benefits for patients in terms of improved clinical outcomes (especially for the critically ill) and reduced stress associated with transfer arrangements. In addition, emergency
cover (of both ambulance resources and medical/nursing staff) would be improved, especially in rural areas. The new service would also help to reduce waiting times for patients in hospital A&E departments and waiting times for elective work, through freeing up hospital bed capacity.

- The new service represents good value for money and is affordable for NHS Scotland.
- Project management arrangements are in place to implement the service, in a phased roll-out programme, as soon as approval was secured. Arrangements are also in place to evaluate the new service during and after the roll-out.

Aeromedical Retrieval to a University Hospital Emergency Department in Scotland

4.45 This paper reviewed the retrievals undertaken by medical staff from the emergency department (ED) or intensive care unit (ICU) of the Southern General Hospital in Glasgow over the previous two years and discussed the potential and difficulties of setting up a critical care retrieval system.

4.46 The paper highlights that rural and remote areas of Scotland were deriving benefit from the availability of the SAS paramedic staffed helicopter for transfers and primary scene responses. There were a small number of patients who required advanced airway management, invasive procedures, or critical care interventions to stabilise them before transport to definitive care. These additional skills were being provided on an ad hoc basis by senior medical staff drawn from intensive care and emergency medicine at the receiving hospitals. Given the potential difficulties of training paramedics to use these infrequently used skills, it was considered potentially preferable to establish a formalised system to access suitably trained medical staff.

4.47 This study reviewed the helicopter admissions log into hospital over the period January 2002 to December 2003 (n=10). Reasons for retrievals, referring area and interventions were recorded, as were data on staff training.

4.48 Air paramedic training included intubation without drugs and needle thoracentesis, but it did not include the use of anaesthetic drugs or formal thoracostomy. Studies of other rural helicopter services had suggested that these skills were required in only 1-5% of flights (this study only included primary missions, i.e. patients treated by a first responder flight crew including an anaesthesiologist). The West of Scotland did benefit from a dedicated inter-intensive care transfer service, but no formal arrangements existed for patients who required time critical transfers.

4.49 A helipad servicing the West of Scotland was situated at the Southern General Hospital. All patients transferred by air were initially assessed by senior ED staff working within the hospital. On several occasions, patients had required

---

urgent medical intervention on arrival. Selected patients seemed to benefit from an experienced physician with advanced airway and other critical care skills being part of the flight team.

4.50 The most common intervention required (during the monitored period) was securing a definitive airway by rapid sequence intubation in seven of the ten patients. In addition to securing the airway, this represented the only safe way of transferring patients who may become restless or agitated during air transfer.

4.51 The authors observed that:

“Work in the USA, Germany and Australia has suggested that reduced mortality is related to the presence of a physician with critical care skills rather than purely as a result of reduced pre-hospital time from air transport alone. This suggested that rapid sequence intubation skills were required for any medical staff undertaking retrieval work. These skills were mandatory for staff working on the London HEMS team. At the time of the report, SAS helicopter paramedics and most rural general practitioners were not trained in these skills.”

Establishing a Rural Emergency Medical Retrieval Service

4.52 In 2004, the Argyll and Clyde Health Board established the Emergency Medical Retrieval Service to support its rural community hospitals. This article describes both why the service was established and its aims. This service was the pre-cursor to the wider West of Scotland service.

4.53 The Argyll & Bute service covered a geographically extensive area, with approximately 85,000 people living in remote locations. Rural general practitioners in six community hospitals provided initial patient assessment and resuscitation. Providing emergency care and safe transfer of seriously ill and injured patients presented a significant challenge to these community hospitals. All parties involved felt that there was a need to provide a service to transport critically ill and injured patients from these remote locations to definitive care.

4.54 The idea of the EMRS team in the Argyll & Bute pilot was to bring the resuscitation room to the patient in the rural setting. With this aim, and in order to implement the Intensive Care Society guidelines for the transport of critically ill patients, it was decided that consultants in Emergency Medicine and Anaesthetics with an interest in critical care would staff the service medically.

4.55 Following appeals by rural GPs and urban emergency medicine consultants, Argyll & Clyde Health Board approved a 12-month evaluation of an emergency medical retrieval service in 2004. A working group of eleven consultant emergency physicians and intensive care consultants from two

---

hospitals keen to provide the service was formed. At the start of the project, the following development priorities were identified:

- activation criteria;
- community hospital liaison;
- ambulance service liaison;
- clinical governance system;
- equipment management; and
- training.

4.56 The service covered a population of 32,700 served by five community hospitals. Accident and emergency type attendances at community hospitals in the health board area totalled approximately 15,000 per year.

4.57 The service aimed to deploy a critical care consultant directly to patients in remote community hospitals, initiate appropriate interventions and safely transfer the patient by the most appropriate method to the most appropriate centre capable of providing definitive care. The retrieval team was led by an ED or anaesthetic consultant together with a flight paramedic from the SAS. Depending on the location and aircraft used, the team could also contain a nurse or retrieval registrar.

4.58 The study concluded that: “....[the] introduction of the retrieval service is a significant step forward in providing an integrated system of care by providing rapid access to an experienced physician with critical care skills and safe transfer to definitive care. The team is also active in promoting optimal care in the rural pre-hospital environment and in the community hospitals.”

Scotland's Emergency Medical Retrieval Service - Report of the EMRS Project Board

4.59 The document includes an outline of the proposed Scottish EMRS as well as an option appraisal, cost analysis, risk analysis and recommendations by the Project Board. In this document, the Project Board proposed the introduction of a national EMRS to support the care of seriously ill and injured patients in remote and rural Scotland.

4.60 The report is introduced with a clear definition of a retrieval.

“The deployment of a medical team from a specialist centre to a smaller healthcare facility with limited on site resources, with the aim of resuscitating and transferring critically ill patients directly to definitive care. A retrieval is always for a patient who is already under the care of

---

S Hearns, D Inglis, P Munro, A Corfield, Scotland's Emergency Medical Retrieval Service. Report of the EMRS Project Board. 2006
4.61 In *Delivering for Health*, the Scottish Executive Health Department (SEHD) made review of helicopter patient transfer (termed HEMS in the document) a clear rural healthcare action point for 2006. This report provided the rationale for the introduction of a national EMRS to support the care of seriously ill and injured patients in remote and rural Scotland. The consultant based EMRS would provide equity of access to critical care and safe transfer to definitive care from the six rural general hospitals and 15 rural community hospitals in Scotland receiving emergency cases. The Service would also cover remote isolated general practices such as those on the islands. The Project Board recommended that the establishment of the EMRS should be achieved in a staged process commencing with a Glasgow based service serving all rural hospitals on the West Coast, increasing to coverage of the North Highlands and Northern Isles after 18 months. This increase in coverage may be through expansion of a single Glasgow centre or the establishment of a second centre in either Inverness or Aberdeen.

4.62 Patients were being transferred from rural hospitals by ambulance service helicopter or fixed wing aircraft escorted by technicians or paramedics. These health care providers had the skills and experience to care for the great majority of patients transferred by air as the vast majority (about 90%) had only mild or moderate illness or injury. Approximately, 10% of patients transferred by air in Scotland, however, had serious illness and injury. The advanced medical interventions these patients urgently required, especially emergency anaesthesia, could not be expected of rural GPs and could not be performed by ambulance service staff. Rural GPs indicated that the introduction of EMRS had transformed the service and care that they could provide to seriously ill patients and was of great benefit to the sustainability of rural healthcare. It was believed that the proposed consultant based retrieval service would bring the following benefits.

- Improved support and advice for rural practitioners and community hospitals
- Improved and more rapid provision of critical care interventions and definitive surgical care, facilitating equity of access
- Improved safety and standard of transfer of critically ill patients in accordance with the UK and international guidelines
- Optimal triage for critically ill patients and a reduction in further transfers
- Introduction of an integrated system of rural emergency care in the form of a Managed Clinical Network (MCN)
- Improvement in survival and functional outcome for seriously ill and injured patients
- Improved training and empowerment for rural healthcare professionals, working with BASICS Scotland
- Introduction of a consultant based team to provide on-scene medical management of mass casualty major incidents in rural areas.

4.63 In terms of identified costs, on a per mission cost of £3,700 to £6,000, this gives a range of cost per QALY of £1,000 to £4,000. This is well below the informal cut-off level of £30,000 per QALY used by the National Institute for Clinical Excellence (NICE) in England and Wales. However, this figure takes no account of other factors that may further increase the cost effectiveness of a national EMRS. Improved initial stabilisation and critical care transfer will decrease the incidence of patient deterioration during transfer. This has a significant knock-on effect on the rest of a patient’s hospital stay, reducing the duration of intensive care and total hospital stay. Further cost savings may be made by a reduction in the overall number of air transfers, following advice given by the retrieval service to remote and rural healthcare providers. Appropriate triage would reduce the number (and cost) of secondary transfers of patients.

4.64 The final recommendation was for:

“A staged introduction which allowed development of local existing service and experience. This was also to allow time for audit of transfer requirements of the Northern Highlands and the Northern Isles and, hence, allow evidence based decision making regarding a possible expansion of services from Glasgow or establishment of second centre in the North East. Furthermore, it allowed time for feasibility of consultant recruitment in potential North East centres to be assessed. This option gave a cost per retrieval of £5,087, with total Year One costs of £1,213,019. It would commence with a Glasgow based service serving all rural hospitals on the west coast, increasing to coverage of the North Highlands and Northern Isles after 18 months”.

A Rural Emergency Medical Retrieval Service: the First Year

4.65 This report describes the first year of operation of the rural EMRS, staffed by emergency medicine and anaesthetic consultants and providing air based retrieval of critically ill and injured patients from general practitioner led community hospitals in rural west Scotland.

4.66 The Service was created as a unique resource within the UK, designed to tackle the challenge of providing care and safe transfer of seriously ill and injured patients presented to community hospitals in remote areas. This care was complicated by limited critical care skills and facilities at the initial point of care coupled with prolonged transfer times to definitive care.

4.67 40 patients were attended and advice was given on a further 21 patients. 21 of the 40 patients (53%) attended required RSI (Rapid Sequence Intubation) prior to transfer. The median Injury Severity Score (ISS) for trauma patients was 26 (range 2-59). The median Acute Physiology and Chronic Health Evaluation (APACHE II) score for all patients was 11 (range 2-37).

4.68 77% of the patients attended over the 12-month period were male. The median age of the group was 45 years (range 15-82 years, as noted above the Service was not for children under 14 years of age). The case mix was 55% medical emergencies and 45% trauma. Four patients died at the original healthcare facility, three of whom died within four hours of the EMRS team arriving at the facility. One further patient died while the team were en route. Of the 34 patients fully transferred to definitive care, two patients died within 24 hours of arrival at the destination hospital, one of whom died within eight hours. During the year, there were only two ‘missed retrievals’: these were patients arriving from the catchment area of the EMRS at a receiving hospital with a critical illness who EMRS staff had not been informed about.

4.69 The authors concluded that:

“The data showed a high level of acuity among this patient group and a need for advanced medical intervention to ensure safe transfer. Therefore, this provided support for the concept of medical retrieval in remote and rural areas of Scotland. The severity of illness and injury in cases included in the study demonstrates a clinical need for rapid access to specialist and advanced medical interventions. Prior to the introduction of the EMRS, such patients with life threatening conditions were often transferred by air without pre-transfer stabilisation, most importantly without definitive airway maintenance and protection. The results demonstrate a need for the combined skills of a consultant and paramedic team, as they have potentially life-saving benefits.”


4.70 This report presented to the Scottish Government the Group’s vision for the development of a sustainable health system for remote and rural Scotland. It provides a framework for rural health services to continue to develop and enhance their roles in the ‘continuum of healthcare’ across Scotland through an integrated network model.

4.71 The report looked to create a vision for the development of a sustainable health system for remote and rural Scotland. Providing access to local healthcare is a key driver in this respect. The Remote and Rural Steering Group were asked to respond to the following main objectives.

¹² These scores are fully defined in Section 5
• Deliver a strategy for sustainable healthcare in remote and rural Scotland, through a number of sub-groups, by acting as Programme Board for Projects, ensuring linkages between relevant projects and identifying synergies, cross-cutting issues and gaps to be addressed

• Define the role and function of a rural general hospital

• Develop a framework of generic principles of service delivery for primary care in remote settings

• Develop a rural education strategy, in support of the national agenda, including development of a proposal to establish a virtual school of rural healthcare

• Review the role of the Helicopter Emergency Medical Retrieval Services to determine the appropriateness of this service in supporting unscheduled care in remote and rural areas

• Develop a workforce planning arrangements to support the remote and rural agenda.

4.72 Focusing on the role of the HEMS, throughout the process of engagement and wide consultation in the production of the report, the lack of an integrated response to transport has been raised consistently as being a problem, resulting in delays for patients accessing appropriate healthcare. Health related transport was provided by a range of different providers/agencies, including voluntary drivers, the Patient Transport Service of SAS and the more specialised neonatal transport and paediatric retrieval services. In addition, the project has proposed the establishment of a pilot to demonstrate the benefits of an EMRS. Therefore, it was proposed that, in order to improve health transport, a national approach was adopted.

4.73 The National Framework for Service Change (NFSC) suggested that, “poor access will adversely affect outcomes” for rural patients, but this was challenged on the basis of the pilot carried out in NHS Argyll & Clyde, which demonstrated that through up-skilling rural practitioners, providing them with rapid access to emergency medical advice and the ability to transfer rapidly to a consultant with critical care skills to the patient, whatever their location, outcomes can be greatly improved. Overall, there was broad support for the evaluation of the EMRS. However, many participants felt that, in light of weather restrictions, it may be more beneficial to invest in road infrastructure or other means of transport such as boats.

4.74 A large number of respondents suggested the need for an integrated transport strategy for remote and rural areas. It was suggested that creative solutions across agencies could be found. Participants also highlighted that the number and placement of centres for this service needed to be carefully considered. To illustrate this, examples were given of time delays currently being experienced in awaiting the arrival of the neonatal retrieval team (up to six hours). There was also a significant degree of concern regarding the opportunity cost of investment in such a service in terms of what it would
mean for investment in local services. Benefits were perceived as the potential to reduce the waiting time for transfer of patients and ensure that they reach definitive care as quickly as possible. It was also thought as being able to enhance the support to local clinicians and protect them from leaving to undertake transfer duties. Additionally, participants reported another benefit as the patient being collected by clinically experienced staff.
5 PERFORMANCE OF THE WEST OF SCOTLAND PILOT

- Over the evaluation of the pilot period (1 June 2008 to 1 June 2009), there were 222 EMRS retrievals across the West of Scotland. There were a further 187 advice only calls.

- The medical conditions of the patients were varied and acuity was generally high. Many advanced interventions were used during transfer, but immediate critical care interventions were not required in just under one-fifth of cases.

- Response times were relatively quick and improved on the initial Argyll & Bute pilot.

- Simultaneous retrievals prevented three retrievals from occurring and required voluntary cover from EMRS consultants on ten occasions over an eight-month period.

- Among health professionals, health board staff and patient representatives, the rationale for EMRS was well understood and the Service was generally well-received. All consultees wanted EMRS to continue in some form, but there was no real consensus on the favoured option for delivery.

- A range of 96 to 710 additional quality adjusted life years (QALYs) is estimated by a number of means for the pilot. This gives an estimated cost per QALY of £1,500 to £11,600. This is a broad range, but even under our most cautious assumptions, the cost per QALY is still well within NICE guidance that a cost of £20-30,000 per QALY gained represents good value for money.

5.1 This section of the report deals with the performance of the pilot in the West of Scotland over a one-year period. Information is based on the EMRS database and results obtained from our primary research. EMRS is assessed using both quantitative and qualitative methods. An assessment of quality adjusted life years (QALY) is also presented.
Activity

5.2 Our review of activity provides details on:

- the number and type of retrievals;
- advice only cases;
- primary missions;
- simultaneous missions;
- aircraft used;
- referral patterns; and
- response times.

5.3 It also considers the profile of patients in terms of demographic indicators and diagnosis of retrieval cases as well as detailing the procedures carried out by the EMRS Team.

Review of EMRS database

5.4 Information on the activities of the EMRS Team is monitored using an Access database. Each retrieval is recorded individually and extensive data relating to that retrieval is provided. This includes information on retrieval times, referring area, destination and procedures. Information relating to outcomes in the form of APACHE II, SAPS II, ISS and TISS scores is also recorded in order to allow the assessment of clinical outcomes.

5.5 This section provides evidence extracted from that database.

Number and type of retrievals

5.6 In total, 222 retrieval missions were carried out by the EMRS team over the 12-month pilot period.14 Of these, 19 were primary retrievals and 203 secondary. On ten occasions, missions were carried out simultaneously, i.e. involving 20 patients.15 Figure 5.1 illustrates the breakdown in total retrievals. The total missions recorded (222) exceeds the estimates initially projected based on models of demand (192).16

---

14 The evaluation of the pilot period ran from 1st June 2008 to 1st June 2009. Data has therefore been collected from 02/06/2008 to 01/06/2009.
15 Data on simultaneous missions was only collected from November 2008 onwards.
16 Taken from EMRS Team presentation to the June 2009 EMRS Project Board Meeting.
5.7 Figure 5.2 shows the total number of retrievals by month. Over the 12-month period, the number of retrievals remained relatively constant throughout the year. Retrieval numbers were at their lowest in June 2008, the first month of the Service, and peaked in March 2009.

5.8 In terms of the time that retrieval missions are carried out, just under half occurred between 0800 and 1800 hours on weekdays. Just under one-third occurred at the weekend, which appears to be a fairly even distribution in terms of activity levels.

5.9 It is noticeable that around two-thirds of weekday activity occurs during the day, while 70% of the weekend activity occurs at night and the early hours of the morning.
Advice only calls

5.10 In addition to the 222 primary and secondary retrieval missions carried out, 187 advice only calls were made.

5.11 Advice only calls were not activated as standard retrievals for a number of reasons. These included:

- most did not require critical care intervention and the advice provided was thought to be sufficient;
- five patients were referred to the paediatric team;
- on seven occasions, no aircraft was available for the retrieval and it was advised that patients would get to the final destination quicker by road transfer; and
- on three occasions, it was not possible to provide a second retrieval team (in two of these cases, patients were transferred by a local clinician by road).

5.12 On 28 occasions over the year, an aeromedical patient transfer was avoided following discussion between the EMRS consultant and referring clinician. These were transfers where it was not deemed necessary for the patient to require an EMRS despatch. Instead, these patients may have been transferred by SAS (by road or air), or they may have stayed in their local area with the clinical staff providing care based on the advice of the EMRS Team.
5.13 Figure 5.4 shows the location of the advice only calls. Most advice only calls received from a single destination were from Stornoway, followed by Campbeltown and Oban. These areas are also common sources of EMRS retrievals, but there does not appear to be a strong correlation between the source of the advice only calls and the source of EMRS retrievals.

Figure 5.4 Advice only calls by area

![Graph showing advice only calls by area]

Source: EMRS database

**Primary retrievals**

5.14 The EMRS team began undertaking primary retrievals in January 2009 and, from then to the end of the evaluation period, 19 primary retrievals were carried out. The largest number of primary retrievals was to attend road traffic accidents where patients were severely injured (nine). Other accidents requiring primary retrieval including climbing, riding and diving accidents. The initial location of these retrievals was not recorded.

**Simultaneous retrievals**

5.15 Information relating to simultaneous missions has only been collated since November 2008 and, therefore, does not reflect the whole period of the pilot. In total, there were ten occasions when the EMRS Team was called out to separate incidents at the same time. One incident involved the call out of three separate teams. On all of these occasions, the second or third team was deployed using staff on a voluntary basis. In addition, there were another three occasions when EMRS requests were made while the Team were out on a retrieval mission. In these instances, a second team was unable to be deployed and the requests were treated as advice only calls.
**Aircraft used**

5.16 Figure 5.5 shows the breakdown in missions by means of transport. Approximately 80% of retrievals were undertaken using SAS aircraft, either the Glasgow helicopter (Helimed 5) or the Glasgow fixed wing aircraft (King Air). In a further 18% of cases, the retrieval was undertaken on the Royal Navy Search & Rescue aircraft based at HMNAS Gannet in Prestwick. In just 2% of missions, alternative transport was used including road transport, the Coastguard SAR helicopter or police helicopter.

![Figure 5.5 Missions by aircraft type](image)

Source: EMRS database

**Referral patterns**

5.17 Referrals were taken from across the pilot area. Stornoway had the largest single number of referrals with 25, followed by Stranraer and then Lochgilphead. The Service was used most infrequently in areas where there was a lower population such as Coll, Colonsay and Cumbrae.
5.18 Figure 5.7 provides analysis of the location of referrals adjusted to reflect populations. This shows that the more remote areas and islands, particularly in Tiree and Colonsay, had a proportionately high number of retrievals. This can partly be explained by the small populations of these areas and their lack of hospitals. These figures suggest that the areas receiving, proportionally, the most benefit from EMRS are the remote islands and Lochgilphead (a place that is particularly difficult to travel to and from by road).

Source: EMRS database
5.19 Figure 5.8 provides a breakdown of referrals by health board area. We have separated NHS Highland into Argyll & Bute (where the Service has been running for some time) and the rest of the Health Board.

5.20 Referrals are fairly evenly split between the health boards in the areas in which the Service was new, but a higher proportion originated from Argyll and Bute (39% of all secondary retrievals). This is likely to be because the Service here is established and there is a higher degree of awareness of the Service in this part of Scotland. Most of Highland is not included in the pilot. As shown in Figure 3.1, as well as Argyll and Bute, the only other main parts of NHS Highland covered are Lochaber, Skye and Wester Ross.

Figure 5.8 Location of referrals by health board area

![Pie chart showing referral distribution by health board area: Argyll and Bute 39%, Western Isles 15%, Dumfries and Galloway 21%, Ayrshire and Arran 12%, Highland 12%]

Source: EMRS database

5.21 Figure 5.9 provides a breakdown of the final destinations for EMRS patients. The largest proportion (40%) travelled to the Southern General Hospital in Glasgow. A further 20% were taken to the nearby Royal Alexandra Hospital in Paisley. The remaining patients were taken to a variety of destinations around Scotland including the Golden Jubilee Hospital in Clydebank, Crosshouse Hospital in Kilmarnock and the Royal Infirmary in Dumfries. A small number of patients were taken to centres in the East of Scotland to access specialist services such as the National Liver Unit or available ICU beds.
Figure 5.9 Final destinations for EMRS patients

![Pie chart showing final destinations for EMRS patients]

Source: EMRS database

**Response times**

5.22 Table 5.1 provides a summary of all the response times before and during the EMRS pilot period.

- **Time to ready** - The time taken for staff to get ready and prepared for the retrieval. Times range from a minimum of 0 minutes (shift staff and aircraft immediately available) to 2 hours 35 minutes (wait for fixed wing aircraft to become available), with a median time of 25 minutes.

- **Time to airborne** - The time spent waiting for the aircraft to arrive when staff are ready and prepared. The median time spent during this phase is around 60 minutes, although this stage has been delayed by a maximum of 7 hours (due to lack of availability and location of aircraft).

- **Time to arrival at patient** - The total time between the EMRS Team arriving at the patient from the time that the call was initially made. The average time to arrival is 1 hour 45 minutes. Again, this varies according to the distance to be travelled and the time spent in preparation for the retrieval. The minimum time to arrival over the pilot period was 40 minutes, while the longest journey took 7 hours and 39 minutes (again, this was due to a wait for the fixed wing aircraft to become available).

- **Time to delivery of patient to definitive care** – This is the overall total retrieval time, i.e. from the activation call time to the delivery of the patient at definitive care. Over the period of the pilot, the average response time was 4 hours. Although this time varied, in 88% of cases the total time to delivery was less than 6 hours.

5.23 The overall median retrieval time has reduced, as have all the component time elements, since the pilot project was introduced across the West of Scotland.
### Table 5.1 EMRS Average (Median) Response Times

<table>
<thead>
<tr>
<th></th>
<th>EMRS Pre-Pilot</th>
<th>EMRS Pilot</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time to Team Ready</td>
<td>43 min</td>
<td>22 min</td>
</tr>
<tr>
<td>Time to Airborne</td>
<td>1 hr 21 min</td>
<td>55 min</td>
</tr>
<tr>
<td>Time to Arrival at Patient</td>
<td>2 hrs 4 min</td>
<td>1 hr 45 min</td>
</tr>
<tr>
<td>Time to Delivery of Patient to Definitive Care</td>
<td>4 hrs 30 min</td>
<td>3 hrs 43 mins, 89% less than 6 hrs, 62% less than 4 hrs</td>
</tr>
</tbody>
</table>

Source: EMRS database

5.24 Figure 5.10 provides more detail on flight times and includes the total time ‘on scene’, which for an average retrieval lasts an hour. Flight times vary considerably and many factors such as the distance travelled, the staff shift pattern, weather conditions and aircraft availability can all affect times.

**Figure 5.10 Average (median), minimum and maximum response times**

![Graph showing response times](image)

Source: EMRS Database

5.25 The large majority of retrieval missions are carried out by Helimed 5 aircraft, which is the fastest transport used by the EMRS Team. King Air and the Royal Navy are also used for retrievals, although times are longer for both these aircrafts. The Coastguard Helicopter has been used for one secondary retrieval and this had the longest average retrieval time at 9 hours 25 minutes.
Table 5.2 Average (median) retrieval times (call out to final destination) by aircraft type

<table>
<thead>
<tr>
<th>Aircraft</th>
<th>Number of retrievals</th>
<th>Average Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coastguard Helicopter</td>
<td>1</td>
<td>09:25</td>
</tr>
<tr>
<td>Helimed 5</td>
<td>136</td>
<td>03:05</td>
</tr>
<tr>
<td>King Air</td>
<td>43</td>
<td>05:30</td>
</tr>
<tr>
<td>Police Helicopter</td>
<td>2</td>
<td>03:45</td>
</tr>
<tr>
<td>Road Vehicle</td>
<td>3</td>
<td>04:33</td>
</tr>
<tr>
<td>Royal Navy</td>
<td>36</td>
<td>04:26</td>
</tr>
</tbody>
</table>

Source: EMRS database

**Demography**

5.26 In terms of the demographic composition of patients, the median patient age was 60 years-old, although patients ranged in age from 5 years-old to 93 years-old. Table 5.3 provides more detail.

**Table 5.3 Age profile of EMRS cases**

<table>
<thead>
<tr>
<th>Age analysis</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median age</td>
<td>60</td>
</tr>
<tr>
<td>Inter-quartile range</td>
<td>43-70</td>
</tr>
<tr>
<td>Range</td>
<td>5-93 years</td>
</tr>
<tr>
<td>Under 16 years</td>
<td>5</td>
</tr>
<tr>
<td>16-29 years old</td>
<td>16</td>
</tr>
<tr>
<td>30-44 years old</td>
<td>38</td>
</tr>
<tr>
<td>45-59 years old</td>
<td>50</td>
</tr>
<tr>
<td>60-74 years old</td>
<td>78</td>
</tr>
<tr>
<td>75 and over</td>
<td>35</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>222</strong></td>
</tr>
</tbody>
</table>

Source: EMRS database

**Diagnosis of retrievals**

5.27 Figure 5.11 sets out the underlying diagnosis of all retrieval patients over the pilot period.

5.28 The large majority of cases (almost 80%) required advanced medical interventions to facilitate safe transfer. 30% of patients were trauma victims and a further 22% suffered from illness associated with the cardiovascular system.
Procedures carried out

5.29 Over the one year pilot period, 15% of patients\textsuperscript{17} attended by the EMRS Team required rapid sequence intubation (RSI) and ventilation on scene. RSI is an advanced medical procedure that sedates and paralyses a patient prior to intubation. The high number of patients receiving RSI gives an indication of the severity of illness in EMRS patients.

5.30 A further 17% of patients were intubated prior to the EMRS Team arriving, taking the total to 72 patients (32%). In all cases, the procedure was successful. A summary of the reasons for intubation is given in Figure 5.12. The category of ‘transfer safety’ relates to patients who are deemed to be at high risk of compromising aircraft safety due to disturbed behaviour. This is a subjective assessment made by the retrieval consultant and is based on several factors including type of aircraft, underlying diagnosis, and geographical location.

\textsuperscript{17} Both primary and secondary retrievals
5.31 In addition to RSI, other advanced procedures such as chest drains, cardiac external pacing and the use of non SAS approved drugs were carried out in a further 98 cases.

5.32 Other advanced procedures carried out during transfer include invasive monitoring of blood pressure (arterial pressure) and/or central venous pressure. 32% of patients required some form of invasive monitoring.

5.33 Some patients were also administered non SAS drugs to help with pain relief. The SAS provides a list of approved drugs for use within the ambulance service, but this does not include more powerful and more specific drugs that are sometimes used in the EMRS and other emergency services. In 57% of cases, non SAS drugs were used.

5.34 In total, 76% of all patients retrieved over the pilot period required some form of advanced medical intervention during the retrieval, including those who required RSI immediately before the flight.

5.35 Table 5.4 provides a guide as to the level of expertise required for various procedures carried out by the EMRS. Nearly all of these interventions are life saving and can be carried out by the EMRS Team, but not by paramedics. A number of other locally based health professionals will have some of these skills, but are unlikely to have all of them and may only use them on an occasional basis.
Table 5.4 Level of Interventions carried out by different staff

<table>
<thead>
<tr>
<th>Intervention</th>
<th>SAS Paramedic skill</th>
<th>Community hospital staff skill</th>
<th>Rural general hospital staff skill</th>
<th>EMRS Team Skill</th>
<th>Potentially life saving intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>RSI (emergency anaesthesia)</td>
<td>No</td>
<td>Occasional</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Non invasive ventilation</td>
<td>No</td>
<td>No</td>
<td>Sometimes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Chest drain</td>
<td>No</td>
<td>Sometimes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Administration of blood products</td>
<td>No</td>
<td>Sometimes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Pelvic splint</td>
<td>No</td>
<td>Sometimes</td>
<td>Sometimes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>External cardiac pacing</td>
<td>No</td>
<td>Sometimes</td>
<td>Sometimes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Therapeutic hypothermia</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Mini laboratory</td>
<td>No</td>
<td>Sometimes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Invasive blood pressure monitoring</td>
<td>No</td>
<td>Occasional</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Vasopressor or inotrope infusion</td>
<td>No</td>
<td>Occasional</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Source: EMRS Team

Quantitative evidence of clinical outcomes

Scoring systems

5.36 Information on the clinical outcome and severity of illness is recorded by the EMRS Team using a number of clinical illness severity scores. Scoring systems for use in intensive care unit patients have been introduced and developed over the last 30 years. These allow an assessment of severity and, also, an estimate of in-hospital mortality. However, as no single scoring system is thought to be superior or more accurate, the EMRS Team records a variety of scores. These are summarised below.

- **APACHE II score** - The Acute Physiology and Chronic Health Evaluation II (APACHE II) scoring system uses 12 individual variables including heart rate, respiratory rate, white cell count and Glasgow Coma Score. Each variable is weighted from 0 to 4, with higher scores denoting an increasing deviation from normal. The APACHE II is measured during the first 24 hours of ICU admission and has a maximum score of 71. A score of 25 represents a predicted mortality of 50% and a score of over 35 represents a predicted mortality of 80%. The APACHE II severity score has shown a good calibration and discriminatory value across a range of disease processes, and remains the most commonly used international severity scoring system worldwide.

- **SAPS II score** - The Simplified Acute Physiology Score (SAPS) is similar to APACHE II in that it measures severity according to a range of 12 physiological variables. Scores range between 0 and 163 and a predicted mortality between 0% and 100%.
• **ISS score** - The Injury Severity Score (ISS) is an anatomical scoring system that provides an overall score for patients with multiple injuries. Each injury is assigned an Abbreviated Injury Scale (AIS) score and is allocated to one of six body regions (Head, Face, Chest, Abdomen, Extremities (including Pelvis), External). Only the highest AIS score in each body region is used. The three most severely injured body regions have their score squared and added together to produce the ISS score. Scores are from 0 to 75, but scores can only be derived for trauma patients.

• **TISS** - The Therapeutic Intervention Scoring System (TISS) is another medical severity scoring system based on the assumption that very ill patients require a greater number of interventions and procedures that are more complex than patients who are less ill.

5.37 It should be noted that these severity of illness scoring systems have a number of flaws that are important to consider in any analysis. In particular, there is scoring system bias and error associated with:

- the selection of included variables;
- the collection of data;
- the lead time before the onset of the acute disease;
- the admission of the patient to ICU;
- imprecision in choosing a principle admission diagnosis; and
- inaccuracy associated with specific disease categories.

5.38 Despite these problems, scoring systems are nonetheless useful for research and service comparisons.

**Predicted mortality**

5.39 Each EMRS patient in the first year of the Service was given an APACHE II score. In addition, trauma patients were given an ISS score and SAPS II scores were provided for all non card iac patients. These scores were calculated at regular intervals during treatment. For APACHE II and SAPS II scores, calculations were made according to physiological variables recorded over the first 24 hours after admission to a critical care area. For ISS scores, because the three most severe injuries are recorded, scores are normally calculated some time after the injury. ISS predicted mortality rates are combined with physiological parameters using the TRISS methodology\(^{18}\) to give the predicted survival rate. The physiological parameters used are the initial value when the patients are first assessed, either pre-hospital or on arrival.

\(^{18}\) TRISS methodology is the Trauma and Injury Severity Score (TRISS) standard methodological tool for evaluating the performance of trauma centres.
5.40 APACHE II and SAPS II have been validated in the Scottish population of critically ill and injured patients within intensive care facilities. SAPS II and a modified TISS have also been specifically validated in intermediate care facilities such as high dependency units (HDUs) where some EMRS patients were admitted.

5.41 Summary scores for patients retrieved by the EMRS are given in Table 5.5, together with the standard ranges for each scoring system.

Table 5.5 Apache II, SAPS II, ISS and TISS scores for EMRS patients

<table>
<thead>
<tr>
<th>Scoring system</th>
<th>No. of Patients Scored</th>
<th>Median Value for EMRS patients</th>
<th>Range for EMRS patients</th>
<th>Inter-Quartile Range</th>
<th>Range for scoring system (highest = most severe)</th>
</tr>
</thead>
<tbody>
<tr>
<td>APACHE II</td>
<td>202</td>
<td>14</td>
<td>0 to 42</td>
<td>7-24</td>
<td>0 to 71 &gt;25 = 50% predicted mortality</td>
</tr>
<tr>
<td>SAPS II</td>
<td>156</td>
<td>30</td>
<td>0 to 102</td>
<td>18-49</td>
<td>0 to 163</td>
</tr>
<tr>
<td>ISS</td>
<td>52</td>
<td>9</td>
<td>1 to 34</td>
<td>4-9</td>
<td>0 to 75</td>
</tr>
<tr>
<td>TISS</td>
<td>222</td>
<td>17</td>
<td>0 to 43</td>
<td>11-28</td>
<td>&gt;10 requires critical care</td>
</tr>
</tbody>
</table>

Source: EMRS database

5.42 Converting these scores into correspondingly probability of mortality gives the following distribution of EMRS patients by severity.

Table 5.6 Predicted mortality rates for EMRS retrievals

<table>
<thead>
<tr>
<th>Predicted mortality</th>
<th>Number of patients in predicted mortality category</th>
<th>APACHE II</th>
<th>SAPS II</th>
<th>ISS (trauma only)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-25%</td>
<td>128</td>
<td>104</td>
<td>48</td>
<td></td>
</tr>
<tr>
<td>25-50%</td>
<td>36</td>
<td>22</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>50-75%</td>
<td>20</td>
<td>19</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>75%+</td>
<td>18</td>
<td>11</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Not scored</td>
<td>0</td>
<td>46</td>
<td>143</td>
<td></td>
</tr>
<tr>
<td>Average predicted mortality</td>
<td>25%</td>
<td>22%</td>
<td>6%</td>
<td></td>
</tr>
</tbody>
</table>

Source: EMRS database

5.43 The following trends are apparent by scoring system.

- **APACHE II** - Just over 200 patients were given an APACHE II score. Scores ranged from a low of zero (3% of patients) to a high of 42. The median score was 14. In 6% of patients, the APACHE II score was 35 or higher, which corresponds to a predicted mortality rate of 80% while 24% of patients had a score of over 25, corresponding to a predicted mortality rate of at least 50%. The median predicted mortality rate according to the APACHE II scoring system over the pilot period is 11%. This means that, on average, EMRS patients had an 11% probability of death. This figure varied from those patients with low predicted mortality rates of under 1% to more severe cases where rates were as high as 94%.
• **SAPS II** - 156 patients were given a SAPs II score, a number that excludes all cardiac patients as the SAPs II data is not valid for these patients. The median SAPs II score was 30. Similar to the APACHE II predicted mortality rate, the median SAPS II predicted mortality score was 9%. Again, this ranged from low scores of under 1 to highs of 95%.

• **ISS** - As already stated, ISS scores are only available for trauma patients, hence the total number of ISS scored patients is only 52. Conditions varied from face and head trauma to chest and multiple trauma. On average, the ISS median score was 9, with 8/50 (16%) patients having an ISS greater than 15, generally accepted as being the definition of major trauma. Six patients scored a low of 1 and two patients scored a high of 34. For the trauma patients, an average probability of death score of 6% was recorded, although, again, this score varied with one patient having an ISS probability of death score of 97%.

5.44 Of the patients transported by the Service, nine patients died within 24 hours of arrival at the destination hospital and a further three patients died at the scene.

**The need for critical care**

5.45 Mortality is not the only indicator of clinical outcomes: the severity of injury, even when not life threatening, is also an indicator of the need for advanced medical support and procedures undertaken by the EMRS Team.

5.46 TISS scores were calculated for all patients who were transported by the Service. Here, the mean score was 17, while 83% of patients had a TISS of 10 or more, which is taken to indicate a level of care requiring a critical care environment. This is supported by the data presented on number of advanced procedures undertaken by the EMRS Team, which would not have been possible on a paramedic-led transfer.

5.47 Overall, the data shows that there is a high acuity among the patients transported by the EMRS Team. The median APACHE II score was 14 (range 7-24). The median TISS score was 17 (range 11-28) and 83% were 10 or above. Taken together, these scores indicate a level of critical care is required by the majority of EMRS patients.

**Case studies**

5.48 The following case studies, produced by the EMRS Team, provide a flavour of the types of service that EMRS provides. They are based on real EMRS retrieval missions.
### Box 5.1 Case study of a secondary retrieval – medical

**Background**

EMRS received notification from an island GP about a 54 year-old man who had suffered a heart attack and, subsequently, a cardiac arrest. He had been successfully defibrillated but remained critically unwell. The team were airborne eight minutes later and on the island with the patient within 40 minutes.

**Action taken**

The EMRS consultant and registrar found the patient to be semiconscious with a low blood pressure and low breathing rate. His heart rhythm was intermittently a ventricular tachycardia rhythm. The Team administered a drug to immediately control his heart rhythm and performed an emergency anaesthetic in the back of the ambulance at the helicopter landing site in order to control the patient’s physiology. Following these interventions, the patient’s condition stabilised. The EMRS consultant spoke to the receiving cardiologist at the cardiac centre in Clydebank and the helicopter transferred the patient to the hospital’s landing site. The patient was handed over to the waiting cardiology team in the catheter lab for immediate percutaneous coronary intervention. This was all undertaken within a two-hour period from the initial call.

**Outcome**

The patient made an excellent recovery and returned to his family and his work.

Source: EMRS Team

### Box 5.2 Case study of a secondary retrieval – medical

**Background**

EMRS were activated by an island GP for a 40 year-old man. He had presented to his local community hospital having been unwell for two days. The GP had found the patient to be critically unwell with a high fever, semi conscious and a very low blood pressure. The EMRS consultant was able to give advice about initial management prior to the Team's arrival.

**Action taken**

On arrival on the island, the EMRS team diagnosed septic shock secondary to severe pneumonia. A full critical care package was delivered to the patient including emergency anaesthesia and ventilation along with invasive monitoring and inotropes to support his blood pressure. The patient remained critically unwell and the team spent two hours on-scene with the patient in order to ensure he was stable enough to transfer. The normal destination hospital for transfer patients from the island had no ICU beds so an ICU bed in another hospital was located. The patient remained very unwell during transfer, requiring continuous intervention from the EMRS team.

**Outcome**

After a stormy course in ICU, the patient survived following a lengthy hospital admission, and was able to be discharged back home.

Source: EMRS Team
Qualitative assessment

5.49 This section of the report provides a qualitative assessment of the value of EMRS based on consultations with health professionals, health board representatives and patient representatives in a number of locations in the pilot area and in areas that may later be included in the pilot.

Visit programme

5.50 Our visit programme is provided in Table 5.7. The purpose of the programme was to try to capture as wide a range of views as possible of EMRS. Table 5.7 identifies the work undertaken on each visit. The numbers in brackets refer to the number of people consulted in each category.

5.51 It was agreed, following discussions with the EMRS Project Board, that five site visits would be undertaken to areas within the pilot. Arran, Fort William, Lochgilphead and Stranraer were all consulted with as referral areas. In each of these areas, a mixture of health professionals and health board staff were consulted through focus groups and one-to-one interviews. In addition, focus groups were held with patient representatives in all areas apart from Stranraer, where it was not possible to set-up such a group.

5.52 We also spoke to a group of health professionals and health board staff in Glasgow, as the main receiving centre in the pilot.

5.53 Furthermore, we consulted with health professionals and/or health board staff in a number of other areas.

- Western Isles – as one of the main referral areas. This was largely completed through telephone interviews.

- Tayside – a part (Kinloch Rannoch) of which was included in the pilot area, although there were no retrievals from this area in the pilot period.

- Orkney and Shetland – areas that would likely be included in a national EMRS and, as remote island health boards, may have particular issues with implementation of a national EMRS.
Table 5.7 Summary of the consultation programme

<table>
<thead>
<tr>
<th>Area</th>
<th>Type of consultation</th>
<th>Health professionals</th>
<th>Health Board representatives</th>
<th>Patient representatives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arran</td>
<td>Visit</td>
<td>X (4)</td>
<td></td>
<td>X (5)</td>
</tr>
<tr>
<td>Fort William</td>
<td>Visit and telephone interview</td>
<td>X (3)</td>
<td></td>
<td>X (8)</td>
</tr>
<tr>
<td>Glasgow</td>
<td>Visit</td>
<td>X (3)</td>
<td>X (1)</td>
<td></td>
</tr>
<tr>
<td>Lochgilphead</td>
<td>Visit</td>
<td>X (8)</td>
<td></td>
<td>X (3)</td>
</tr>
<tr>
<td>Orkney</td>
<td>Video conference and telephone interview</td>
<td>X (3)</td>
<td>X (3)</td>
<td></td>
</tr>
<tr>
<td>Shetland</td>
<td>Video conference</td>
<td>X (3)</td>
<td>X (2)</td>
<td></td>
</tr>
<tr>
<td>Stranraer</td>
<td>Visit</td>
<td>X (7)</td>
<td>X (1)</td>
<td></td>
</tr>
<tr>
<td>Tayside</td>
<td>Telephone interview and email exchange</td>
<td>X (2)</td>
<td>X (1)</td>
<td></td>
</tr>
<tr>
<td>Western Isles</td>
<td>Telephone interviews</td>
<td>X (3)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5.54 The main themes from the consultation programme are highlighted below, with supporting quotes.

**Rationale for EMRS**

5.55 Most consultees believed that there was a clear rationale for EMRS. The reasons given can be broken down into a number of categories.

1. Equity – allowing all people in Scotland access to emergency treatment.
   
   “All people should get access to key treatments and not be disadvantaged because they live far from a main hospital.”
   
   Hospital consultant

2. Reducing time to consultant assessment.
   
   “Anything that reduces time to consultant assessment is to the patient’s advantage.”
   
   Hospital consultant

3. Lack of suitably skilled staff in certain areas to undertake emergency medical procedures or transfers.
   
   “There are too few emergency cases here to make a consultant’s position sustainable and to maintain their skills. This makes EMRS necessary.”
   
   GP

4. Providing expertise and access to the best facilities.
   
   “Our consultants are generalists and may not be replaced....We could not support an ICU.”
   
   Patient representative

5. Providing a single point of contact for organising emergency medical retrievals.
   
   “Emergency care is made much easier because there is a single point of contact.”
   
   GP
5.56 However, a number of patient representatives seemed unsure as to what EMRS was and why it was needed.

“I am not sure why we need this service. Our GPs are skilled and can stabilise patients...A helicopter may be delayed in getting here and then getting the patient to definitive care, so how can EMRS be additional?”

Patient representative

5.57 Nevertheless, in the same consultation, the patient representatives indicated that they were content for their GPs to make the decision on whether the Service was needed.

“We are happy to be guided by our GPs on whether they need this.”

Patient representative

5.58 There were some isolated comments that questioned the need for EMRS in certain parts of Scotland, e.g. places where the journey to a major hospital is under two hours.

“EMRS is valid for more remote places, but questionable for places where road journeys are under two hours....It is better to have people travelling sooner.”

GP

5.59 Part of this seemed to be based on a fear that EMRS may lead to cut-backs in the provision of land ambulances. The same GP told us:

“EMRS should not be seen as a solution for everything. It should not be an excuse to avoid resourcing land ambulances.”

GP

Use of the Service

5.60 A group of patient representatives believed the use of EMRS would be driven by the following factors (in no particular order).

- Ageing population
- Increase in population during the tourist season
- Risky and extreme sports
- Dangerous roads
- Poor weather and road conditions
- Reliance on ferry services to transport patients.
5.61 Due to the Service only handling around 200 cases per annum, actual contact with the Service among local health professionals was rare.

“Two of us have used it directly, but only on the odd occasion and only a handful of times over the year.”

Group of GPs

5.62 There were also some health professionals who had never used the Service. However, these staff did all seem aware of the Service and valued it.

“I have not used the Service, but like the security of knowing that the back-up is there.”

GP

5.63 The use of the Service was thought, in some areas, likely to increase over the next few years, especially if consultants retire.

“Some hospitals are dependent on EMRS because they lack consultants. [This area] will become dependent if the hospital does not replace its consultant anaesthetists. The threshold for transfers will fall and the number of cases will increase.”

GP

Overall impression of Service

5.64 The Service was, generally, very well received by health professionals and patient representatives. Quotes such as those below were quite typical.

“The Service is exceptionally good and I would hate to see it go.”

GP

“They operation is slick and they know what is here ready and waiting and what they have to bring.”

GP

“It’s the difference between best care and other care.”

Hospital consultant

Benefits of the Service

5.65 The Service was seen as having a number of key benefits. In some of the areas, emergency medical treatment could not be provided because of a lack of key staff and facilities. It was also thought that, because of this, EMRS helped them to retain their health staff. Furthermore, it was thought that EMRS provided a joined-up approach to emergency medical cases, improving the times of getting a patient to consultant assessment and their overall care. All of these benefits were succinctly stated by one GP.
“Without EMRS, we would struggle to provide emergency care here and it would be difficult to retain our GPs. Before EMRS, emergency care provision for severe cases was hit-and-miss and dangerous. There were delays and the consultants did not know the skills of the local GPs or the facilities in the hospital, which often led to GPs being asked to do inappropriate procedures. Much time was wasted organising a retrieval and GPs could not concentrate on the care of the patient.”

GP

5.66 The advice line was also seen as being of significant benefit to health professionals.

“The advisory service is very useful medically, especially in giving advice to consultants who have not performed a procedure in a while….It is an additional resource.”

GP

5.67 The advice line and the support provided by the EMRS Team were also seen as valuable in creating a support network for health professionals in remote and rural areas.

“EMRS creates a support network through its advice line and presentations and training [to GPs].”

GP

5.68 Another benefit of the Service was in helping hospitals and local practices by avoiding the need for key staff to accompany patients on transfer.

“[EMRS] helps the department with staff not having to leave the hospital to accompany patients….This helps to put nursing time back into patients.”

Nurse

5.69 This seems to be a particular issue on islands, where a patient may have to be transferred twice by staff who do not routinely undertake such work.

“The process of transferring a patient [without EMRS] can be difficult and an anaesthetist will need to go with the patient. It can be something of a relay race and the transfers are not safe, sometimes leading to bad choices and sub-standard care. Military patients in Afghanistan have better treatment than this….A retrieval team, like EMRS, will put a patient on a trolley and the patient will not then have to leave the trolley until they get to the place of definitive care.”

Hospital consultant
5.70 It was also generally thought that the EMRS Team were better able to organise such transfers.

“The EMRS Team have more clout in organising a transfer.”

GP

5.71 In terms of patient outcomes, health professionals generally thought that they were much improved with EMRS and a number of examples were given of patients’ lives being saved. Two quotes, below, help to illustrate this.

“All of our EMRS cases were appropriate.....All patients improved and would have died otherwise. We would not seek transfer unless the cases were very severe.”

GP

“[There was] a patient who suffered a cardiac arrest but was revived. This would have been unlikely if only paramedics attended.”

Nurse

Issues

5.72 A number of issues did emerge in our consultations. In two areas, there were complaints about retrieval times.

“I am not trying to trip the Service up, but the time taken to get a consultant ready to travel is too long and the Service is too vulnerable to bad weather....At the moment, EMRS is unfairly getting a bad reputation because of these factors.”

Patient representative

5.73 There was also some debate about the need for tasking criteria for using the Service. Some health professionals dismissed the need for this as not being practically possible.

“Tasking criteria is not possible because it is too complex. There are many variables and the final decision needs to come down to the consultant’s judgement....Different areas of Scotland will have different needs given the skills and facilities present, so you cannot have a one size fits all criteria.”

GP

5.74 However, there were other health professionals who believed that there had been cases where EMRS had not been used appropriately and tasking criteria would help to deal with this.

“I do have concerns about EMRS being used for cases that are not severe when there is no available land ambulance....This is a waste of resources and may lead to patients getting unnecessary procedures....EMRS needs to have a tasking criteria and guidelines for usage that should be shared with the hospitals. This should include for contingencies for things like bad weather.”

GP
5.75 This view was supported by one patient representative who also claimed that there had been inappropriate call-outs.

“In some circumstances, a GP will not actually have visited or seen a patient prior to calling out EMRS. This could cause inappropriate call-outs....It could also result in the Service not being available for a genuine emergency elsewhere.”

Patient representative

5.76 The occurrence of this incident was disputed by the EMRS Team. However, perceptions of such cases are still important and some form of tasking criteria may help to assuage such concerns. At the moment, there is a clinician based judgement sieve after an initial filter, with a broad based inclusion criteria – “any adult with life threatening illness who would benefit from advanced medical intervention to facilitate safe transfer.” This is followed by a one-to-one senior clinician discussion to further discriminate. The key element of this is to ‘err on the side of caution’ and not miss cases if there appear to be doubts. From discussions had with local health professionals, not all of them may be aware of this and a number seem to favour more prescriptive arrangements.

5.77 In a number of areas, it was also thought that demand for the Service was likely to grow.

“In the future, we may need [to use] EMRS more frequently. Certainly, demand will grow over the next five to eight years, but after ten years the Service will be absolutely relied upon due to the personnel changes that are likely.”

Patient representative

5.78 This caused some concern as it was thought that as EMRS expanded, there would be pressure on local areas to use EMRS to cut costs and the areas would lose key skilled staff as a result.

“Health boards could be encouraged to de-skill and a pressure to leave everything to EMRS. Highly trained GPs could be dispensed with and new staff would not be trained to the same level.”

Patient representative

5.79 With expanding demand, it was also thought by one GP that EMRS may struggle to resource all retrievals with its existing pool of consultants.

“There is a danger of junior staff being sent if demand is too high. What safeguards are there to prevent this?”

GP

Options for delivery

5.80 No consultee wanted the Service to be disbanded. One GP thought this was not possible after the pilot.
“The Service cannot be un-invented or removed. You cannot take essential care away from people once you have given them it.”

GP

5.81 However, there were isolated comments from those who thought the Service to be useful, but thought that there were higher priorities.

“I would prefer us to have another consultant rather than EMRS.”

GP

5.82 It was also commonly thought that the Service should be extended to cover all of remote and rural Scotland and, for this to occur, another centre in the North of Scotland would be required.

“The Service should be available across all of remote and rural Scotland. More centres would be needed to do this as helicopters do not have the range to cover all of Scotland from one base.....Another centre would be required in Aberdeen or Inverness. To work, the team would need to know the North as well as the EMRS Team knows the West.”

GP

5.83 However, there were areas in the West of Scotland that were worried about the consequences of an extended Service.

“There is concern that if the scope of EMRS is extended to cover all of remote and rural Scotland that it might not be available here all of the time that it is needed.”

GP

5.84 Some consultees even thought there was a need for more than two centres in order to minimise journey times.

“You would need three centres across Scotland so that patients could get to a hospital quickly.”

Patient representative

5.85 But there was an awareness of the additional costs of expanding the number of centres and that this may mean that such an expansion was not possible.

“Ideally, you would like two centres, but this is likely to have serious cost implications.”

Nurse

5.86 There was also support for the Service to operate from a single centre as being the most practical option.

“An advantage of a single centre is that the staff know what is available locally and centrally....But there would be a need to acquire more intelligence on facilities and personnel in other areas.”

Hospital consultant
5.87 Generally, there was support for air emergency services to be better joined-up and some form of hybrid model for future delivery of HEMS services.

“Air emergency services need more co-ordination. There are too many services just now. In Australia, an experienced clinician decides on retrievals. Scotland should be small enough to do this.”

Hospital consultant

“I would view a hybrid service favourably, particularly for paediatrics as we lack experience in dealing with such cases.”

GP

“Integration with other air services should be considered....a bigger team would be better resourced and it would be less likely to have breaks in the service.”

Patient representative

5.88 However, there were also concerns raised about a hybrid model, especially if it involved a larger EMDC.

“A hybrid model might introduce another bureaucratic layer into decision-making and might interfere with local knowledge...Transfers should be left to GPs and consultants to make the decisions.”

Patient representative

5.89 Consultees were split on whether the Service should deal with primary (as well as secondary) retrievals. Some were supportive, although they thought that this part of the Service needs proper tasking criteria to avoid resources being wasted.

“The rationale for extending the Service to cover primary retrievals is clear: patients will do a lot better if they are seen quicker by an expert consultant. However, the patient needs to be saveable....The tasking criteria will make or break this part of the Service. Often, poor information can be given or the caller is not as interrogated as well as they could be, leading to false positives”

Hospital consultant

5.90 However, there were also concerns, especially on decision-making.

“I would be suspicious of such [primary] retrievals. It is not clear who makes the call to EMRS. Paramedics will not always be with the ambulance, so how is a decision fed through to EMRS?”

Patient representative

“[Primary retrieval] is chasing the exciting stuff. [EMRS] needs to stick to what it was created for.”

GP

5.91 It was also felt that, in very remote places, primary retrievals may simply take too long to arrive when the patient needs some immediate help.
“Where I am based, because of journey times, it may be better to get a patient to a nearby hospital rather than organise a primary retrieval, even if they are seriously injured.”

5.92 There were also comments on the need for greater investment in aircraft if the Service was to be expanded.

“[We need] more access to aircraft and more appropriate aircraft....Expanding EMRS but not the aircraft capacity would have serious consequences in terms of response and retrieval times.”

Quality Adjusted Life Years (QALY)

5.93 Based on the literature review and consultation feedback, it is clear that there are clinical benefits from the EMRS. This section aims to quantify the scale of these clinical benefits in order to inform the later value for money calculations.

5.94 Quality Adjusted Life Years (QALY) is a commonly used outcomes measure for health services and interventions, recommended by NICE (National Institute for Health & Clinical Excellence). QALY estimation takes into account differences between treatment methods in terms of the number of years that a patient may live and the quality of these years, from best to worst possible health.

5.95 Estimates of difference in the quality of life years are measured using a weighting between 0 (death) to 1 (perfect health), typically judged by the patients themselves following treatment, or based on their identified preference over a potential range of outcomes. For example, a procedure could be judged to extend a patient's life by four years, however, they may not be in perfect health during these years, judging the quality of life with a 0.5 weight. This is equal to 2 QALYs (4 years * 0.5 weighting).

5.96 Application of this approach requires detailed information about both the survival rates under different treatments (in this case, EMRS support, local treatment or SAS paramedic transfer) and the quality of life, taking into account factors such as pain and disability. The information on the quality of life needs to be converted into an overall estimate of health status and there are various techniques for doing this.

5.97 With this in mind, there are a number of issues in relation to QALY estimation for the EMRS.

- Information about survival rates and quality of life is often obtained from randomised clinical trials in which patients have been randomly assigned to different treatment methods and the outcomes measured in detail over a period of time. In the case of EMRS, we are not looking at a randomised trial and cannot therefore obtain the detailed estimates that are provided by such trials.

- There is not an immediately suitable comparator benchmark group.
• The literature review highlighted that the EMRS is relatively unique, offering few like-for-like comparators in other countries and none with quantified clinical outcomes to benchmark.

• An immediately suitable comparator group cannot be identified within Scotland because of the number of other influences on outcomes in health board areas that are not participating in the EMRS pilot, or because of other developments in the pilot health boards over the same time period.

• The pilot data assessed includes recent patients (as at July 2009) for whom final outcomes are not yet known and recorded centrally.

• The total number of patients retrieved by the EMRS is relatively low (with 203 secondary and 19 primary retrievals), so any results based on percentage trends may not be statistically reliable and subject to a significant margin for error.

5.98 Despite these limitations, we have used the available evidence to make some estimates of quality adjusted life years using the available severity scores and observed mortality rate of EMRS patients. While these QALY estimates are a far from perfect measure, when taken in the context of the other clinical and qualitative evidence gathered on the service, they are still a useful addition to the evaluation.

5.99 A number of scenarios have been developed to offer a range of QALY estimates. While each may be flawed on its own, triangulating the results across the different calculation methods gives a likely order of magnitude for EMRS.

**QALY context**

5.100 As a benchmark, NICE suggest that a cost of £20-30,000 per quality-adjusted life year gained from treatment represents good value. Based on the cost of the pilot of £1.12 million, this suggests a minimum threshold of 56 QALYs for the EMRS to achieve to represent good value (£1.12 million / £20,000) by this measure.

5.101 The average age of retrieved EMRS patients was 56. Average healthy life expectancy in Scotland is 67.9 for males (source: GRO-Scotland). This is lower than the female rate and therefore used as a prudent estimate in the calculations. This implies an average of 12 additional years of healthy life for those patients who survive following EMRS retrieval who would otherwise have died.

5.102 Assuming each life saved by the EMRS yields 6 QALYs (i.e. 12 healthy life years with a quality weighting of 0.5), then the minimum saving in lives required is around 10 (=56/6). This is equivalent to 5% of the number of patients treated in the pilot.

---

While this seems a low number, this is typical for emergency services. A life saved can generate many QALYs. This is compared to other non life saving treatments where each patient may only contribute a fraction of a QALY (e.g. faster recovery might generate a marginal quality improvement from 0.9 to 1 over a single year). Thus, many patients are required to generate the same QALY total.

The methods applied for calculating QALYs for the EMRS service are as follows.

**EMRS Estimate 1 – case-by-case assessment**

In the absence of a suitable control group, expert medical judgement can be used to estimate the difference in outcomes achieved through EMRS involvement on a case-by-case basis.

Proving a causal link between a particular intervention and patient outcome is highly complicated: a subjective judgement as to whether a patient would have died or not is even more difficult. It is essentially personal opinion and very variable. External judgement by the Centre for Rural Health was therefore tentative, given the level of detail available for each individual case.

The EMRS Team was therefore asked to make a direct expert judgement of the cases and level of life-saving intervention. The Team felt that this was inappropriate, given their direct involvement, referring to estimate 2 (below) as a most robust alternative. The Team, however, suggested that the TISS score demonstrates that 83% of EMRS patients (184 patients) received an intervention beyond the level available from a paramedic transfer. These were additional interventions based on their clinical judgement of need and, therefore, could all have been potentially life-saving.

In order to make a prudent estimate we:

- included those patients with an advanced intervention who were intubated for retrieval because of a compromised airway, impaired GCS, respiratory failure, or because it was judged to have been necessary for transfer safety; and

- excluded those patients with advanced interventions who were not intubated, or intubated because this was the anticipated clinical course on arrival at definitive care.

This gives a total of 55 patients. Taking the average healthy life expectancy for males in Scotland (67.9) and comparing this with the age of each individual patient at the time of retrieval gives a total of 687 additional life years. Adjusting for the quality weighting gives a range of possible scenarios, as shown in Table 5.8.
Table 5.8 QALYs under Estimate 1

<table>
<thead>
<tr>
<th>Assumed weighting</th>
<th>Definition</th>
<th>QALY total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Assumes all are returned to good health (up to point of healthy life expectancy).</td>
<td>687</td>
</tr>
<tr>
<td>0.5</td>
<td>Assumes a combination with some returned to full health and others with varying degrees of impairment.</td>
<td>343</td>
</tr>
<tr>
<td>0.3</td>
<td>Assumes the majority are significantly impaired following retrieval.</td>
<td>229</td>
</tr>
</tbody>
</table>

Source: DTZ

5.110 Spread across the 203 secondary retrievals, this gives a range of between 1.1 to 3.4 QALYs of additional clinical benefit on average per patient retrieved by the EMRS. In the conclusions of this section, these rates are used to assess the associated cost per QALY achieved by the service in comparison with standard acceptable limits recommended by NICE.

**EMRS Estimate 2 – predicted versus observed mortality**

5.111 This method of calculation was adopted for the EMRS evaluation of the initial Argyll & Bute pre-pilot. It relies on assessing the difference between anticipated mortality for patients (based on a number of physical and clinical factors), and actual observed mortality following EMRS intervention. The key steps for calculating QALYs are as follows.

1. All EMRS patients were assigned APACHE II scores. These have been converted into a perceived probability of mortality following standard APACHE II conventions by the EMRS Team (based on a range of individual, diagnostic, physiological and chronic health variables).

2. This gives an average probability of mortality for EMRS retrievals of 25%, assuming no EMRS intervention.

3. Observed actual mortality rates data are available on the patient’s arrival at definitive care and at 30 days. Observed mortality was 17% of EMRS retrievals at 30 days.

4. The difference between the observed (17%) and perceived mortality rates (25%) is about 8% of total EMRS cases. This represents the change in outcomes compared with the anticipated rate for patients with like-for-like conditions.

5. This gives an estimate of 16 lives saves that would have been lost without EMRS support (8% * 203 secondary retrievals).

6. The average age of retrieved EMRS patients was 56. Average healthy life expectancy in Scotland is 67.9 for males. This implies an average of 12 additional years of health life for those additional patients who survived following EMRS retrieval.

7. This gives a total of 192 additional life years (16 * 12).
8. A qualitative adjustment is typically made to reflect the level of health of patients following intervention. This ranges from 1 (perfect health) to 0 (death). Based on the severity scores for medical patients, an average of 0.5 has been assumed across EMRS patients. This is consistent with the clinical judgement applied during the initial EMRS pilot in Argyll & Bute.

9. This gives a total of 96 QALYs (192 * 0.5), equal to an average of 0.47 per secondary patient retrieved (96 / 203).

5.112 It should be noted that this calculation only includes avoided deaths. Total QALYs will also comprise a number of marginally improved outcomes across those patients without life-threatening conditions. For example, these patients may move 0.1 point on the weighting scale for one year, recovering quicker due to EMRS support. Across all 203 secondary retrieval patients, this would equate to an additional 20 QALYs. This is an assumed minimum, given the qualitative feedback received from referring medical professionals about the value of the service.

5.113 One issue with this method is that APACHE scores are allocated once a patient is at the point of definitive care. Therefore, the observation is after the EMRS Team has intervened so may differ in terms of implied severity at the point of initial retrieval.

**EMRS Estimate 3 – benchmarking outcomes from the pre-pilot in Argyll & Bute**

5.114 This estimate uses the Argyll & Bute EMRS pre-pilot as a baseline, adjusting for the number of cases and observed survival during the West of Scotland pilot. The following assumptions were made.

- Based on the standardised mortality ratio (SMR) for the Service, it was calculated that the Argyll & Bute pre-pilot added an average of 3 to 7 years of life per patient retrieved. The study also assumes a quality of life to survivors of 0.5 of that prior to his or her critical illness.

- Two QALY scenarios were therefore developed:
  - low scenario of 1.5 QALYs per patient retrieved (3 years * 0.5 quality weight); and
  - high scenario of 3.5 QALYs per patient retrieved (7 years * 0.5 quality weight).

- These benchmark rates per patient have been applied to the 203 secondary EMRS pilot cases.

- This yields a score of 304 to 710 QALYs for this scenario.

5.115 It should be noted that the SMR for the 12-month West of Scotland pilot (0.69) was lower than that for the Argyll & Bute pre-pilot (0.83). This gives the ratio of observed to probable mortality, therefore, the lower ratio implies a higher number of additional survivals under the West of Scotland pilot,
representing an improvement in EMRS outcomes. The original SMR assumptions have been used for consistency and prudence.

5.116 Across all three estimates, gives a range of 96 to 710 QALYs, or an average of 0.47 to 3.5 per patient retrieved. This yields an estimated cost per QALY of £1,500 to £11,600. Although this is a very broad range, even under the most prudent scenario the cost per QALY is still well within NICE guidance that a cost of £20-30,000 per quality-adjusted life year gained from treatment represents good value.

5.117 It should also be noted that these scenarios were debated by the project board and a number alternative amendments suggested. In each case, the revisions were not unanimously agreed, and when tested did not change the current maximum and minimum QALY estimates, simply the findings of individual estimates. The assumptions we have presented are the most prudent available, and the proposed amendments looked to be more liberal. Thus, the conclusion of strong value for money is retained, as demonstrated even under the strictest interpretation of outcomes.

Conclusions

5.118 Detailed monitoring of EMRS has been undertaken over the period of the West of Scotland pilot. Some of the main findings are listed below.

**Activity**

- Activity over the pilot period has been slightly higher than expected, with 222 retrievals (203 secondary) compared with initial estimates of 192 cases.

- Patients are referred from across the West of Scotland, with Stornoway and Stranraer referring the highest numbers of patients to the EMRS, but areas such as Tiree and Islay have proportionally higher numbers in terms of relative population.

- Patients are transferred to final delivery centres across Scotland although the Glasgow Southern General Hospital has the largest intake.

- Medical acuity remains high among patients. Medical conditions are varied and range from trauma to cardiovascular conditions and sepsis.

- As a result of high levels of acuity, many advanced medical interventions are used during transfer.

- EMRS response times are relatively good and improvements have been made since original Argyll & Bute service began.

**Outcomes**

- There is strong evidence to justify the need for EMRS involvement in attended cases. This is based on:
o the number of retrievals with a high probability of mortality;
o the vast majority with an assessed need for critical care intervention at that time (83%); and
o the number of complicated procedures carried out on-board that required consultant led intervention.

- One issue identified is that 17% of retrievals attended were assessed as not requiring critical care. There are several explanations for this.

o **Difficulties judging the need for dispatch in marginal cases.** The EMRS Team has acknowledged that there were a small number of cases where effective clinical judgement is difficult by phone/video and, on arrival, severity was judged to have reduced, or not to have required EMRS support. This is infrequent and judged a low risk to the Service. Possible mitigating actions could include development of stronger tasking criteria, or greater familiarity with the Service among local medical professionals.

o **Inappropriate dispatch.** There is some anecdotal evidence from the consultations to suggest inappropriate use of EMRS on infrequent occasions. This includes requests from local medical facilities that did not originate from an EMRS trained medical professional, or where severity was suspected to be low. This is infrequent and not systematic and it may be inevitable for emergency services of this kind to have such cases. However, it is a potential risk to effective service delivery, especially where local health professionals have a perception that the Service is being used for these types of cases, and such cases should be minimised. Possible mitigating actions include stronger tasking criteria, increased training for local medical professionals, or, potentially, second consultant opinions before dispatch in suspected marginal cases.

o **Natural patient course.** EMRS deals with a heterogeneous group of patients and it is inevitable that some will improve while the EMRS team is en-route.

o **Improved patient treatment.** Following treatment advice by the EMRS Team prior to dispatch, there will be patients whose conditions will improve while EMRS is en-route.

o **Medical escort requirement.** There may be a danger that the patient may deteriorate in transit and transfer therefore needs to be undertaken by a clinician who is able to deliver the appropriate interventions.

- This is a difficult issue to tackle effectively because it is likely that such cases will always occur and, in marginal cases, clinical judgement will
always err on the side of caution. However, there may be actions to minimise these numbers that could be taken.

**Qualitative assessment**

- Our qualitative assessment showed a generally good understanding of EMRS and its rationale in the areas in which we consulted, although actual contact with the Service was rare.

- The Service was also generally well-received and was thought to have a number of benefits, especially in improving patient outcomes and helping to take pressure of local staff from having to deal with acute emergency cases.

- Some concerns were expressed, notably about retrieval times, inappropriate referrals and increased future demand for the Service and the impact that this may have on local provision.

- All consultees wanted EMRS to continue in some form. Generally, they wanted the Service to also cover the North of Scotland, although there was concern in the West that this may weaken their existing service.

- There was no real consensus on the number of centres required to deliver EMRS or whether the Service should undertake primary retrievals or join-up with other HEMS-type services.

**QALY**

- The three methodologies result in a range of estimates of 96 to 710 QALYs gained in total, an average of 0.47 to 3.5 QALYs per patient retrieved. This yields an estimated cost per QALY of between £1,500 and £11,600. Although this is a very broad range, even under the most prudent scenario, the cost per QALY is still well within the NICE threshold of £20-30,000 per quality-adjusted life year. This suggests that EMRS can be considered cost effective.

- The project board debated these assumptions and some alternatives were suggested which in each case increased the overall QALY total and improved value for money. However, the amendments were not unanimously agreed, and thus we have retained the most prudent assumptions. The demonstration of strong value for money, even under this set of assumptions, would only serve to be further strengthened by introducing further sensitivity tests.
6 DEMAND ASSESSMENT

- The number of retrievals during the pilot was 222. Extending the Service to cover all of remote and rural Scotland would increase cases to 311-345.

- Usage rates are highest in Argyll & Bute, where the Service is longer established, implying that demand could increase to about 360 cases over five years.

- There were 10 simultaneous retrievals (affecting 20 patients) in the current model that could increase to 20-40 (affecting 40-80 patients) if the Service was extended.

- Drivers of demand include demography, level of local service provision, incidence of accidents, tourism, provision of alternative transport, local geography and weather.

6.1 It is important to understand the likely demand for EMRS in order to inform the optimal format for delivery. This section estimates annual demand for each of the proposed catchment options. In turn, this will inform the value for money assessment offered by each option.

6.2 The two main geographic catchments considered are:

- **West of Scotland** coverage – continuation of the partial remote and rural coverage as per the pilot scheme.

- **National remote and rural** coverage – extension of the pilot area to include all of the Mid-Highland Community Health Partnership (CHP) area, Northern Highlands, Orkney and Shetland.

6.3 It is essential that the definition of ‘national coverage’ fits with the rationale for delivery of the Service. The key aim is to address and improve outcomes for remote and rural areas, not to challenge existing delivery models for urban areas. A national option including all health board areas in Scotland (rural and urban) would represent a significant re-modelling of the existing service outside the required scope, and is therefore excluded. The definition of ‘national coverage’ option is to service only those areas defined as remote and rural by the Scottish Government\(^\text{20}\).

---

\(^{20}\) See Scottish Government Urban Rural Classification
http://www.scotland.gov.uk/Topics/Statistics/About/Methodology/UrbanRuralClassification
6.4 The demand estimates presented in this section are based on:

- the evaluation data for one year of the West of Scotland pilot, provided by the EMRS Team;
- consultations with current users and representatives from the areas proposed for inclusion if moving to a national delivery model;
- local estimates of potential usage based on their current profile of critical transfers; and
- supplementary General Registry Office for Scotland (GRoS) population forecasts and Office for National Statistics (ONS) statistics relating to the key demand drivers.

6.5 Table 6.1 presents the scope of coverage for the two delivery options by area, medical facilities covered and population catchment.

**Table 6.1 Scope of coverage of EMRS delivery options**

<table>
<thead>
<tr>
<th>Options</th>
<th>Coverage / Catchment</th>
<th>Medical facilities</th>
<th>Isolated General Practices</th>
<th>Population</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Geographic</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Health Board Area</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>West of Scotland (as per current pilot)</td>
<td>Highland (A&amp;B CHP)</td>
<td>Argyll &amp; Bute</td>
<td>Oban</td>
<td>Bute</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Campbeltown</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Dunoon</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Islay</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Lochgilphead</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Mull</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Bunessan</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Coll</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Colonsay</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Jura</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Tighnabruaich</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Tire</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>63,497</td>
</tr>
<tr>
<td>Highland (Mid CHP)</td>
<td>Lochaber</td>
<td>Skye &amp; Lochalsh</td>
<td>Fort William</td>
<td>Broadford</td>
</tr>
<tr>
<td></td>
<td>Wester Ross</td>
<td></td>
<td></td>
<td>Acharacle</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Applecross</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Egg</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Lochaline</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Mallaig</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>32,576</td>
</tr>
<tr>
<td>Dumfries &amp; Galloway</td>
<td>Wigtown</td>
<td>-</td>
<td>Stranraer</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>29,700</td>
</tr>
<tr>
<td>Western Isles</td>
<td>Western Isles</td>
<td>Stornoway</td>
<td>Barra</td>
<td>Benbecula</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Maivago</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>North Harris</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Pair</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>South Harris</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>26,502</td>
</tr>
<tr>
<td>Ayrshire &amp; Arran</td>
<td>Arran</td>
<td>Cumbrae</td>
<td>Arran</td>
<td>Cumbrae</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6,492</td>
</tr>
<tr>
<td>Tayside</td>
<td>Kinloch</td>
<td>Rannoch</td>
<td>-</td>
<td>Kinloch</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Rannoch</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>944</td>
</tr>
<tr>
<td><strong>Additional areas for National remote and rural coverage options</strong></td>
<td>Orkney</td>
<td>Orkney</td>
<td>Orkney</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Eday</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>North Ronaldsay</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Sanday</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Stronsay</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Westray</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>19,245</td>
</tr>
<tr>
<td>Shetland</td>
<td>Shetland</td>
<td>Shetland</td>
<td>-</td>
<td>Hillswick</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Unst</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Yell</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>21,988</td>
</tr>
<tr>
<td>Options</td>
<td>Coverage / Catchment</td>
<td>Medical facilities</td>
<td>Population</td>
<td></td>
</tr>
<tr>
<td>---------</td>
<td>----------------------</td>
<td>--------------------</td>
<td>------------</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Geographic</td>
<td>Rural General Hospitals</td>
<td>Community Hospitals</td>
<td>Isolated General Practices</td>
</tr>
<tr>
<td>Health Board Area</td>
<td>Sub-areas</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Highland (North CHP)</td>
<td>• Caithness • Sutherland</td>
<td>Wick</td>
<td>• Golspie • Thurso</td>
<td>• Armadale • Durness • Lochinver • Scourie • Tongue</td>
</tr>
<tr>
<td>Highland (Mid CHP)</td>
<td>Gairloch &amp; northward</td>
<td>-</td>
<td>-</td>
<td>• Gairloch • Torridon • Ullapool</td>
</tr>
</tbody>
</table>

Source: DTZ
Note: Population figure refers to population of the remote and rural part of each NHS Board, defined as more than 60 minutes from a hospital receiving emergency cases.

**Demand by health board area**

6.6 During the period of the evaluation, EMRS completed 222 retrievals, of which 203 were secondary retrievals within the scope of this study. A further 187 advice only calls were taken.

6.7 The West of Scotland pilot area covers a population catchment area of 159,711 residents and there will also be day visitors to the area. This represents an incidence rate of 1.27 cases per 1,000 population. Including the 19 pre-hospital retrievals undertaken, which are assumed to have become secondary retrievals on arrival at the initial point of care, increases the incidence rate to 1.39 per 1000 population. This is marginally higher than the 1.22 per 1,000 rate experienced during the initial Argyll & Bute pre-pilot undertaken in 2004.

6.8 Based on the pilot cases, we have developed a range of incidence scenarios to estimate potential demand when moving to a national service model. The assumptions are as follows:

- **Low estimate – 311 cases per annum** – this is based on the current secondary activity of the service (excluding primary). 203 cases in the pilot year equates to an incidence of 1.27 per 1000 of the target population.

- **Medium estimate – 317 cases per annum** – this includes primary and secondary cases (222) on the basis of qualitative evidence that primary cases would have become secondary cases following the initial retrieval. However, an adjustment has been made to remove the simultaneous retrievals, as these were conducted outside normal operating practices for the service, and thus were judged to be less sustainable activity in the long term (10 in 8 months equates to est. 15 in 12 months). This gives pilot activity of 207 and represents the caseload that would have been achieved under normal operating conditions, equating to an incidence of 1.3 per 1000 of the target population.
• **High estimate – 345 cases per annum** – this includes primary and secondary retrievals (222) plus those missed cases that would have been retrievals were the team / resources available at the time of the call (+3). This gives 225 for the pilot area, equating to prevalence of 1.41 per 1000 of the target population.

6.9 Applying these incidence rates to the populations of the proposed new areas gives a range of demand estimates. These are presented in Table 6.2, overleaf. On this basis, demand for the national EMRS is anticipated to increase to a total of 311 to 345 cases per annum for the national service options.

**Table 6.2 Demand estimates by health board area**

<table>
<thead>
<tr>
<th>Area</th>
<th>Cases per annum</th>
<th>Incidence per 1,000 pop.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Actual during pilot</td>
<td>Low estimate</td>
</tr>
<tr>
<td>Highland (Argyll &amp; Bute CHP)</td>
<td>114</td>
<td>-</td>
</tr>
<tr>
<td>Highland (Mid CHP partial)</td>
<td>25</td>
<td>-</td>
</tr>
<tr>
<td>Dumfries &amp; Galloway</td>
<td>24</td>
<td>-</td>
</tr>
<tr>
<td>Western Isles</td>
<td>32</td>
<td>-</td>
</tr>
<tr>
<td>Ayrshire &amp; Arran</td>
<td>8</td>
<td>-</td>
</tr>
<tr>
<td>Tayside</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td><strong>West of Scotland total</strong></td>
<td><strong>203</strong></td>
<td><strong>203</strong></td>
</tr>
<tr>
<td>Orkney</td>
<td>-</td>
<td>24</td>
</tr>
<tr>
<td>Shetland</td>
<td>-</td>
<td>28</td>
</tr>
<tr>
<td>Highland (North CHP)</td>
<td>-</td>
<td>49</td>
</tr>
<tr>
<td>Highland (Mid CHP partial)</td>
<td>-</td>
<td>6</td>
</tr>
<tr>
<td><strong>Additional areas total</strong></td>
<td><strong>-</strong></td>
<td><strong>108</strong></td>
</tr>
<tr>
<td><strong>National total</strong></td>
<td><strong>-</strong></td>
<td><strong>311</strong></td>
</tr>
</tbody>
</table>

Note: Tayside is zero because only one part (Kinloch Rannoch) is within the EMRS pilot boundary and had no cases in the pilot evaluation period. Given the small population, this would be expected.

Source: DTZ

6.10 There are, however, a range of incidence rates between the health board areas participating in the West of Scotland pilot, from 0.77 to 1.8 retrievals per 1,000 population. While these incidence rates relate to a small number of retrievals, there are a number of potential drivers for this effect, explored in the following section.

6.11 Demand estimates were discussed during the consultation programme. For those new areas not already engaged in the pilot, the low and medium estimates were relatively consistent with local estimates of requirement based on the share of current critical transfers. The Health Boards in the pilot area felt that their current demand was broadly representative of likely future demand, and that no significant patient groups were excluded.
6.12 Maintaining a consistent rate of advice only calls, we estimate that total demand for this element of the service will increase by about 80 cases per annum if moving to the national delivery model. This equates to total annual activity of about 267 advice only calls.

Drivers of future demand

6.13 A number of local factors have been identified and agreed with the EMRS Project Board and consultees as potential influences on the rate of future local demand for the EMRS. This section explores these in turn, estimating their potential implications for future delivery of the Service.

- **Demographic change.** The population of the target areas is changing, both in terms of scale and composition. Based on the results of the pilot, prevalence does not change significantly across adult age cohorts. GRoS’s estimates population growth across the Highlands (+1.9%) and Orkney (+3.3%) health board areas over the next five years. The other areas are comparatively static or in marginal decline. This equates to around six additional cases per annum by 2014 via population growth effects.

- **The level of local service provision.** The range of facilities (such as A&E) and level of staffing (GP or consultant led) available in each target area may affect their ability to deliver locally and, therefore, their relative reliance on EMRS. During the pilot, however, there was little variance in the usage rates between rural general hospitals and community hospitals.

- **Local behaviours.** Certain industries, occupations and activities will carry a higher risk of injury and, therefore, are more likely to require retrieval. Using ISD’s 2007 Emergency Hospital Admissions as a result of an unintentional injury by NHS Board of residence as an initial proxy, we can distinguish those local areas with a higher incidence of recorded accidents and, therefore, those that are potentially proportionately more likely to require EMRS. Orkney, Shetland and the Highlands are each about one-third above the national average by this measure. Applying the current incidence rate in the part of the Highlands included in the pilot (1.80) to these new areas implies a potential increase of around 30 additional cases per annum in Orkney and Shetland. However, the consultations with these areas, combined with local demand estimated based on current A&E and retrieval activity, suggests that this incidence rate is too high for these areas. Thus, there may be a risk of providing over-capacity if designing the Service on the basis of this higher rate.

- **Local tourism.** It is not only local residents that may require retrieval. Population estimates alone are therefore not a sufficient base from which to estimate incidence rates. An adjustment has to be made to take account of the total number of people in the area at any stage, including temporary tourists. This is a particular issue for small, remote areas that act as central tourism hubs, where the locals will only account for a small share of total potential demand. In addition, it is important to capture any influx of local workers who are not resident in the area, as their most likely point of
day time admission is at their place of work. To make an initial estimate of this demand pressure, we have assessed data available from VisitScotland, together with the Day and Night Time Population analysis available from the Census.

- **Alternative transport.** More remote hospitals will have fewer alternative links with the receiving hospitals. For example, the lower rates in Dumfries & Galloway and Mid-Highlands may mask the fact that a number of emergency transfers took place by road. In some cases, road travel is faster than waiting for aerial pick-up, although may not achieve the same clinical outcome, e.g. if there is a delay in time to consultant assessment. However, for more remote areas, the distance and travel time involved will mean that there are fewer available alternatives. We have used comparative air and road travel times to proxy this indicator.

- **Local geography and adverse weather.** The evaluation has demonstrated that adverse weather (e.g. fog, storms) means that helicopters cannot fly to access more remote areas. This will affect the ability to retrieve patients effectively (incidence), but will not affect the underlying demand for the EMRS. We have therefore not made an adjustment to these demand estimates for this indicator.

- **Joint working with other teams.** EMRS is forging relationships with other emergency retrieval teams, such as the Paediatric Retrieval Service, and have dealt with a small number of cases that would have previously been dealt with by other services. As these relationships grow and protocols are agreed, this may affect the number of cases that EMRS deals with. To some extent, such a driver is difficult to quantify in terms of impact as we cannot as yet foresee how this particular area will develop. It is likely that there will be other unforeseen challenges as well impacting on demand. Clearly this represents a potentially significant area of new demand, with the EMRS team estimating an additional 25 to 35 cases per annum if these new patient groups are adopted. Incorporation of these groups is not within the scope of this study. However the final conclusions acknowledge that the design of the service may have to change in light of a RRIG decision to extend the scope of the service.

**Conclusions**

6.14 During the pilot, EMRS was operating at 222 retrievals per annum. Extending the Service to cover all Scottish remote and rural areas is estimated to increase demand to a total of 311 to 345. On this basis, the mid-point between the medium and high estimates has been used to give a prudent estimate of the caseload in Section 7 (cost and value for money estimates).

**Implication:** extending the service to national coverage will exceed the capacity of the current one team/one centre model. However, demand is not anticipated to be sufficient to maintain two teams/two centres at full capacity in the short-term.
6.15 There is variance in usage between areas. Usage rates are highest in Argyll & Bute, which has had longest exposure of EMRS, following the initial 2004 pilot. It may be that this is a truer estimate of prevalence, while other areas demonstrate only incidence of use.

**Implication:** Demand could potentially grow as high as 360 cases per annum as the Service becomes better established. Again, this is a potential effect, rather than a known short-term demand. Scotland’s population is projected to increase marginally across the targeted health boards over the next five years.

**Implications:** Demand for the Service could grow by six to ten cases by 2014, assuming consistent usage of the Service.

6.16 Over the course of the pilot there were ten simultaneous retrievals. Increasing the number of cases increases the likelihood of simultaneous call-outs. Based on current retrieval times and patterns, and comparable rates for the neo-natal service, this could range from 40 to 80 patients per annum. This issue is explored further in Section 7.

**Implication:** a second team/centre should offer a faster response in the case of simultaneous retrievals; however, there may not be sufficient simultaneous retrievals to maintain a second team at current levels for a single team.

6.17 It should be noted that, since the conclusion of the evaluated pilot period, the EMRS team have provided data on the 5 months of retrievals up to November 2009. During this subsequent period, the incidence rate of retrievals increased to 1.6 per 1000 population. If this rate were continued and pro-rated nationally, it would equate to 393 annual retrievals. The new data lies outside the evaluation period and thus has not been independently verified. In addition, the final indicators of severity scoring and survival at 30 days etc. are not completed. It has also been noted that the increased incidence rate includes an increased number of pre-hospital retrievals and cover for the shock and paediatric teams, both of which lie outside the scope of the appraisal. Within the conclusions we acknowledge the need for continued monitoring and review of this data, within the context of the overarching conclusions.
7 OPTIONS DEVELOPMENT AND SHORT LISTING

- The options development and short-listing process followed HM-Treasury Green Book guidance and much discussion with the EMRS Project Board, health boards, health professionals and patient representatives.

- Options were reduced from an initial long-list and then scored and weighted by key criteria.

- Further analysis produced a short-list of five options: No EMRS; Current model covering the West of Scotland; Augmented current Team covering all of remote and rural Scotland; Two clinical teams in the West covering all of remote and rural Scotland; and Two centres covering all of remote and rural Scotland.

Introduction

7.1 This section explains how the options for future service delivery were developed. In developing the options and short-listing, guidance from the HM Treasury Green Book\(^{21}\) was relied on. The key steps taken are outlined below, which summarises the process.

- A long list of potential options was developed based on a number of key components and parameters. This flowed out of discussions with the EMRS Project Board as well as the primary research.

- This was reduced to a list of 12 options believed to be practically deliverable.

- Key criteria for the Service were devised, ranked and weighted.

- The options were scored and weighted against these key criteria by members of the Project Board.

- Based on this exercise and further analysis, five options were selected as the short-list on which to undertake the full economic appraisal.

Developing the long list of options

7.2 Table 7.1 summarises the development of the options and the key components, as well as the operational parameters, which were applicable to all of the components. Combinations of these components and parameters were then used to produce a set of possible options. This ‘long list’ is a combination of these components and parameters that was then reduced to a set of options (12) that were believed to be practically deliverable.

---

Table 7.1 Summary of option components and rationale for inclusion

<table>
<thead>
<tr>
<th>Option / option component</th>
<th>Overview</th>
<th>Key drivers for inclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Location / medical resource parameters</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline: No EMRS</td>
<td>Removal of the Service when the current pilot is completed and no further funding committed.</td>
<td>Standard HM-Treasury Green Book appraisal guidance requires this ‘do nothing’ option to be included to benchmark changes associated with service provision.</td>
</tr>
<tr>
<td>Revert to Argyll &amp; Bute pilot model</td>
<td>Coverage: Argyll &amp; Bute Model: 1 Glasgow centre with 4.6 consultant WTEs covering 8am to 6pm shifts and overnight on-call. Shared access to a combination of SAS, military and police aircraft pending availability.</td>
<td>The pre-pilot voluntary service around Argyll &amp; Bute was well used and demonstrated strong outcomes in the initial business case.</td>
</tr>
<tr>
<td>1 Centre</td>
<td>Central operation of the service from a single base (Glasgow) based on current service profile.</td>
<td>As per West of Scotland pilot model, but with potential to increase scope, coverage and operational model of the service. The EMRS Project Board report (April 2006)\textsuperscript{22} recommends roll-out of this national coverage option on a phased basis.</td>
</tr>
<tr>
<td>2 Centres</td>
<td>Addition of a second location to the Glasgow base to increase capacity and ability to respond to simultaneous transfers. Second area to be determined by optimal travel model for current users and fit with optimal triage.</td>
<td>Potential for reduction in travel time, thus time to definitive care. Potential for reduction in risk of simultaneous transfers. Creates greater capacity.</td>
</tr>
<tr>
<td>3 Centres</td>
<td>Inclusion of a third centre against same criteria as above.</td>
<td></td>
</tr>
<tr>
<td><strong>Operational parameters (applicable to all location options)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hybrid model</td>
<td>Collaboration with other retrieval services and possible integration into a network of other services, as opposed to a free-standing service. <em>Delivering for Remote &amp; Rural Health</em> discusses the need to move towards an integrated national service. This covers dispatch, transport and logistics, rather than medical composition of the teams, so can be applied as an extension of any of the above options in terms of EMRS team/shift structure.</td>
<td>Potential operational efficiencies (dispatch and prioritisation of cases) and improved access to aircraft. There is an ongoing review between retrieval teams to discuss resource sharing and potential critical mass for dedicated aircraft.</td>
</tr>
<tr>
<td>Geographical coverage</td>
<td><strong>National</strong> – extension of the service to cover all areas in Scotland defined by the Government as remote &amp; rural. <strong>Partial</strong> – continuation of the West of Scotland coverage model.</td>
<td>The original business case recommended staged progression to national delivery to achieve equality, pending a successful West of Scotland pilot.</td>
</tr>
<tr>
<td>Inclusion of primary retrievals</td>
<td>Incorporation of additional primary retrievals at the discretion of EMRS and SAS, within</td>
<td>Potential for improved clinical outcomes and</td>
</tr>
</tbody>
</table>

\textsuperscript{22} EMRS Project Board, *Scotland’s Emergency Medical Retrieval Service*, April 2006.
<table>
<thead>
<tr>
<th>Option / option component</th>
<th>Overview</th>
<th>Key drivers for inclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location / medical resource parameters</td>
<td>existing capacity of the EMRS centre(s).</td>
<td>efficiency, linking with current secondary service.</td>
</tr>
</tbody>
</table>
| Staffing / rota model | Number of teams: Multiple sites or single site with multiple teams  
Shift or on-call coverage models:  
Shift = 8am to 6pm staffed base, with on-call cover at night (the current Glasgow model).  
On-call = 24/7 on-call cover | Multiple teams allow response to simultaneous call outs.  
Shift systems allow faster response.  
An on-call rota without full staffing is potentially cheaper, but also reduces ability to respond to time critical emergencies.  
Qualitatively, the EMRS Team believes it is not feasible to operate a service with just on-call cover and no shift pattern. |
| Seasonal service | EMRS only to be used at certain parts of the year when demand for the Service is high. | Demand for the Service fluctuates, so best to concentrate resources on those times of the year when it is most required. |
| Local enhanced service delivery | The use of other staff and resources to supplement EMRS at particular localities. | Certain areas, particularly those that are more remote and where travel times are longer, may benefit from enhanced local delivery with 'virtual' EMRS support, e.g. a extra local consultant anaesthetist and greater use of the EMRS advice line. |

Source: DTZ

**Reducing the long list**

7.3 Following the June 2009 EMRS Project Board meeting, a number of options from the long list were ruled out and agreement was reached on how to deal with some of the key option parameters, as summarised below.

- Discussions were on-going about the merits of the hybrid option and its practicality. Although desirable, it was believed that such a model was, as yet, ill defined, and may be a number of years away. If possible, the merits of hybrid delivery were to be judged individually and applied to the preferred option as an addition to the option, i.e. to assess the net impact of a hybrid service on the costs and benefits of the preferred option.

- The three centre option was not believed to be practical or sustainable. At our then estimate of around 325 cases per annum for all of remote and rural Scotland, demand was not thought to be sufficient to justify a third centre as it would operate significantly below capacity. Practically, the level of recruitment for key staff was also not thought to be feasible.
• Enhanced local delivery was agreed to be considered as an addition to the preferred option, i.e. the net impact of introducing this in certain parts of remote and rural Scotland was to be considered based on feedback received from local areas on supplementary local requirements and their impact on EMRS demand and analysis of response times.

• After analysis of retrieval patterns and discussions with the Project Board, seasonal delivery was excluded given the fairly even spread of retrievals during the year.

• It was decided that primary retrievals lie outside the scope of the evaluation and that primary retrievals were to be attended at the discretion of the EMRS Team, within their spare capacity, while prioritising secondary retrieval.

7.4 Table 7.2 summarises these arguments and reduced the number of practical options (those shaded in grey were removed from consideration).

7.5 The following option components were retained.

• No EMRS was retained as the baseline option for Green Book appraisal purposes. There was also a belief that it may be possible to retain at least an Argyll & Bute service as a de minimis option, so this was further considered.

• It was thought that one and two centre options should be considered with different geographical parameters (West of Scotland only and all of remote and rural Scotland).

• Different staffing configurations were also thought to be relevant parameters for these options.

Table 7.2 Summary of retained options for scoring and weighting

<table>
<thead>
<tr>
<th>Delivery model</th>
<th>Scope</th>
<th>A - Secondary retrieval</th>
<th>B - Primary and secondary retrieval</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>a – National</td>
<td>b – Partial coverage (WoS)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(all remote and rural)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>c – Seasonal</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>a – National</td>
<td>b – Partial coverage (WoS)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(all remote and rural)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>c – Seasonal</td>
<td></td>
</tr>
<tr>
<td>Baseline - No EMRS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Revert to Argyll &amp; Bute only model</td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>EMRS – 1 centre</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>EMRS – 2 centres</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Both shift cover vs. On-call cover</td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>EMRS – 3 centres</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Both full shift cover vs. On-call cover</td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

Source: DTZ
7.6 This exercise provided us with a suite of remaining options, summarised in Table 7.3.

**Table 7.3 Options used for the scoring and weighting exercise**

<table>
<thead>
<tr>
<th>Option</th>
<th>Components</th>
<th></th>
<th>Rota model (number of teams on rota pattern)</th>
<th></th>
<th>Geographic coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of centres (locations)</td>
<td>Total number of teams</td>
<td>Shift: 8am-6pm</td>
<td>On-call: night</td>
<td>On-call day and night</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>No EMRS</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>Argyll &amp; Bute</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>West of Scot.</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>All remote &amp; rural</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>West of Scot.</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>All remote &amp; rural</td>
</tr>
<tr>
<td>7</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>West of Scot.</td>
</tr>
<tr>
<td>8</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>All remote &amp; rural</td>
</tr>
<tr>
<td>9</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>West of Scot.</td>
</tr>
<tr>
<td>10</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>All remote &amp; rural</td>
</tr>
<tr>
<td>11</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>West of Scot.</td>
</tr>
<tr>
<td>12</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>All remote &amp; rural</td>
</tr>
</tbody>
</table>

Source: DTZ

7.7 These were the options presented to the EMRS Project Board for scoring after the June 2009 Project Board meeting. All of the options were discussed by the Board, in an exercise facilitated by DTZ, with advice from Scottish Government economists. The options were then scored by the Project Board subsequent to this.

7.8 Five key criteria were agreed with the EMRS Project Board, with the following scope and weightings attached. The criteria were first ranked in order of their importance and then weights were assigned to reflect this ranking and the relative importance of each criterion.
Table 7.4 Criteria and weighting

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Definition</th>
<th>Indicators</th>
<th>Weighting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinical effectiveness</td>
<td>Achieving the Service objective to deliver improved clinical outcomes to patients in remote and rural areas by providing improved access to definitive care. The ability to judge the need for retrieval of a patient, rather than regular SAS air transfer.</td>
<td>Uplift in clinical outcomes: survival rate and Quality Adjusted Life Years (QALY). Geographic scope of coverage: number of cases attended. Level of skills and facilities at referring units. Frequency of retrievals without intervention.</td>
<td>100%</td>
</tr>
<tr>
<td>Sustainability and practicality</td>
<td>The ability physically to achieve the required levels of staffing, resources, funding and performance stated by the option, and maintain this on a permanent basis.</td>
<td>Ability to recruit and retain staff. Spare capacity / efficiency of staff use. Efficiency of dispatch.</td>
<td>95%</td>
</tr>
<tr>
<td>Response times</td>
<td>The ability to meet reasonable targets for retrieving patients to definitive care. (Note: there is no formal target at present, but there are proposed standards for emergency response)</td>
<td>Ability to respond to simultaneous retrievals. Dispatch time. Time on-site. Travel times.</td>
<td>90%</td>
</tr>
<tr>
<td>Equity</td>
<td>Achieving the Government aim to offer equity of access to remote and rural areas across Scotland.</td>
<td>Geographic coverage. Number of retrievals / requests not attended.</td>
<td>80%</td>
</tr>
<tr>
<td>Impact on other services</td>
<td>Cost or performance externalities at the referring or receiving hospital or health board area as a result of patient movement (out-going or in-coming) or consultant commitments to EMRS.</td>
<td>Impact on SAS workload. Aircraft access for other retrieval services. Capacity at receiving centres (intensive care and A&amp;E bed spaces and consultant capacity). Training and staff retention at referring centres (and ability to take other projects forward). Loss of local clinician from the referring centre while undertaking transfer.</td>
<td>75%</td>
</tr>
</tbody>
</table>

Source: DTZ

7.9 Affordability and value for money were also discussed, but the Project Board agreed that these factors were to be included in the full assessment of the preferred short-listed options once the costs of each of the options had been established.

7.10 Based on the emerging evidence from data and information collected by the June 2009 Project Board meeting, DTZ offered the Project Board illustrative guidance to aid scoring the options.
Table 7.5 Guidance notes for scoring the options

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Notes for scoring guidance</th>
</tr>
</thead>
</table>
| Clinical effectiveness    | • National coverage offers greater potential for improvement than partial coverage, as patient base is larger.  
• Shift coverage is better than on-call teams in terms of dispatch times and ability to cover the advisory service.  
• Increasing the number of centres may offer potential outcome uplift through faster travel.                                                                                                                    |
| Sustainability and        | • Demand at national level is estimated at about 325 cases per annum.  
The Glasgow centre with a single team has completed around 220 retrievals this year. This is thought to be the capacity of a single team, given aircraft availability and the spacing of emergency retrievals.  
• Options that increase the number of centres/teams require recruitment, but may be spread across increased number of health boards.  
• Options with a reduced patient/consultant ratio are potentially sub-optimal, based on capacity of the current EMRS model.                                                                                  |
| practicality              |                                                                                                                                                                                                                             |
| Response times            | • Increasing the number of teams minimises the risk of delayed dispatch due to simultaneous transfers.  
• Increasing the number of centres should reduce flight distance/time, assuming optimal location chosen.  
• Options with shift staff, rather than on-call, minimise possible delays in dispatch.  
• National coverage options include destinations with longer travel times, thus will increase overall total retrieval time, reducing potential capacity of a fixed staff number.                      |
| Equity                    | • National options have a larger catchment and potential demand than partial coverage options.  
• An increased number of centres provide a local presence and more consistent travel times.                                                                                                                                |
| Impact on other services  | • Increasing the number of teams or centres increases the need for local boards to recruit, either to cover the EMRS rota, or to backfill consultants while performing EMRS duties.  
• National options may increase demand for SAS resources via EMRS.  
• EMRS avoids potential loss of local clinician from referring unit while undertaking transfer.                                                                                                                                   |

Source: DTZ
7.11 Members of the EMRS Project Board were asked to score each of the options against the criteria on a 1-5 scale, with 1 being the lowest score (the option not achieving the aims on which the criterion is based) and a score of 5 representing the best outcome (the option fully achieving aims on which the criterion is based).

7.12 Seven replies were received, with the following bodies represented. Three of the replies were from the EMRS Team, which we consolidated into one overall response so that the scores from the EMRS Team members did not have any greater weighting than those of any of the other bodies.

- EMRS Team
- Greater Glasgow and Clyde Health Board
- North of Scotland Planning Group
- Remote and Rural Implementation Group
- Scottish Ambulance Service.

7.13 The average scores for the options are provided in Table 7.6. The scores were then weighted to provide an overall average weighted score.
## Table 7.6 Scoring of the options

<table>
<thead>
<tr>
<th>Service Option</th>
<th>Criteria</th>
<th>Indicator weight</th>
<th>Clinical effectiveness</th>
<th>Sustainability &amp; practicality</th>
<th>Response times</th>
<th>Equity</th>
<th>Impact on other services</th>
<th>Overall weighted average score</th>
<th>Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Baseline:</strong> No EMRS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
<td>1.0</td>
<td>2.5</td>
<td>1.3</td>
<td>2.3</td>
<td>1.4</td>
<td>1.7</td>
<td>12</td>
</tr>
<tr>
<td>1</td>
<td>Revert to Argyll &amp; Bute coverage</td>
<td></td>
<td>1.9</td>
<td>1.8</td>
<td>2.6</td>
<td>1.7</td>
<td>1.6</td>
<td>1.8</td>
<td>11</td>
</tr>
<tr>
<td>1</td>
<td>1 Centre, 1 team with shift rota</td>
<td></td>
<td>3.1</td>
<td>3.3</td>
<td>3.4</td>
<td>2.0</td>
<td>2.5</td>
<td>2.9</td>
<td>6</td>
</tr>
<tr>
<td>1</td>
<td>1 Centre, 1 team with shift rota</td>
<td></td>
<td>4.1</td>
<td>3.6</td>
<td>2.7</td>
<td>3.3</td>
<td>2.3</td>
<td>3.1</td>
<td>5</td>
</tr>
<tr>
<td>1</td>
<td>1 Centre, 2 teams both with shift rota</td>
<td></td>
<td>3.1</td>
<td>1.9</td>
<td>3.8</td>
<td>1.8</td>
<td>2.2</td>
<td>2.6</td>
<td>=8</td>
</tr>
<tr>
<td>1</td>
<td>1 Centre, 2 teams both with shift rota</td>
<td></td>
<td>4.8</td>
<td>2.8</td>
<td>3.5</td>
<td>3.7</td>
<td>2.0</td>
<td>2.6</td>
<td>=3</td>
</tr>
<tr>
<td>1</td>
<td>1 Centre, 2 teams: 1 with shift cover, 1 on-call</td>
<td></td>
<td>3.5</td>
<td>2.4</td>
<td>3.7</td>
<td>1.8</td>
<td>2.1</td>
<td>2.7</td>
<td>7</td>
</tr>
<tr>
<td>1</td>
<td>1 Centre, 2 teams: 1 with shift cover, 1 on-call</td>
<td></td>
<td>4.6</td>
<td>3.5</td>
<td>3.1</td>
<td>3.5</td>
<td>2.3</td>
<td>2.6</td>
<td>2</td>
</tr>
<tr>
<td>1</td>
<td>2 Centres, 2 teams both on shift rota</td>
<td></td>
<td>3.0</td>
<td>2.1</td>
<td>3.7</td>
<td>2.1</td>
<td>2.0</td>
<td>2.6</td>
<td>=8</td>
</tr>
<tr>
<td>1</td>
<td>2 Centres, 2 teams both on shift rota</td>
<td></td>
<td>4.4</td>
<td>2.7</td>
<td>4.3</td>
<td>3.7</td>
<td>2.6</td>
<td>3.5</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>2 Centres, 2 teams: 1 with shift cover, 1 on-call</td>
<td></td>
<td>2.9</td>
<td>2.6</td>
<td>3.3</td>
<td>1.8</td>
<td>1.7</td>
<td>2.5</td>
<td>10</td>
</tr>
<tr>
<td>1</td>
<td>2 Centres, 2 teams: 1 with shift cover, 1 on-call</td>
<td></td>
<td>3.9</td>
<td>3.2</td>
<td>3.5</td>
<td>3.4</td>
<td>2.6</td>
<td>3.3</td>
<td>=3</td>
</tr>
</tbody>
</table>

Source: DTZ

Note on coding and scores: **RED** – de minimis options; **GREEN** – one centre options; **BLUE** – two centre options. Scores in **BOLD** represent the highest score in a given column.
7.14 These scores do appear to be consistent.

- Options with multi-teams and shift cover nationally scored higher on clinical effectiveness. We would expect this as the patient base will be larger for national options, particularly where there is more than one team (avoiding simultaneous retrievals), and shift coverage will have better despatch times and allow for an advisory service to provide continuous support.

- Options involving a single centre were judged to be more sustainable and practical, which we would expect given a Glasgow base makes it easier to recruit staff.

- Response times are also dependent on the number of teams and we would expect response times to reduce with multi-teams.

- Equity scored highest on options with national coverage and multi-teams, again expected as more patients are covered and more centres provides a more localised presence and consistent travel times.

- Impact on other services was felt to less detrimental where there were two centres with national coverage, probably due to the increased capacity of EMRS and its flexibility to respond as well as taking the organising of transfers out of the hands of local health professionals.

7.15 The option offering national coverage with two centres and two teams on shift rota (Option 10) had the highest weighted score. The next highest scores were also for options that had national coverage with two teams (Options 6, 8 and 12), followed by a one centre/one team option with national coverage (Option 4). Options confining EMRS to the West of Scotland and the de minimis options scored relatively poorly in this exercise.

**Short-listing**

7.16 These scores, together with results from the primary research, were used to arrive at a considered judgement on the options short-list.

7.17 On further reflection, it was believed the options scoring, from the list in Table 7.6 had been made a little too complicated, especially by splitting options by different types of staffing cover. It was apparent from the primary research that very few areas of the country were too concerned about this and believed that the EMRS Team should be allowed to decide on how to configure itself within its budget.

7.18 It was therefore considered it to be a better solution to consider the staffing configuration of the Service as an additional element rather than as stand-alone options, particularly in making recommendations on staffing configuration for the preferred option. This allowed us to simplify the short-listing process.

7.19 Analysis of the scoring and weighting exercise and the primary research data led us to the conclusion that certain options should be excluded.
• Option 2 – revert back to Argyll and Bute pilot area. Further discussion with the EMRS Team revealed that there was little appetite for this to be re-run as a voluntary, ad hoc Service. If it was to be centrally funded, it was thought that it would have much the same staffing costs as the current model of delivery across the whole of the West of Scotland, but would not have the benefit of the same level of coverage. As the Green Book recommends, options with discernibly lower benefits but with the same or higher costs, can be excluded at the long list stage. It was also apparent in the fieldwork that areas outside Argyll & Bute in the West of Scotland are highly appreciative of the Service and view it as essential. Such areas would be hostile to a retreat of the operating area to its former narrowly focused pilot area.

• Option 5 - one centre, two teams, West of Scotland, both with shift rota. On closer reflection, the rationale for Option 5 appeared weak. The current EMRS team are able to cover the West Coast as a single team, with some additional capacity that can be used for primary retrievals. On these grounds, the need for two teams to cover just the West Coast will have significant additional costs for, at best, marginal benefit. The option also scored poorly in Table 7.6.

• Option 7 – one, Centre, two teams, West of Scotland, one shift and one on-call. Can be excluded for the same reasons as Option 5.

• Options 9 and 11 – two centres, two teams, West of Scotland. Can also be excluded for these reasons.

7.20 This left seven remaining options. Of these, Options 6 and 8 are very similar, only differing in their staffing model. As argued above, it was believed that it was sensible to examine the actual staffing components of the Service as an additional element to the preferred option and there was not a discernible difference between the options in the scoring and weighting process. These options were then combined. The same was true of Options 10 and 12.

7.21 This left us with five options on which to undertake the full economic appraisal.

• Option 1 – no EMRS. This seemed prudent to use as the de minimis option recommended by the Green Book.

• Option 3 – one centre, one team, covering West of Scotland. This is the current model of operation, which seemed important to include as a baseline. The evaluation suggested that the current service is both clinically and cost effective in addition to being very well received.

• Option 4 – one centre, one team, covering all of remote and rural Scotland. This option would involve extending the scope of EMRS. It was placed in the top five options in the scoring and weighting matrix and some areas outside the current pilot area did express a wish to see the EMRS extended.
• **Option 6/8** – one centre, two teams, covering all of remote and rural Scotland. This option was second in the scoring and weighting matrix. It would see two teams operating from the same centre to meet the increased number of cases arising from expansion of EMRS.

• **Option 10/12** – two centres, two teams, covering all of remote and rural Scotland. This was the preferred option on the basis of the scoring and weighting exercise. It would see another EMRS centre, to cover the North of Scotland, likely to be based in Aberdeen or Inverness. One team would operate from each centre. There was support for this option in the fieldwork as the ‘ideal’ option in a number of areas if the funding could be found to meet it.

7.22 To avoid confusion, the short-listed options were then re-labelled using letters and are highlighted below.

- **Option A** – No EMRS
- **Option B** – One centre, one team, covering West of Scotland
- **Option C** – One centre, augmented team, covering all of remote and rural Scotland
- **Option D** – One centre, two teams, covering all of remote and rural Scotland
- **Option E** – Two centres, two teams, covering all of remote and rural Scotland.

7.23 A further benefit of structuring the options in this way is that each option was a graduated step from the previous option and that this would be useful in the cost-benefit analysis as a way of assessing incremental costs and benefits.
8 COST AND VALUE FOR MONEY ASSESSMENT

- Option C was split into three sub options as the costs for this option were dependent on the number of simultaneous retrievals, for which there were a range of estimates. High, medium and low versions of this option were derived and were called C1, C2 and C3.

- The following numbers of cases were assumed for each option: A (0), B (207), C1 (302), C2 (287), C3 (272), D (332) and E (332).

- Costs were broken down into: staff; facilities; accommodation and equipment; drugs and consumables; training; and additional costs/benefits.

- The total cost for each option was estimated at approximately: A (£80,000), B (£1.4 million), C1 (£1.8 million), C2 (£1.8 million), C3 (£1.7 million), D (£2.2 million) and E (£2.7 million).

- Analysis of incremental costs (total, per case and per score from the scoring and weighting exercise) favours extending the Service to Option C or Option D as they have acceptable incremental costs against benefits. However, it also concludes that extending the Service to Option E represents poor value for money.

- In terms of cost per QALY, the analysis indicates that Option C offers the best value for money, although, under the high and medium QALY scenarios, Options B, C and D all generate a similar cost per QALY.

- Options B, C and D all appear to offer good value for money, with Option C offering the best value for money. However, Option E appears to represent poor value for money.

Costing of options

8.1 The scoring and weighting analysis provided five options on which to undertake the full economic appraisal

- Option A – No EMRS
- Option B – Current service. Single centre, single team, operating in West of Scotland
- Option C - Extended service. Single centre, single team, operating in all of remote and rural Scotland
- Option D - Two teams. Single centre, two teams, operating in all of remote and rural Scotland
• Option E - Two centres. Two centres, two teams, operating in all of remote and rural Scotland.

8.2 As highlighted above, each of the options show an incremental change based on the previous option and this will be very useful for incremental analysis of option costs and scores.

8.3 Below, estimated costs are presented for each of the options. The costings are based on the figures for the current service, supplied to us by NHS Greater Glasgow & Clyde and assumptions based on our consultation programme.

8.4 The costings have been broken down into discrete elements.

• Staff costs
• Medical facilities
• Accommodation and equipment
• Drugs and consumables
• Training
• Additional costs/benefits.

8.5 In the following sub sections, the costs are analysed against each of these elements.

**Number of cases**

8.6 The numbers of cases were estimated in making assumptions about the weighting of some of the costs.

8.7 Option A was simply no cases as there would be no EMRS.

8.8 For the remaining options, the key issue was in estimating the number of simultaneous retrievals. As highlighted above, ten simultaneous retrievals were only recorded from November 2008, when they first started to be recorded, i.e. an eight-month period. On a pro rata basis, this means that around 15 such retrievals per year (affecting 30 patients) could be expected under Option B. There were three further occasions on which retrievals were missed because it was not able to deploy a second team and only advice could be provided. This provides an estimate of 18 simultaneous retrievals (affecting 36 patients) under Option B. The EMRS Team has a view that, without change in the makeup of the current single team, including additional staff, it would not have the ability to meet the simultaneous retrievals requirements in future. The current model relies on staff working on a voluntary basis.

8.9 It was assumed that Options D and E would provide the EMRS teams with additional capacity to meet simultaneous retrievals, except in rare cases.
8.10 For Option B, therefore, the same level of cases as had occurred in the pilot was assumed as there seemed no good reason to believe that this level of cases was unusual. This included the 19 primary retrievals because these cases were picked-up because the Team had the capacity to respond. However, the 18 simultaneous retrievals were excluded as these were conducted on a voluntary basis and this was not thought to be sustainable. This provides a total number of cases for this option of 207. This should be seen as the capacity figure for this option.

8.11 Options D and E were based on the demand modelling work. A midpoint estimate from the middle and high end estimates was used to arrive at a figure of 332. It was believed that it was best to err on the side of caution on national roll-out and there is some evidence to suggest in our demand modelling work that there will be an increase in cases because of factors like demography, and as awareness of the Service increases and it becomes established, there may also be more cases (as seems to be happening in Argyll & Bute). However, this is likely to take time (Argyll & Bute has been established for five years) and adopting the high end estimate would give too great a weighting to Argyll & Bute’s greater level of incidence. This midpoint figure also seemed to correspond with health boards’ estimates of likely demand.

8.12 Option C was the most difficult to estimate the number of cases because, unlike the other national service options, in Option C there would be a much higher likelihood of simultaneous retrievals and less capacity to deal with them. Under this option, the EMRS Team would be unable to meet every case as it would lack capacity trying to cover the much larger geographical area than currently with only augmented resources. It is not possible to estimate precisely the number of cases likely be missed because it is not possible to tell when and where cases will occur. This was discussed at length with the EMRS Team and a consensus emerged that this should be dealt with through sensitivity analysis on the number of simultaneous retrievals.

8.13 In calculating the likely incidence of simultaneous retrievals, the increase in consultant hours that would be required by the extension to cover the north of Scotland was estimated. The average consultant time (in hours) on a case is around seven hours (from notification to completion of equipment checks at base). The EMRS Team calculated that the additional travel time for cases throughout the rest of remote and rural Scotland will be around three hours per case, i.e. ten hours in total. Assuming 225 cases for the West of Scotland and 107 for the North, as per the demand model, it is estimated that consultant time would increase by a factor of 1.68. Applying this to the current rate of simultaneous retrievals would see such retrievals rise to 30 (affecting 60 patients) under a linear model such as this.

8.14 The EMRS Team argued that the increase would be exponential rather than linear, i.e. a doubling of this estimate to around 60 cases (120 patients). It gave a number of reasons for this.

- There is likely to be greater consultant ‘fatigue’, e.g. it is easier to turnaround quickly from dealing with a retrieval to Bute than it is from a 12-
hour mission to Shetland. Allowance would need to be made for this additional time.

- The expanded catchment area with increased simultaneous calls will impair response to some time-critical calls, e.g. if the team are currently on an average call to Lochgilphead and are called out to Stranraer, they can probably be there in three hours, but if they were en route to Orkney, the response is likely to be much lengthier (around eight hours).

- Longer journeys will be more prone to transport and weather issues, with attendant delays.

- An expanded service will be more onerous for the staff. There will be increased risk of missions over-running shift changes and increased times involved in retrievals, and staff may then be less likely to respond to a ‘second mission’. Only a number of the consultants in the EMRS Team are able to respond to a simultaneous retrieval (e.g. those working outside NHS Greater Glasgow & Clyde are unlikely to be involved in a ‘second call’), so this burden is likely to fall on a small number of staff.

8.15 It is very difficult with current information to estimate simultaneous retrievals with any degree of accuracy. The analysis described gives a range of 30 to 60 such retrievals, with a midpoint of 45. This is the number of cases would likely to be missed under the national model in Option C. Given the uncertainty on this issue, it seems reasonable to use sensitivity tests for Option C with these different numbers of simultaneous retrievals that would be missed.

- Linear case – 30 retrievals missed, now called Option C1
- Midpoint case – 45 retrievals missed, now called Option C2
- Exponential case – 60 retrievals missed, now called Option C3.

8.16 All of this provided the following caseload for each of the options.

Table 8.1 Caseload for options

<table>
<thead>
<tr>
<th>Option</th>
<th>Number of cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0</td>
</tr>
<tr>
<td>B</td>
<td>207</td>
</tr>
<tr>
<td>C1</td>
<td>302</td>
</tr>
<tr>
<td>C2</td>
<td>287</td>
</tr>
<tr>
<td>C3</td>
<td>272</td>
</tr>
<tr>
<td>D</td>
<td>332</td>
</tr>
<tr>
<td>E</td>
<td>332</td>
</tr>
</tbody>
</table>

Source: DTZ
Staff costs

8.17 The following assumptions on staff costs for each of the options were made.

- Option A – Assumed to be zero, but a value to account for loss of staff time locally in dealing with transfers, including accompanying patients, would be needed. From the primary research, this seemed a significant burden to staff in all areas where EMRS did not operate and in the pilot area pre-EMRS. This is estimated in the sub section on additional costs/benefits later in this section.

- Option B – Used staff costs supplied for the pilot, but adjusted after discussions with the EMRS Team:
  - consultant hours seem to be running at 5.2 Whole Time Equivalent (WTE) and not 4.6;
  - cost of an Audit Paramedic seems to be £36,000 rather than £47,000; and
  - although the administrator is currently Band 4, the Team believes that the extent of the workload means that the future operation of the Service requires a Band 5.

- Option C – From discussions with the EMRS Team, it seems clear that an expanded service will require additional staff time to deal with a greater number of cases and serving all of Scotland. Consultant hours were estimated to be 6.4 WTE. The number of Registrars rose from 4 to 5. Audit Paramedic and Administrator costs were assumed to be the same.

- Option D – More staff time was considered to be necessary when expanding to two clinical teams. Consultant staff hours went to 8.9 WTE and 6 Registrars were felt to be required. Again, Audit Paramedic and Administrator costs remained the same as the Team believed that this level of staffing for these posts was adequate.

- Option E – Assumes two teams in two separate centres, so we simply doubled all staff costs from Option B.

8.18 This provides total staff costs for each of the options as shown below.

Table 8.2 Staff costs

<table>
<thead>
<tr>
<th>Option</th>
<th>Consultants</th>
<th>Registrars</th>
<th>Audit Paramedic</th>
<th>Administrator</th>
<th>Total staff costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>£0</td>
<td>£0</td>
<td>£0</td>
<td>£0</td>
<td>£0</td>
</tr>
<tr>
<td>B</td>
<td>£582,400</td>
<td>£331,600</td>
<td>£36,000</td>
<td>£35,000</td>
<td>£985,000</td>
</tr>
<tr>
<td>C1</td>
<td>£716,800</td>
<td>£414,500</td>
<td>£36,000</td>
<td>£35,000</td>
<td>£1,202,300</td>
</tr>
<tr>
<td>C2</td>
<td>£716,800</td>
<td>£414,500</td>
<td>£36,000</td>
<td>£35,000</td>
<td>£1,202,300</td>
</tr>
<tr>
<td>C3</td>
<td>£716,800</td>
<td>£414,500</td>
<td>£36,000</td>
<td>£35,000</td>
<td>£1,202,300</td>
</tr>
<tr>
<td>D</td>
<td>£996,800</td>
<td>£497,400</td>
<td>£36,000</td>
<td>£35,000</td>
<td>£1,565,200</td>
</tr>
<tr>
<td>E</td>
<td>£1,164,800</td>
<td>£663,200</td>
<td>£72,000</td>
<td>£70,000</td>
<td>£1,970,000</td>
</tr>
</tbody>
</table>

Source: DTZ
**Medical facilities**

8.19 The following assumptions were made on the costs of the various medical facilities in each of the options.

- **Option A** – Assumed no costs.
- **Option B** – Used the costs supplied for the pilot.
- **Option C and D** – For labs and pharmacy, assumed the same as Option B. The EMRS Team was confident that there would be no uplift for these elements, but that there would for medical physics, which was pro-rated by patient numbers.
- **Option E** – Assumed that the second centre would have the same labs and pharmacy as the first (doubled the pilot costs), with medical physics again pro-rated by patient numbers.

8.20 This provided the following costs for medical facilities.

**Table 8.3 Medical facilities costs**

<table>
<thead>
<tr>
<th>Option</th>
<th>Labs</th>
<th>Pharmacy</th>
<th>Medical Physics</th>
<th>Total medical facility costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>£0</td>
<td>£0</td>
<td>£0</td>
<td>£0</td>
</tr>
<tr>
<td>B</td>
<td>£8,200</td>
<td>£16,300</td>
<td>£5,100</td>
<td>£29,600</td>
</tr>
<tr>
<td>C1</td>
<td>£8,200</td>
<td>£16,300</td>
<td>£7,441</td>
<td>£31,941</td>
</tr>
<tr>
<td>C2</td>
<td>£8,200</td>
<td>£16,300</td>
<td>£7,071</td>
<td>£31,571</td>
</tr>
<tr>
<td>C3</td>
<td>£8,200</td>
<td>£16,300</td>
<td>£6,701</td>
<td>£31,201</td>
</tr>
<tr>
<td>D</td>
<td>£8,200</td>
<td>£16,300</td>
<td>£8,180</td>
<td>£32,680</td>
</tr>
<tr>
<td>E</td>
<td>£16,400</td>
<td>£32,600</td>
<td>£8,180</td>
<td>£57,180</td>
</tr>
</tbody>
</table>

Source: DTZ

**Accommodation, equipment and associated costs**

8.21 The following assumptions were made on the costs of the various accommodation, equipment and associated costs.

- **Option A** – Assumed no cost.
- **Option B** – Used the costs supplied by the pilot.
- **Option C** – Assumed that accommodation and capital charges would be the same. The EMRS Team believed that they could continue to run the Service with an augmented team at the helipad, although such accommodation is quite basic and may need to be upgraded in the future. Equipment, transport and communications and insurance was pro-rated based on the number of cases as further resources would be required for increased patient numbers.
- **Option D** – Following discussions with the EMRS Team, it was believed that moving to two teams would require investment in accommodation, although the extent of this would be dependent on the structuring of the
staff rota. To err on the side of caution, assumed a doubling of accommodation costs and capital charges. Equipment, transport and communications and insurance were again uplifted based on patient numbers.

- Option E – Assumed a doubling of costs from pilot as the same level of accommodation and capital charges will be required at the second centre. As with the other options, equipment, transport and communications and insurance were uplifted based on patient numbers

8.22 This provided the following costs for accommodation, equipment and associated costs.

### Table 8.4 Accommodation, equipment and associated costs

<table>
<thead>
<tr>
<th>Option</th>
<th>Accommodation</th>
<th>Capital charges (depreciation and interest)</th>
<th>Equipment</th>
<th>Transport &amp; Communications</th>
<th>Insurance</th>
<th>Total accommodation, equipment and associated costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>£0</td>
<td>£0</td>
<td>£0</td>
<td>£0</td>
<td>£0</td>
<td>£0</td>
</tr>
<tr>
<td>B</td>
<td>£8,500</td>
<td>£21,750</td>
<td>£50,000</td>
<td>£20,000</td>
<td>£6,800</td>
<td>£107,050</td>
</tr>
<tr>
<td>C1</td>
<td>£8,500</td>
<td>£21,750</td>
<td>£72,947</td>
<td>£29,179</td>
<td>£9,921</td>
<td>£142,296</td>
</tr>
<tr>
<td>C2</td>
<td>£8,500</td>
<td>£21,750</td>
<td>£69,324</td>
<td>£27,729</td>
<td>£9,428</td>
<td>£136,731</td>
</tr>
<tr>
<td>C3</td>
<td>£8,500</td>
<td>£21,750</td>
<td>£65,700</td>
<td>£26,280</td>
<td>£8,935</td>
<td>£131,166</td>
</tr>
<tr>
<td>D</td>
<td>£17,000</td>
<td>£43,500</td>
<td>£80,193</td>
<td>£32,077</td>
<td>£10,906</td>
<td>£183,677</td>
</tr>
<tr>
<td>E</td>
<td>£17,000</td>
<td>£43,500</td>
<td>£100,000</td>
<td>£40,000</td>
<td>£13,600</td>
<td>£214,100</td>
</tr>
</tbody>
</table>

Source: DTZ

**Drugs and consumables**

8.23 The following assumptions were made on the costs of drugs and consumables for each option.

- Option A – Assumed no costs.
- Option B – Used costs supplied by the pilot.
- Options C and D – Pro-rated costs based on patient numbers as an enhanced service was thought likely to require additional drugs and consumables to cover greater patient numbers.
- Option E – Assumed that the same level of drugs and consumables would be required at the new centre, so doubled the costs from the pilot.

8.24 This provided the following costs for drugs and consumables.
Table 8.5 Drugs and consumables costs

<table>
<thead>
<tr>
<th>Option</th>
<th>Drugs &amp; consumables</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>£0</td>
</tr>
<tr>
<td>B</td>
<td>£22,000</td>
</tr>
<tr>
<td>C1</td>
<td>£32,097</td>
</tr>
<tr>
<td>C2</td>
<td>£30,502</td>
</tr>
<tr>
<td>C3</td>
<td>£28,908</td>
</tr>
<tr>
<td>D</td>
<td>£35,285</td>
</tr>
<tr>
<td>E</td>
<td>£44,000</td>
</tr>
</tbody>
</table>

Source: DTZ

**Seminar and training**

8.25 The following assumptions were made on the provision of a seminar and training.

- Option A – Assumed no costs.
- Option B – Used costs supplied by the pilot.
- Option C and D – Assumed that the one national seminar would still be sufficient (same costs as the pilot), but that more training would be required and this was pro-rated by the number of patients.
- Option E – Assumed the no further seminars would be needed as the one seminar would cover the whole country, but that training costs would double.

8.26 This provided the following costs for seminar and training.

Table 8.6 Seminar and training costs

<table>
<thead>
<tr>
<th>Option</th>
<th>Annual seminar</th>
<th>Training</th>
<th>Total training and seminar costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>£0</td>
<td>£0</td>
<td>£0</td>
</tr>
<tr>
<td>B</td>
<td>£5,000</td>
<td>£24,000</td>
<td>£29,000</td>
</tr>
<tr>
<td>C1</td>
<td>£5,000</td>
<td>£32,097</td>
<td>£37,097</td>
</tr>
<tr>
<td>C2</td>
<td>£5,000</td>
<td>£30,502</td>
<td>£35,502</td>
</tr>
<tr>
<td>C3</td>
<td>£5,000</td>
<td>£28,908</td>
<td>£33,908</td>
</tr>
<tr>
<td>D</td>
<td>£5,000</td>
<td>£35,285</td>
<td>£40,285</td>
</tr>
<tr>
<td>E</td>
<td>£5,000</td>
<td>£48,000</td>
<td>£53,000</td>
</tr>
</tbody>
</table>

Source: DTZ

**Additional costs**

8.27 Assumptions were made based on additional costs faced by SAS under the options and other avoided costs (or benefits) that could be quantified. These avoided costs were in the areas of staff time saved in local areas and avoided transfers through the advice line.
8.28 It was clear during the primary research that one of the key benefits of EMRS was that local health professionals did not have to arrange a transfer and accompany a patient to a place of definitive care before returning home. The impact of such duties was very variable in terms of the type of staff that would have to do this and the time it would take them. As a proxy, it was assumed that this would be a GP and it would take them roughly the same time as it took an EMRS transfer from notification to completion of tasks, i.e. around seven hours or, approximately, one day.

8.29 A study of GP earnings by the NHS Information Centre calculated that contractor GP average earnings in Scotland in 2006-07 were £89,468\(^{23}\). This was uplifted by the Treasury’s GDP deflator, to take account of inflation, and rounded to £94,300 at current prices. This produced a figure of around £363 per day as the cost for a GP. Not having to deal with 207 cases meant that staff time saved was around £80,500. This was relative to Option B (additional savings £0), but there was a need to uplift for Options C, D and E to take account of the greater patient caseload.

**Scottish Ambulance Service costs**

8.30 Table 8.7 shows the total costs incurred by SAS while delivering the EMRS pilot over the 16-month period: 1 June 2008 to 30 Sept 2009. Data were provided by SAS, and built up from the costs of individual retrievals.

<table>
<thead>
<tr>
<th>Aircraft</th>
<th>Marginal Cost (Inc Opp Cost)</th>
<th>Fixed Charge Proportion</th>
<th>Total Cost</th>
<th>No of Responses</th>
<th>Average Cost per Response (Marginal Only)</th>
<th>Average Cost per Response (Total Cost)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EC135 Helicopter</td>
<td>£197,252</td>
<td>£172,724</td>
<td>£369,976</td>
<td>167</td>
<td>£1,181</td>
<td>£2,215</td>
</tr>
<tr>
<td>King Air Fixed Wing</td>
<td>£73,732</td>
<td>£67,533</td>
<td>£141,265</td>
<td>53</td>
<td>£1,391</td>
<td>£2,665</td>
</tr>
<tr>
<td>MOD / Coastguard</td>
<td>£332,268</td>
<td>£0</td>
<td>£332,268</td>
<td>52</td>
<td>£6,390</td>
<td>£6,390</td>
</tr>
<tr>
<td>Overall</td>
<td>£603,252</td>
<td>£240,257</td>
<td>£843,509</td>
<td>272</td>
<td>£2,218</td>
<td>£3,101</td>
</tr>
</tbody>
</table>

1. No of Responses excludes EMRS attendance at HEMS calls
2. Fixed Charge proportion is allocated on basis of aircraft cost divided by total hours flown multiplied by hours flown by EMRS on type

8.31 Applying this average retrieval cost to the estimated level of demand for each option by aircraft type, SAS estimate the following total annual delivery costs for air transport provision for EMRS.

Table 8.8 Estimated annual cost of EMRS air transport provision

<table>
<thead>
<tr>
<th></th>
<th>Estimated Activity</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0</td>
<td>£0</td>
</tr>
<tr>
<td>B</td>
<td>207</td>
<td>£617,888</td>
</tr>
<tr>
<td>C1</td>
<td>302</td>
<td>£976,185</td>
</tr>
<tr>
<td>C2</td>
<td>287</td>
<td>£927,699</td>
</tr>
<tr>
<td>C3</td>
<td>272</td>
<td>£879,213</td>
</tr>
<tr>
<td>D</td>
<td>332</td>
<td>£1,073,157</td>
</tr>
<tr>
<td>E</td>
<td>332</td>
<td>£1,025,870</td>
</tr>
</tbody>
</table>

8.32 Table 8.8 presents the gross annual cost to SAS. However, it is the marginal additional cost that is required to determine the order of preference between the options.

8.33 In the absence of EMRS, a number of patients would still be transferred by the SAS according to current operating practices. The current EMRS caseload was reviewed and locations and patients identified where normal SAS triage protocol had been changed.

8.34 There was some dispute between EMRS and SAS as to the number of EMRS retrievals that would have been undertaken by road in the absence of the EMRS service. This ranged from estimates of 8.7% up to 32% of cases. We have modelled based on the mid-point assumption that in 15% of cases the normal SAS triage protocol had been altered due to, for example, the clinical assessment of the EMRS team as to location of definitive care.

8.35 Therefore, 85% of EMRS cases would still be transferred by air in the absence of EMRS, and SAS would incur associated costs under Option A (no EMRS service). This fits with the rationale for EMRS that it is upgrading the level of service for emergency patients by providing consultant support, rather than identifying new target patient groups.

8.36 There are three key effects to be considered when estimating the SAS costs associated with the options. These are:

- The costs of delivering the modelled EMRS activity. This is calculated as per Table 8.7, above, and varies with patient numbers.

- Total demand for EMRS is estimated at 332 nationally. Therefore, under non-national options, SAS will be transferring a number of cases that are assumed to be retrieved by EMRS under Options D and E. SAS estimates the average cost for non-EMRS air retrievals at about £2,000, a third lower than the EMRS retrieval average (although this rate was disputed by the EMRS team as being too low). Potential national demand for the EMRS is estimated at 332 cases. This activity is estimated to cost SAS £564,400 (332 cases * 85% still transferred by air * £2,000 per transfer) under Option A. SAS also incurs costs for these patients under options B and C, though to a lesser extent.
• In addition, it has been estimated that the EMRS advisory service has resulted in an estimated 28 avoided retrievals during the pilot under option B, although this is debated by SAS. With these cases, normal local procedure would be to contact SAS (perhaps after consultation with local clinicians where available) and arrange triage to definitive care. Following EMRS advice, these patients were retained in local units, rather than being transferred. Using the estimated £2,000 average per air retrieval gives a cost of £56,000 (28 * £2,000) avoided under Option B. Moving to national EMRS delivery, this level of avoided transfers is anticipated to increase to 45 per annum, or a potential saving of £90,000 to SAS against current costs. This cost would have been incurred under Option A in the absence of EMRS.

8.37 Total estimated costs and savings for SAS under each option are presented in Table 8.9, overleaf. However, it must be acknowledged that the cost of air retrievals, both for EMRS and non-EMRS, can vary significantly due to aircraft availability, flight time, weather conditions etc. During the EMRS pilot, costs of individual retrievals ranged from £400 to £15,000. Therefore, it is very difficult to make an exact estimate of total associated costs for new cases.

8.38 SAS has raised concerns that they do not have sufficient capacity to sustain delivery of Options C, D or E unless a new aircraft is purchased. A fifth air resource for SAS is estimated to cost about £2 million per annum. This offers a real potential barrier to delivery of EMRS and is discussed further in the report. However, the cost of the new air resource is related to the total activity of SAS, rather than being entirely attributable to EMRS. The total cost of the new air resource is therefore not included within the value for money calculation for the Service.

8.39 Due to the disagreements between SAS and EMRS on these issues, the Research Team has had to make an objective assessment as to where the weight of the evidence lies. Although there are serious disagreements about some of the detail, we do not believe that this affects the overall appraisal of the options, most importantly, the relative positioning of the options against each other.
Table 8.9 Additional Costs and Savings

<table>
<thead>
<tr>
<th>Option</th>
<th>Estimated EMRS activity</th>
<th>Estimated SAS cost of EMRS activity</th>
<th>Estimated un-met EMRS demand (based on national demand of 332)</th>
<th>Est. SAS transfer costs of un-met EMRS demand</th>
<th>Total estimated costs to SAS (cost of EMRS + un-met demand)</th>
<th>Marginal cost uplift for each option</th>
<th>Avoided SAS retrievals due to EMRS advisory</th>
<th>Estimated cost saving to SAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0</td>
<td>£0</td>
<td>332</td>
<td>£564,400</td>
<td>£564,400</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>B</td>
<td>207</td>
<td>£617,888</td>
<td>125</td>
<td>£212,500</td>
<td>£830,388</td>
<td>28</td>
<td>-£56,000</td>
<td>-£56,000</td>
</tr>
<tr>
<td>C1</td>
<td>302</td>
<td>£976,185</td>
<td>30</td>
<td>£51,000</td>
<td>£1,027,185</td>
<td>41</td>
<td>-£82,000</td>
<td>-£82,000</td>
</tr>
<tr>
<td>C2</td>
<td>287</td>
<td>£927,699</td>
<td>45</td>
<td>£76,500</td>
<td>£1,004,199</td>
<td>39</td>
<td>-£78,000</td>
<td>-£78,000</td>
</tr>
<tr>
<td>C3</td>
<td>272</td>
<td>£879,213</td>
<td>60</td>
<td>£102,000</td>
<td>£981,213</td>
<td>37</td>
<td>-£74,000</td>
<td>-£74,000</td>
</tr>
<tr>
<td>D</td>
<td>332</td>
<td>£1,073,157</td>
<td>0</td>
<td>£0</td>
<td>£1,073,157</td>
<td>45</td>
<td>-£90,000</td>
<td>-£90,000</td>
</tr>
<tr>
<td>E</td>
<td>332</td>
<td>£1,025,870</td>
<td>0</td>
<td>£0</td>
<td>£1,025,870</td>
<td>45</td>
<td>-£90,000</td>
<td>-£90,000</td>
</tr>
</tbody>
</table>

Total costs

8.40 In Table 8.10, all of the costs are summarised to give a total cost for each option. Staff costs are over 67-73% of total costs under each of the ‘service continuing’ options (Options B to E).

Table 8.10 Total costs

<table>
<thead>
<tr>
<th>Option</th>
<th>Staff costs</th>
<th>Medical facilities costs</th>
<th>Accommodation, equipment &amp; associated costs</th>
<th>Drugs &amp; consumables</th>
<th>Seminar &amp; training</th>
<th>Additional costs/savings</th>
<th>Total costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>£0</td>
<td>£0</td>
<td>£0</td>
<td>£0</td>
<td>£0</td>
<td>£80,500</td>
<td>£80,500</td>
</tr>
<tr>
<td>B</td>
<td>£985,000</td>
<td>£29,600</td>
<td>£107,050</td>
<td>£22,000</td>
<td>£29,000</td>
<td>£209,908</td>
<td>£1,382,638</td>
</tr>
<tr>
<td>C1</td>
<td>£1,202,300</td>
<td>£31,941</td>
<td>£142,296</td>
<td>£32,097</td>
<td>£37,097</td>
<td>£346,329</td>
<td>£1,792,059</td>
</tr>
<tr>
<td>C2</td>
<td>£1,202,300</td>
<td>£31,571</td>
<td>£136,731</td>
<td>£30,502</td>
<td>£35,502</td>
<td>£332,784</td>
<td>£1,769,391</td>
</tr>
<tr>
<td>C3</td>
<td>£1,202,300</td>
<td>£31,201</td>
<td>£131,166</td>
<td>£28,908</td>
<td>£33,908</td>
<td>£319,238</td>
<td>£1,746,722</td>
</tr>
<tr>
<td>D</td>
<td>£1,565,200</td>
<td>£32,680</td>
<td>£185,677</td>
<td>£35,285</td>
<td>£40,285</td>
<td>£373,420</td>
<td>£2,230,547</td>
</tr>
<tr>
<td>E</td>
<td>£1,970,000</td>
<td>£57,180</td>
<td>£214,100</td>
<td>£44,000</td>
<td>£53,000</td>
<td>£326,133</td>
<td>£2,664,413</td>
</tr>
</tbody>
</table>

Source: DTZ
Value for Money Assessment

**Cost per case**

8.41 Analysis of cost per case is outlined in Table 8.11.

**Table 8.11 Cost per case**

<table>
<thead>
<tr>
<th>Option</th>
<th>No. of cases</th>
<th>Cost</th>
<th>Cost per case</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0</td>
<td>£80,000</td>
<td>-</td>
</tr>
<tr>
<td>B</td>
<td>207</td>
<td>£1.4 million</td>
<td>£6,679</td>
</tr>
<tr>
<td>C1</td>
<td>302</td>
<td>£1.8 million</td>
<td>£5,934</td>
</tr>
<tr>
<td>C2</td>
<td>287</td>
<td>£1.8 million</td>
<td>£6,165</td>
</tr>
<tr>
<td>C3</td>
<td>272</td>
<td>£1.7 million</td>
<td>£6,422</td>
</tr>
<tr>
<td>D</td>
<td>332</td>
<td>£2.2 million</td>
<td>£6,719</td>
</tr>
<tr>
<td>E</td>
<td>332</td>
<td>£2.7 million</td>
<td>£8,025</td>
</tr>
</tbody>
</table>

8.42 Table 8.10 also shows that, for Options B, C and D, the cost per case are all quite similar at around £6,000 - £7,000. This is the high end of the initial estimate of the EMRS Team of what the Service would cost. The cost per case is lower for Option C, regardless of the sub-options. The cost per case for Option D is also approximate to that of the current pilot. The cost per case for Option E is over £1,000 more expensive than in the pilot.

**Analysis of incremental costs**

**Total costs**

8.43 In Table 8.12, we provide details on the costs per case and the incremental costs. The incremental costs provide the estimate of the additional cost of each option compared to its predecessor, e.g. Option B is £1.4 million higher than Option A and Option C1 is around £400,000 higher than Option B. The different variants of Option C have incremental costs in relation to Option B and Option D has a range of incremental costs depending on the variants of Option C.

**Table 8.12 Incremental costs**

<table>
<thead>
<tr>
<th>Option</th>
<th>Cost per case</th>
<th>Incremental cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>B</td>
<td>£6,679</td>
<td>£1,302,138</td>
</tr>
<tr>
<td>C1</td>
<td>£5,934</td>
<td>£409,421</td>
</tr>
<tr>
<td>C2</td>
<td>£6,165</td>
<td>£386,753</td>
</tr>
<tr>
<td>C3</td>
<td>£6,422</td>
<td>£364,084</td>
</tr>
<tr>
<td>D</td>
<td>£6,719</td>
<td>£438,888 - £483,825</td>
</tr>
<tr>
<td>E</td>
<td>£8,025</td>
<td>£433,866</td>
</tr>
</tbody>
</table>

Source: DTZ

8.44 Under this analysis, approximately, it would cost at least an additional £360,000 to extend EMRS from its current operation to cover the whole of Scotland (the lowest incremental change of the Option C sub-options). The incremental cost of then moving up to two teams/centres is around £400,000 to £500,000 for each subsequent stage (Options D and E).
**Costs per case**

8.45 The incremental costs per case are based on comparing the change in costs relative to the change in the number of cases in each option. This is illustrated in Table 8.13.

**Table 8.13 Incremental costs per case**

<table>
<thead>
<tr>
<th>Option</th>
<th>Total cost (1)</th>
<th>Incremental cost (2)</th>
<th>Total cases (3)</th>
<th>Incremental cases (4)</th>
<th>Incremental Cost per Case (5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>£80,500</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>B</td>
<td>£1,382,638</td>
<td>£1,302,138</td>
<td>207</td>
<td>207</td>
<td>£6,291</td>
</tr>
<tr>
<td>C1</td>
<td>£1,792,059</td>
<td>£409,421</td>
<td>302</td>
<td>95</td>
<td>£4,310</td>
</tr>
<tr>
<td>C2</td>
<td>£1,769,391</td>
<td>£386,753</td>
<td>287</td>
<td>80</td>
<td>£4,634</td>
</tr>
<tr>
<td>C3</td>
<td>£1,746,722</td>
<td>£364,084</td>
<td>272</td>
<td>65</td>
<td>£5,601</td>
</tr>
<tr>
<td>D</td>
<td>£2,230,547</td>
<td>£438,888</td>
<td>332</td>
<td>30-60</td>
<td>£8,064-£14,616</td>
</tr>
<tr>
<td>E</td>
<td>£2,664,413</td>
<td>£433,866</td>
<td>332</td>
<td>n/a</td>
<td>n/a</td>
</tr>
</tbody>
</table>

Source: DTZ

8.46 The additional cost per extra case is lowest for Option C, followed by Option B. The additional cost per extra case in Option D is higher, especially if the simultaneous retrievals are at the low end of our estimates. It is not possible to calculate an incremental cost per additional case in Option E since there are no extra cases.

**Costs per score**

8.47 The assessment of the qualitative benefits of the options, from the scoring and weighting exercise, can be combined with the costing information to obtain a more rounded assessment of the options.

8.48 Table 8.14 shows the change in costs relative to the change in scores. This provides an indication of how much extra it costs to secure a measure of extra benefit.

**Table 8.14 Incremental costs per score**

<table>
<thead>
<tr>
<th>Option</th>
<th>Total cost (1)</th>
<th>Incremental cost (2)</th>
<th>Scores (3)</th>
<th>Incremental scores (4)</th>
<th>Incremental costs per change in score (5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>£80,500</td>
<td>-</td>
<td>1.7</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>B</td>
<td>£1,382,638</td>
<td>£1,302,138</td>
<td>2.9</td>
<td>1.2</td>
<td>£1,085,115</td>
</tr>
<tr>
<td>C1</td>
<td>£1,792,059</td>
<td>£409,421</td>
<td>3.1</td>
<td>0.2</td>
<td>£2,047,107</td>
</tr>
<tr>
<td>C2</td>
<td>£1,769,391</td>
<td>£386,753</td>
<td>3.1</td>
<td>0.2</td>
<td>£1,933,763</td>
</tr>
<tr>
<td>C3</td>
<td>£1,746,722</td>
<td>£364,084</td>
<td>3.1</td>
<td>0.2</td>
<td>£1,820,419</td>
</tr>
<tr>
<td>D</td>
<td>£2,230,547</td>
<td>£438,888</td>
<td>3.4</td>
<td>0.3</td>
<td>£1,461,625-£1,612,751</td>
</tr>
<tr>
<td>E</td>
<td>£2,664,413</td>
<td>£433,866</td>
<td>3.5</td>
<td>0.1</td>
<td>£4,338,661</td>
</tr>
</tbody>
</table>

Source: DTZ
8.49 The final column of this table suggests that the incremental costs of achieving successive improvements in the Service rise quite sharply. The benefit scoring is obviously a rather ‘broad brush’ method, and it suggests that the incremental cost relative to the additional benefits of moving to national coverage with an augmented team (Option C), or moving to national coverage with two teams (Option D) is quite similar. However, moving from Option D to Option E seems to offer very poor value for money. It offers very little improvement in the benefit score while involving significant additional costs.

**Costs per QALY (Quality Adjusted Life Year)**

8.50 Cost per QALY provides an indication of cost effectiveness. Section 5 demonstrated a range of QALY-per-patient outcomes achieved during the West of Scotland pilot. Pro-rating this to the number of patients predicted under each delivery option gives an estimate of total QALYs that might be achieved. As referenced in Section 5, NICE indicates a level of £20-30,000 per QALY achieved represents good value for money.

8.51 Table 8.15 illustrates the cost per QALY estimated for each delivery option under three QALY scenarios: low, medium and high. This reflects the range of QALY estimates generated due to difficulties with exact measurement. The following assumptions are made for the QALY scenarios.

- Low = 0.47 QALYs per patient
- Medium = 1.5 QALYs per patient
- High = 3.5 QALYs per patient.

**Table 8.15 Costs per QALY**

<table>
<thead>
<tr>
<th>Option</th>
<th>Total cost</th>
<th>Total QALYs</th>
<th>Cost per QALY</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>QALY scenario</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Low</td>
<td>Medium</td>
<td>High</td>
</tr>
<tr>
<td>A</td>
<td>£80,500</td>
<td>-</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>B</td>
<td>£1,382,638</td>
<td>207</td>
<td>97</td>
<td>311</td>
</tr>
<tr>
<td>C1</td>
<td>£1,792,059</td>
<td>302</td>
<td>142</td>
<td>453</td>
</tr>
<tr>
<td>C2</td>
<td>£1,769,391</td>
<td>287</td>
<td>135</td>
<td>431</td>
</tr>
<tr>
<td>C3</td>
<td>£1,746,722</td>
<td>272</td>
<td>128</td>
<td>408</td>
</tr>
<tr>
<td>D</td>
<td>£2,230,547</td>
<td>332</td>
<td>156</td>
<td>498</td>
</tr>
<tr>
<td>E</td>
<td>£2,664,413</td>
<td>332</td>
<td>156</td>
<td>498</td>
</tr>
</tbody>
</table>

Source: DTZ
8.52 In terms of QALY outcomes, the following conclusions can be drawn.

- Options D and E offer the highest total QALYs, therefore, the best overall clinical outcomes. This is because these options have the highest potential number of retrievals.

- Option C, regardless of which sub option is chosen, offers the lowest estimated cost per QALY, therefore the best value in terms of clinical outcomes achieved. However, there is very little variance between Options B, C and D in cost per QALY terms under the medium and high QALY scenarios. This is particularly significant given the uncertainty around measurement of exact clinical outcomes, therefore, cost per QALY alone is not a sufficient measure upon which to base the selection of the preferred option.

- The order of preference between options is the same, regardless of the QALY scenario adopted.

- Besides Option A, each option, under each QALY scenario, achieves an estimated cost per QALY that is within the NICE threshold of £20,000 per QALY and can be taken as representing good value for money.

Conclusions

8.53 The five options selected for further analysis show incremental change, which is useful in our cost benefit analysis in helping to set out the relative merits of each option as the extent of EMRS is enhanced with successive steps.

8.54 Around 70% of costs will be staff under each of the options. Around 10% will be accommodation, equipment and other associated costs. Other elements will have a minimal contribution to overall costs.

8.55 It would cost at least an additional £360,000 to extend EMRS to the whole of Scotland. The incremental cost of then moving up to two teams/centres is around £400,000 to £500,000 for each subsequent stage (Options D and E).

8.56 For Options B, C and D, the cost per case are all quite similar at around £6,000 to £7,000. This is the high end of the initial estimate of the EMRS Team of what the Service would cost. The cost per case is lowest for Option C, regardless of the sub-options. It is also lower than the pilot for Option D, but over £1,000 per case higher for Option E.

8.57 Analysis of incremental costs per extra case also favours Option C. The additional cost per extra case in Option D is higher, especially if the number of simultaneous retrievals is at the low end of our estimates.

8.58 Analysis of incremental cost per score suggests that the incremental cost relative to the additional benefits of moving to national coverage with an augmented team (Option C), or moving to national coverage with two teams (Option D) is quite similar. However, moving from Option D to Option E seems to offer very poor value for money.
8.59 Option C, regardless of which sub option is chosen, offers the lowest estimated cost per QALY, therefore the best value in terms of clinical outcomes achieved. However, there is very little variance between Options B, C and D in cost per QALY terms under the medium and high QALY scenarios.

8.60 The analysis of costs and value for money figures implies that:

- the current service focused in the West of Scotland offers good value for money;
- extending the service to the whole of remote and rural Scotland (Option C) also seems to offer good value;
- establishing a second team in one centre (Option D) may also offer good value, but looks, on this analysis, to be less value for money compared with Option C; and
- extending the service to two centres probably offers poor value since it does not enable any extra patients to be seen, compared to Option D, and costs are substantially higher.
9 RISK ASSESSMENT

- A risk assessment for each of the options was carried out.

- The main risks of Option A are in worsening patient outcomes. Additional investment in alternative provision is also likely to be needed to combat this option’s risks.

- The risks of Option B seem largely manageable, based on the evidence from the pilot, but Option C has significant risks, especially around the issue of simultaneous retrievals and its likely knock-on effects on performance of the Service and staff workload and morale.

- Options D and E are able to deal with the riskier elements in Option C, but may present a number of risks, including staff recruitment, affordability and under utilisation of the Service.

9.1 As recommended in the Green Book, all option appraisal exercises should have a risk assessment to identify, assess and control risks that emerge during the course of a programme. This should include measures to mitigate against these risks. Such measures may not provide a definitive solution but are suggestions as to how the risk can be reduced or managed.

9.2 The full risk matrix for each option is provided in Appendix C. The risks for each of the options have been ranked, i.e. starting with those judged to have the highest probability of occurring and the greatest potential impact.

9.3 These risks are summarised and discussed in this section.

Summary of key risks for each option

9.4 Table 9.1 highlights the key risks for each of the options.
Table 9.1 Risk matrix of key risks for each option

<table>
<thead>
<tr>
<th>Option</th>
<th>Main risks</th>
</tr>
</thead>
</table>
| A      | 1. Rise in patient deaths  
        | 2. Poorer patient outcomes  
        | 3. Ineffective triage  
        | 4. Loss of health professional time in dealing with transfers |
| B      | 1. Loss of key staff  
        | 2. Rise in case workload |
| C      | 1. Loss of key staff  
        | 2. Rise in simultaneous transfers  
        | 3. Rise in case workload  
        | 4. Increase in SAS resource requirements |
| D      | 1. Increase in SAS resource requirements  
        | 2. Under utilisation of the Service  
        | 3. Ability to recruit sufficient staff  
        | 4. Affordability/level of funding required |
| E      | 1. Under utilisation of the Service  
        | 2. Affordability/level of funding required  
        | 3. Increase in SAS resource requirements  
        | 4. Ability to recruit sufficient staff |

9.5 It seems clear that under Option A that patient outcomes are likely to worsen and this is the key concern about disbanding EMRS. Triage is also likely to be ineffective, with patients being transferred to two or more hospitals before reaching definitive care and local health professionals will lose time in arranging transfers and accompanying patients.

9.6 It is also clear that investment into some form of alternative provision would be required in the absence of EMRS, e.g. around staff training, local resourcing and investment in air and land ambulances so that the more serious impacts are avoided.

9.7 Although there are risks for Option B, they do seem more manageable to those present in the other options because the Service has largely been able to deal effectively with these risks over the pilot period. The main risks are probably around losing key staff, as EMRS to date is dependent on a small group of dedicated staff, and the likely rise in case workload over the next three to five years as the Service becomes more established.

9.8 Option C seems to be the ‘riskiest’ option in some respects, particularly around the issue of simultaneous retrievals and the knock-on impact of this in terms of the ability to deliver the Service, as it is likely to be operating at near maximum capacity for a lot of the time, and local perceptions (and perhaps use) of the Service if it is seen to have poorer response times than the pilot. Pressure on staff in terms of workload may also see issues emerge of recruiting and retaining staff. There is also likely to be pressures on SAS to resource the rise in patient numbers, particularly for EMRS retrievals that take twice as long as normal transfers. SAS believe that providing national EMRS coverage would mean that it would need additional air resources in order to meet this demand and increasing demand for other services. The EMRS Team of consultants are of the opinion that Option C would stretch their ability to deliver the Service to the extent that most of them would not participate in
its future delivery. More consultants could obviously be recruited, but it would be potentially deleterious for the Service if this was to happen and its ability to continue to operate must therefore be open to question.

9.9 Option D is able to deal with many of the downsides of Option C by expanding the capacity of the Service. However, its main risks will be around staff recruitment as more staff will have to be recruited from the West of Scotland, and the likely under utilisation of the Service, which means that it is likely that there will be inefficient utilisation of key hospital staff unless steps are taken to explore extending the Service into other areas, which will also bring risks in terms of the scope of the Service being seen as being pushed out by local health professionals who then become more concerned about de-skilling. It may also be an expensive way of delivering medical services for people who are not acutely ill or injured. Other key risks for this option are the ability to recruit sufficient staff to run the Service and its affordability, given the increase in resource requirements in comparison with the current pilot, as well as the additional air resource that SAS believes will be needed.

9.10 Option E has similar risks to D, except they are probably more acute. It is, again, able to deal with many of the downsides of Option C by expanding the capacity of the Service. However, one of the main risks will be around staff recruitment, which is likely to be much more difficult as the service in the North will only be able to draw from one or two hospitals (e.g. Aberdeen and/or Inverness), whereas the Service in the West can draw from seven. It could attempt to deal with this through use of secondments from elsewhere in Scotland. The likely under utilisation of the Service, especially in the North, where there is a similar sized team but fewer cases is also likely to be an issue and could lead to inefficient utilisation of key hospital staff unless steps are taken to explore extending the Service into other areas, which will also bring risks in terms of the scope of the Service being seen as being pushed out by local health professionals, who become more concerned about de-skilling. It may also be an expensive way of delivering medical services for people who are not acutely ill or injured. Another mitigation strategy could be having fewer staff in the North, but that may increase the risk of simultaneous retrievals and it may also be viewed then as an inferior service to that provided in the West. This option also requires a substantial increase in funding compared to the current pilot and will stretch the resources of SAS.

Responses from Health Boards

9.11 Having carried out a full risk appraisal using Green Book guidelines, it was also important to consult with each of the relevant health boards to gather their general views on the service and also to identify risks associated with each of the options. A questionnaire was sent out to the following health boards.
Table 9.2 Health boards involved in the questionnaire

<table>
<thead>
<tr>
<th>Health Board</th>
<th>Response Received</th>
</tr>
</thead>
<tbody>
<tr>
<td>NHS Ayrshire and Arran</td>
<td>✓</td>
</tr>
<tr>
<td>NHS Dumfries and Galloway</td>
<td>✓</td>
</tr>
<tr>
<td>NHS Grampian</td>
<td>✓</td>
</tr>
<tr>
<td>NHS Greater Glasgow and Clyde</td>
<td>✓ (no comments)</td>
</tr>
<tr>
<td>NHS Highland</td>
<td>✓</td>
</tr>
<tr>
<td>NHS Orkney</td>
<td>✓</td>
</tr>
<tr>
<td>NHS Shetland</td>
<td>✓</td>
</tr>
<tr>
<td>NHS Tayside</td>
<td>✓</td>
</tr>
<tr>
<td>NHS Western Isles</td>
<td>No response received</td>
</tr>
</tbody>
</table>

Views on the EMRS pilot service

9.12 Overall, the majority of health boards offering a response on the one year pilot service were positive.

- Clinical advice and feedback was greatly appreciated. Health boards found it useful to have access to a highly skilled professional.

- It was felt that EMRS delivered improved outcomes and, consequently, helped save lives, although there was no consensus over the degree of improvements.

- The consensus was that EMRS offered a high quality specialised service in remote areas of Scotland.

- EMRS also helped to reduce pressure on the local health sector workforce.

- When health boards were asked about the EMRS in terms of processes (e.g. the working of the service in terms of the advice provided, dispatch times and availability), four out of seven that responded thought that they were either ‘good’ or ‘very good’.

9.13 However, each health board also raised concerns over the Service. Some of these related to local factors and circumstances, but a number were more general. These correspond to the risks identified earlier in this section.

- Concerns were raised over the costs of the service. Of those health boards that responded, four ‘did not know’ whether the Service offered value for money.

- Issues were raised over staff de-skilling. Some health boards felt that the Service might affect the recruitment and retention of GPs staffing remote community hospitals.

- There were mixed views on clinical outcomes. A number of health boards could not comment on the EMRS impact on clinical outcomes. When asked ‘What are your views of the Service in terms of Outcomes for Patients?’, four health boards responded either ‘don’t know’ or ‘neither good nor poor’, while three responded ‘good’ or ‘very good’.
Views on the preferred option

9.14 In terms of the preferred option for taking EMRS forward, responses were mixed. All health boards that responded felt that the service should continue although there were differing views about which option would be most effective. Most health boards agreed that an extended service offering a wider geographical coverage would be more equitable, although issues were raised over the response times and additional costs.

9.15 Overall, preferences were given to options D and E. While it was acknowledged that these options were the most expensive, it was also felt that they would offer a more equitable service. Many health boards, however, did recognise that not enough information was available on clinical outcomes to understand fully the benefits of EMRS and, as a result, the preferred option identified were only ‘best estimates’.

9.16 Responses from the health boards were supportive of a continued EMRS, but it was also stressed that the Service should not be developed in isolation. Integration with other specialist services, such as paediatrics and neonatal, should be fully explored.

Conclusions

9.17 Based purely on the risk analysis, Option B is the easiest to deliver as the pilot has not highlighted any serious risks that could not be handled. There are clearly substantial risks for Option A, especially in terms of patient outcomes. To mitigate against these outcomes, it is also likely to require additional investment in local and ambulance services.

9.18 Option C has high levels of risks, particularly around the issue of simultaneous retrievals, case workload and staff retention, and the knock-on impacts of this in terms of the ability to deliver an effective service. SAS also believes that a national service requires them to receive additional air resources.

9.19 Options D and E are able to deal with many of the downsides of Option C by expanding the capacity of the Service, apart from additional resourcing requirements for SAS. However, their main risks will be around staff recruitment and the likely under utilisation of the Service, which means that it is likely that there will be inefficient utilisation of key hospital staff unless steps are taken to explore extending the Service into other areas. These are particular problems for Option E, as the North is likely to have a lower pool of staff from which to recruit and far fewer cases than in the North. Better co-ordination of services between the centres in the West and the North, or re-drawing the boundaries so that case loads are more even may help to tackle this, but problems of under utilisation on a two team model look likely. The higher level of annual funding required for both of these larger service options is also likely to be a key risk in terms of acquiring or maintaining funding for an EMRS at this kind of level, particularly given the likely tighter public sector financial settlement in Scotland in the next few years. This is a particularly high risk for Option E given the level of the funding commitment required.
10 ADDITIONAL DATA

10.1 Since the evaluation period finished in June 2009, EMRS has continued to be delivered by the EMRS Team. They have provided further data of the operation of the Service since this point up until early November, i.e. a period of around five months.

10.2 Although this is outside the evaluation period, there have been some significant changes in terms of caseload and simultaneous retrievals that will need to be reflected on before the final conclusions and recommendations. However, this report cannot analyse these cases in any detail given that they occurred outside the scope of the study.

10.3 In the period of around five months, there were 104 retrieval missions carried out by the EMRS Team (92 secondary and 12 primary). If reflected over a one year period, this would imply a demand for the West of Scotland pilot of 250, higher than the 225 from the demand assessment in the first year concluded in Section 5. This is a rate of around 1.57 per annum, which is above our high end estimate of 1.41. If extrapolated for the whole of remote and rural Scotland over the evaluation period, this would see the EMRS Team undertake around 384 retrievals.

10.4 Figures on simultaneous retrievals are also now running considerably higher, up from our estimated level of 18, based on the one-year evaluation period, to an actual level of 25 for the first full year of data on simultaneous retrievals (November 2008 to November 2009). Based on our calculations in Section 8, this could see the range of simultaneous retrievals for Option C increase to 40-80 cases (from 30-60) where patients would be missed.

10.5 DTZ worked with the EMRS Team to calculate whether, with a full year of data now from simultaneous retrievals, the relationship between missions and number of simultaneous retrievals could be estimated more reliably.

10.6 The attempt to so this is illustrated in Figure 10.1. However, the relationship between mission hours and simultaneous calls is not that linear, or clear.
10.7 As the figure above shows, the number of simultaneous retrievals is not that well correlated with active mission hours. For instance, there have been relatively high number of simultaneous retrievals in months with relatively low number of mission hours (e.g. August 09), and relatively low number of simultaneous retrievals in months with high mission hours (e.g. January 09).

10.8 The R squared statistic, or coefficient of determination, a measure of how well future outcomes are likely to be predicted by the model, is only 0.3, a poor fit. This means that the model is much more likely to be ‘wrong’ than it is to be ‘right’ for any future period.

10.9 It is likely that this is because there are other variables that impact on the number of simultaneous calls received during a month, particularly location of calls and time of calls (as activation times are not normally distributed).

10.10 Nevertheless, taking this model and basing mission hours on the assumption derived from EMRS statistics, that the average length of time for West cases is seven hours and ten hours for cases in the North. Based on our national model, demand would be 225 cases in the West and 107 in the North, i.e. 2,645 mission hours. This is around 220 cases per month. Taking the above equation, \( y = 12.5x + 115 \), or:

- No. simultaneous calls = \((220-115)/12.5 = 8\) per month. This would translate into 96 cases per year.
10.11 This model is not sufficiently rigorous to provide a reliable estimate of simultaneous retrievals. Instead, attempts should be made to develop the concept behind the model. As the appraisal has found the level of simultaneous retrievals to be a significant factor in determination of the preferred option, particularly the sustainability of the Service around Option C, the development of a valid statistical model is important for any future monitoring and viability work.

10.12 One suggestion would be to develop a model that contains more variables in an effort to improve predictive accuracy and statistical reliability. It would seem that a form of logistic regression, which can support ordinal as well as time interval data, would possibly be the best way forward. More data points would be required to support this type of modelling to improve its robustness, i.e. more months of data.

10.13 It does seem appropriate to increase the high end estimate of simultaneous retrievals though to 96. At this level, it is likely that just under 30% of cases would be ‘missed’ because they were occurring simultaneously and the EMRS Team would lack the capacity to cope under Option C.

10.14 The reasons for these uplifts since the end of the evaluation period are not clear and it is not possible to undertake detailed analysis on the additional data to attempt to determine the reasons. It could be a blip, but it may also reflect the Service becoming better established at a quicker rate than the Argyll & Bute pilot and the caseload gradually rising to reflect this.
11 OVERALL CONCLUSIONS AND RECOMMENDATIONS

11.1 The research was in two parts, running in parallel.

1. An evaluation of EMRS over a one-year period

2. An appraisal of options for the future delivery of the Service.

Evaluation

11.2 The Service has a clear rationale in terms of providing emergency care to critically ill or injured people in remote and rural parts of Scotland. Given the lack of comparability with air medical retrieval services elsewhere and the lack of rigorous, prospective randomised trials, the international literature by itself does not provide conclusive proof of the need for an EMRS-type service, but it does offer some support of the importance of initial medical care and expertise in improving patient outcomes. Air medical retrievals appear to be most effective when they are provided in a timely manner, are directed to the appropriate facility and are appropriate to the type of patient and situation.

11.3 In terms of the overall evaluation of the Service, our results are, generally, very positive.

11.4 During the evaluation period, activity was slightly higher than expected and patients were retrieved across the whole of the West of Scotland.

11.5 Medical conditions were varied, but acuity was generally high and, as a result, advanced medical interventions were required during transfer. There appears to be strong evidence to justify the need for EMRS involvement in the vast majority of cases.

11.6 Response times were relatively good: they have improved since the original Argyll & Bute service began.

11.7 On the whole, the Service was well-received among health professionals, health boards and patient representatives. In particular, it was seen as improving patient outcomes and helping to take pressure off local staff from having to deal with acute emergency cases.

11.8 There appear to be a few areas in which improvements could be made. One particular area requiring improvement was highlighted throughout the primary research. There are a number of non-critical care retrievals and, although relatively small in number, they may represent a very expensive way of getting expert care to a patient who does not specifically need it. It may also serve to concern local health professionals that EMRS is undertaking non-critical work. We understand that EMRS cases are all different and that prescriptive guidance, in these circumstances, could be a hindrance and may even carry risk in that cases are missed. However, we recommend that EMRS draws revised guidance and training material that takes account of these concerns, which is not overly prescriptive, to inform local health professionals of the circumstances in which EMRS should be called. Cases should also be
audited afterwards, perhaps by the EMRS Team or independent medical consultants, to determine that the Service continues to be used appropriately. This may minimise the number of non-critical retrievals as well as allay concerns of local health professionals. In marginal dispatch cases, it may also be of value to have a second opinion over the need to dispatch if this is possible, perhaps a second EMRS team member.

Appraisal

11.9 It would cost at least an additional £360,000 to extend EMRS from the current position (option B) to the whole of Scotland (Option C). The incremental cost of then moving up to two teams (Option D) is around £400,000 (a total of £800,000 from current position) and to two centres (Option E) £400,000 (a total of £1.2 million).

11.10 In terms of cost per case, these are quite similar for Options B, C and D at around £6,000 to £7,000. This is the high end of the initial estimate of the EMRS Team of what the Service would cost. The cost per case is lower for Option C, regardless of the sub-options. It is also lower than the current pilot in Option D, but Option E is over £1,000 higher than the pilot.

11.11 Analysis of value for money in terms of incremental costs and cost per QALY support Option C, although do not rule out Options B or D. Option E, however, appears to offer poor value for money. Evidence from the literature, although limited, also suggests that an EMRS is likely to be cost effective.

11.12 Results from our demand modelling work imply that extending the Service to national coverage will exceed the capacity of the current one team/one centre model. However, demand is not anticipated to be sufficient to maintain two teams/two centres. This also lends support to Option C (an augmented team).

11.13 However, Option C presents substantial risks, particularly around the issue of simultaneous retrievals and the knock-on impacts of this in terms of the ability to deliver an effective service. A majority of the current EMRS consultants do not believe that EMRS could operate effectively at Option C given that cases would be missed and the reputation of the Service would then be seriously harmed.

11.14 The exact number of simultaneous retrievals is difficult to forecast, but the higher the number, the greater the detrimental impact on service delivery, and staff workload and morale. We also have to be aware that demand may grow as the Service becomes better established, as seems to be the case in Argyll & Bute. Demographic changes are also thought likely to increase demand for the Service in future. Ongoing monitoring of these factors may serve to justify a second team, but not a second centre.
It seems clear from the analysis that two of the shortlisted options can now be discounted.

- **Option A.** This option would see the disbandment of a well-received Service that appears to have a clear rationale. It is also unlikely to represent a significant cost saving as investment in alternative provision is likely to be required if patient outcomes in remote and rural areas are not to worsen significantly.

- **Option E.** The costs of this option appear prohibitive and it offers poor overall value for money.

This leaves us with the remaining options, which all seem to offer value for money.

- **Option B.** Although the current model has operated effectively, the rationale for the Service implies that it should also be made available for the north of Scotland, where there appears to a level of need. However, if the current clinical team are unable to staff the Service to operate at Option C and/or Option C or D are not currently affordable, the Service should at least be retained at the pilot level.

- **Option C.** This option appears to offer the best value for money, but has significant risks to delivery. It could be considered on a time limited basis but remain subject to review as more data becomes available on the future rate of retrievals and simultaneous retrievals.

- **Option D.** This option probably offers the greatest value in terms of meeting clinical needs. However, there are concerns about whether the Service would be fully utilised. In our estimate, the caseload required to justify two clinical teams is around 360-380 cases. This could not be supported from the evidence gathered during the pilot although more recent statistics provided by the EMRS team suggest that this level could be met. Further work, outside the scope of this review, would be required to validate the more recent data. The cost is also around £800,000 more than the current pilot and this may not be affordable in the current economic climate.

Given the importance of the issue of simultaneous retrievals, attempts should be made to develop a reliable statistical model for any future monitoring and viability work.

There is not a straightforward conclusion here. On the balance of the evidence, our recommendation is that the Service should continue. Our current advice would be that the Service be scaled up to Option C (a national model) for a time limited period (six months or one year) while establishing whether sufficient demand exists for two clinical teams or whether the number of simultaneous retrievals and workload for the consultants makes this option unviable in the medium term. At the same time, avenues should continue to be explored to examine the possibilities of expanding the scope of the Service through integration with other air emergency and retrieval services, or through
covering other rural parts of Scotland. This may lead to an expansion in the number of cases to a level where a second team is justified and Option D can be implemented. This should also tie-in with the SAS retendering of Air Ambulance provision in 2011 to ensure optimal continued provision.

11.19 This represents a pragmatic conclusion based on the evidence. It is necessary to be aware that Option C may not be deliverable. Having the Service extended for a time limited period also carries risks on the operational side (staff morale and uncertainty) and in recruitment (may be less attractive). For these reasons, we believe that Options B and D should also remain open and be considered further before any final decision is made.
APPENDIX A – LITERATURE REVIEW BIBLIOGRAPHY

Scottish papers:


Dr Stephen Hearns, Dr Drew Inglis, Dr Phil Munro, Dr Alasdair Corfield, 2006, *Scotland’s Emergency Medical Retrieval Service - Report of the EMRS project board*


Other Literature:


Position Statement of the Air Medical Physician Association, 2002, Approved by the AMPA Board of Trustees April 2002, *Medical Condition List and Appropriate Use of Air Medical Transport*


Booz, Allen and Hamilton for Department of Health, Social Services & Public Safety (Belfast) and Department of Health & Children (Dublin), 2004, **Feasibility Study on a Helicopter Emergency Medical Service (HEMS) for the Island of Ireland**.


R E Burney, L Passini, D, Hubert, R Maio, 1992, **Comparison of Aeromedical Crew Performance by Patient Severity and Outcome**, *Annals of Air Medicine*


A Public Policy Paper by FARE, 2005, **Air Medicine: Accessing the Future of Health Care**


R Hotvedt et Al, 1996, **Which Groups of Patients Benefit from Helicopter Evacuation?** The Lancet, Volume 347, Issue 9012, Pages 1362 - 1366


### Appendix B - Secondary Retrieval Literature

#### Scottish Literature

<table>
<thead>
<tr>
<th>Author</th>
<th>Title</th>
<th>Journal (if applicable)</th>
<th>Year</th>
<th>Short Summary</th>
<th>Relevance to review</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>UK</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>S J</td>
<td><strong>Aeromedical Retrieval to a University Hospital</strong></td>
<td>2005</td>
<td>This paper aims to review the retrievals undertaken by medical staff from the emergency department (ED) or intensive care unit (ICU) of this hospital over the past two years and to discuss the potential and difficulties of setting up a critical care retrieval system. A helipad servicing the west of Scotland is situated at the Southern General Hospital. All patients transferred by air are initially assessed by senior ED staff working within the hospital. On several occasions patients have required urgent medical intervention on arrival. Selected patients seem to benefit from an experienced physician with advanced airway and other critical care skills being part of the flight team. Over the past two years, a senior physician from the ED or ICU has travelled with the paramedic crew on an ad hoc basis.</td>
<td>Aeromedical service established in 1989, located at Southern General hospital. Gives a summary of survival rates over 2002 and 2003 of the 10 retrieval cases (70% survive)</td>
</tr>
<tr>
<td></td>
<td>Caldow, T R J</td>
<td><strong>R J Parke, C A Graham, P T Munro</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>A R</td>
<td><strong>A Rural Emergency Medical Retrieval Service: The First year</strong></td>
<td>2006</td>
<td><strong>Introduction:</strong> We describe the first year of operation of a rural emergency medical retrieval service (EMRS), staffed by emergency medicine and anaesthetic consultants and providing air based retrieval of critically ill and injured patients from general practitioner led community hospitals in rural west Scotland. <strong>Methods:</strong> Data were collected on all patients referred to the service, both those subsequently transported and those where transport by the service was not indicated, for a period of 1 year from 1 October 2004 to 30 September 2005. Data collected included information on demographics, physiology, and medical interventions. Detailed data were collected regarding advanced airway care and any complications relating to transfer. <strong>Results:</strong> Forty patients were attended and advice was given on a further 21 patients. Twenty one of the 40 patients (53%) required rapid sequence</td>
<td>Follows on from the study above and provides some analysis on the severity of injury that might be useful to draw on.</td>
</tr>
<tr>
<td></td>
<td>Corfield, L R</td>
<td><strong>Thomas, A Inglis, S Hearns</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Author</td>
<td>Title</td>
<td>Journal (if applicable)</td>
<td>Year</td>
<td>Short Summary</td>
<td>Relevance to review</td>
</tr>
<tr>
<td>--------</td>
<td>-------</td>
<td>-------------------------</td>
<td>------</td>
<td>--------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>Dr Stephen Hearns, Dr Drew Inglis, Dr Phil Munro, Dr Alasdair Corfield</td>
<td>Scotland’s Medical Retrieval Service - Report of the EMRS project board</td>
<td>April 2006</td>
<td>The document includes an outline of the proposed Scottish EMRS, as well as an option appraisal, cost analysis, risk analysis and recommendations by the project board. With this document the project board proposes the introduction of a national EMRS to support the care of seriously ill and injured patients in remote and rural Scotland. The consultant based EMRS would provide equity of access to critical care and safe transfer to definitive care from the six rural general hospitals and fifteen rural community hospitals in Scotland receiving emergency cases. The service would also cover remote isolated general practices such as those on the islands. The project board recommends that the establishment of the EMRS should be achieved in a staged process commencing with a Glasgow based service serving all rural hospitals on the West Coast, increasing to coverage of the North Highlands and Northern Isles after 18 months. This increase in coverage may be through expansion of a single Glasgow centre or the establishment of a second centre in either Inverness or Aberdeen.</td>
<td>Very relevant - provides an options appraisal and information used to decide on the initial EMRS scheme.</td>
<td></td>
</tr>
<tr>
<td>Remote and Rural Steering Group, NHS Scotland</td>
<td>Delivering for Remote and Rural Healthcare - The Final Report of the Remote and Rural Work-Stream</td>
<td>Nov 2007</td>
<td>This report presents to the Scottish Government the group’s vision for the development of a sustainable health system for remote and rural Scotland. It provides a framework for rural health services to continue to develop and enhance their roles in the ‘continuum of healthcare’ across Scotland, through an integrated network model. This model describes how much of clinical care can be provided within local communities, with only a minority of cases requiring further referral outwith that community. The remote and rural steering group were tasked to develop a policy for sustainable remote and rural healthcare services and this report summarises their response to the agreed objectives for the first phase of the Remote and Rural Work Stream.</td>
<td>Provides an overview of the direction of the remote and rural steering group. Useful for background setting. Also touches on the EMRS service.</td>
<td></td>
</tr>
</tbody>
</table>
Is there anything different about Remote and Rural areas?
The collective term ‘Remote and Rural’ is used, but this masks large variations between areas, especially in terms of mainland and island. This report proposes an overarching framework that is relevant and fits all remote and rural (and non-urban) areas but is sufficiently flexible to permit application to particular local circumstances.
Rural patients’ experience of care differs from that of urban patients in that they often have to travel large distances to receive care. Although the pattern of disease is similar in urban and rural areas, differences do exist:
• Higher suicide rates;
• Higher incidence of alcohol related disease;
• There are a higher number of accidents in rural areas: on roads, through climbing, farming, diving and fishing;
• Palliative Care workload is proportionally higher than might be seen in urban areas, as patients from remote areas often prefer to or are enabled to die at home, rather than in a distant centre;
• Seasonal fluctuation in population

<table>
<thead>
<tr>
<th>Author</th>
<th>Title</th>
<th>Journal (if applicable)</th>
<th>Year</th>
<th>Short Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Scottish Ambulance Service Board</td>
<td>Proposal for the Development of an Inter-Hospital Transfer Service</td>
<td></td>
<td>2005</td>
<td>This paper sets out the Scottish Ambulance Service’s proposals to establish a dedicated Inter-Hospital Transfer (&quot;IHT&quot;) Service, for patients transferring between hospitals in NHS Scotland, in response to Delivering for Health (Scottish Executive 2005). The dedicated, national, 24/7 service would comprise ambulance staff, vehicles, control centre and management, and would be implemented over a 2 year timeframe. The service requires to be implemented from 2006, because significant change in the pattern of hospital services is already underway and the existing arrangements, whereby frontline A&amp;E and NES resources carry out inter-hospital transfers, are not sustainable.</td>
</tr>
<tr>
<td>Author</td>
<td>Title</td>
<td>Journal (if applicable)</td>
<td>Year</td>
<td>Short Summary</td>
</tr>
<tr>
<td>-----------------</td>
<td>--------------------------------------------</td>
<td>-------------------------</td>
<td>------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>S Whitelaw, R Hsu, A R Corfield, S Hearns</td>
<td>Establishing a Rural Emergency Medical Retrieval Service</td>
<td>Emergency Medical Journal</td>
<td>2006</td>
<td>In 2004 the Argyll and Clyde health board established the Emergency Medical Retrieval Service to support its rural community hospitals. This article describes both why the service was established and its aims. This service covers a geographically extensive area, with approximately 85,000 people living in remote locations. Rural general practitioners in six community hospitals provide initial patient assessment and resuscitation. Providing emergency care and safe transfer of seriously ill and injured patients presenting to these community hospitals is a significant challenge. All parties involved felt that there was a need to provide a service to transport critically ill and injured patients from these remote locations to definitive care. The idea of the team is to bring the resuscitation room to the patient in the rural setting. With this aim and in order to implement the Intensive Care Society guidelines for the transport of critically ill patients, it was decided that consultants in Emergency Medicine and Anaesthetics with an interest in critical care would staff the service medically. This service is unique within the UK and the authors aim to report our findings from ongoing research and audit in future papers.</td>
</tr>
</tbody>
</table>
### Other EMRS Literature

<table>
<thead>
<tr>
<th>Author</th>
<th>Title</th>
<th>Journal (if applicable)</th>
<th>Year</th>
<th>Short Summary</th>
<th>Relevance to review</th>
</tr>
</thead>
</table>
| Association of Air Medical Services | Position Paper on the Appropriate Use of Emergency Air Medical Services | The Journal of Air Medical Transport, Volume 9, Issue 9, pages 29-30, 32-3 | 1990 | **A. Time**
| | | | | Emergency patient care is a continuum of discovery and treatment that includes the elements of:
| | | | | • dysfunction recognition (anatomical and/or physiological);
| | | | | • assessment;
| | | | | • diagnosis;
| | | | | • supportive interventions;
| | | | | all culminating in definitive medical and/or surgical therapy. The continuum of critical and high risk patients is usually time-dependent. The more time that elapses after the event, the less the chance of recovery and survival; i.e., the "Golden Hour" of trauma.
| | | | | Non-trauma patients also must be treated within their disease specific "Golden Hour." Examples include the following conditions: cardiac patients who require thrombolysis; patients with dissecting aneurysms who require immediate surgery; neonates who require access to special care units to survive; hemorrhaging patients who require aggressive resuscitation and restoration of blood volume, and others. Time affects survival. Inefficient transport times expose patients to an environment where the ability to respond to life-threatening complications is seriously hampered. When air medical services can significantly reduce the time to deliver critical or high-risk patients to definitive care, they should be employed. Examples may include, but are not limited to: trauma victims; high-risk mothers; neonates; cardiovascular patients, and hemorrhagic states. |
| | | | | **B. Patient Transport Decisions**
| | | | | Medical direction is preeminent in defining which patients will benefit from air medical transport. This may be accomplished on-line or through... |

Association of Air Medical Services
protocols and standing orders. It is essential that patients transferred between medical facilities have physician-to-physician communication to ensure continuity of care and also to establish parameters of care during transport.

C. Appropriate Facility
Within geographic limitations, patients should be referred to an appropriate facility. Considerations for choosing a facility may include, but are not limited to, the following:
- a hospital or facility that matches the needs of the patient based upon the physician's knowledge of the capabilities of equally "equipped" hospitals;
- a hospital or facility where the patient has previously undergone specialized treatment and where the patient's medical records are located and are likely to significantly influence care;
- a hospital or facility where the attending physician practices, ensuring appropriate continuity of care;
- a hospital or facility with a specialized level of care not available in the referring institution.

D. Patient Selection Criteria
Even though they are necessary to guide first responders, rigid adherence to descriptors identifying appropriate air medical patients should not replace decisions based on sound medical judgment. Timely EMS response demands a degree of overtriage. It is intended to protect the patient and must be accepted as a part of air medical service. Examples to be considered include, but are not limited to, the following:
- anatomical and physiological identifiers
- mechanisms of injury identifiers
- situational identifiers

E. Medical Direction
Medical direction of air medical programs should be appropriate to the
<table>
<thead>
<tr>
<th>Author</th>
<th>Title</th>
<th>Journal (if applicable)</th>
<th>Year</th>
<th>Short Summary</th>
<th>Relevance to review</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 Position Statement of the Air Medical Physician Association Approved by the AMPA Board of Trustees April 2002</td>
<td>Medical Condition List and Appropriate Use of Air Medical Transport</td>
<td>Air Medical Transport Guidelines</td>
<td>2002</td>
<td>AMPA supports the NRM work group recommendation to replace the list of conditions in section 2120.4 B (Medical Appropriateness) with: • Acute neurological emergencies requiring emergent/time sensitive interventions not available at the sending facility • Acute vascular emergencies requiring urgent/time sensitive interventions not available at sending facilities • Acute surgical emergencies requiring urgent/time sensitive interventions not available at the sending facility • Critically ill patients with compromised hemodynamic/respiratory function who require intensive care during transport and whose time of transfer between critical care units must be minimized during transport • Critically ill obstetric patients who require intensive care during transport and whose time of transfer between facilities must be minimized to prevent patient/fetal morbidity • Acute cardiac emergencies requiring emergent/time-sensitive intervention not available at sending facility • Critically ill neonatal/pediatric patients with potentially compromised hemodynamic/respiratory function, a metabolic acidosis greater than 2 hours postdelivery, sepsis, or meningitis • Patients with electrolyte disturbances and toxic exposure requiring immediate life-saving intervention • Transplantation patients (fixed wing vs. helicopter) • Patients requiring care in a specialty center not available at the sending facility • Conditions requiring treatment in a hyperbaric oxygen Unit • Burns requiring treatment in a burn treatment center • Potentially life- or limb-threatening trauma requiring treatment at a trauma center, including penetrating eye injuries • EMTALA physician-certified interfacility transfer (not a patient request) • EMS regional or state-approved protocol identifies need for on-scene air</td>
<td></td>
</tr>
</tbody>
</table>

Position Statement of the Air Medical Physician Association Approved by the AMPA Board of Trustees April 2002
<table>
<thead>
<tr>
<th>Author</th>
<th>Title</th>
<th>Journal</th>
<th>Year</th>
<th>Short Summary</th>
<th>Relevance to review</th>
</tr>
</thead>
<tbody>
<tr>
<td>9 G Bellingan, T Olivier, S Batson and A Webb</td>
<td>Comparison of a Specialist Retrieval Team with Current United Kingdom Practice for the Transport of Critically Ill Patients</td>
<td>Intensive Care Med Vol 26, Issue 6: 740±744</td>
<td>2000</td>
<td><strong>Objective:</strong> The inter-hospital transfer of critically ill patients in the United Kingdom is commonly undertaken using standard ambulance under junior doctor escort, despite recommendations for the use of specialist retrieval teams. Patients are transferred into University College London Hospitals (UCLH) intensive care unit (ICU) by both methods. We undertook to evaluate the effect of transfer method on acute physiology (within 2 h of ICU admission) and early mortality (&lt; 12 h after ICU admission). <strong>Design:</strong> Retrospective review of all transfers over 1 year. <strong>Setting:</strong> UCLH ICU. <strong>Subjects:</strong> 259 transfers; 168 by specialist retrieval team (group A) and 91 by standard ambulance with doctor provided by referring hospital (group B). <strong>Interventions:</strong> None <strong>Main outcome measures:</strong> Acute physiology (pH, PaO2, PaCO2, heart rate (HR), mean arterial blood pressure (MAP), 24 h severity of illness scores (APACHE II, SAPS II), length of stay and mortality. <strong>Results:</strong> There were no differences in demographic characteristics or severity of illness between the two groups; nevertheless significantly more patients in group B than in group A were severely acidotic (pH &lt; 7.1: 11% vs. 3%, p &lt; 0.008) and hypotensive (MAP &lt; 60: 18% vs. 9%, p &lt; 0.03) upon arrival. In addition, there were more deaths within the first 12 h after admission with 7.7% deaths (7/91) in group B transfers vs. 3% (5/168) in group A. <strong>Conclusions:</strong> The use of a specialist transfer team may significantly improve the acute physiology of critically ill patients and may reduce early mortality in ICU.</td>
<td>Again the study is looking at expertise and finds that additional specialist knowledge could improve mortality rates.</td>
</tr>
<tr>
<td>10 D. Belway, W. Henderson, S. Keenan, A. Levy, P. Dodek</td>
<td>Do Specialist Transport Personnel Improve Hospital Outcome in Critically Ill Patients</td>
<td>Journal of Critical Care Volume 21, Issue 1, Pages 8-17</td>
<td>2006</td>
<td><strong>Purpose:</strong> The aim of the study was to determine whether the use of specialist transport personnel improves patient outcome at the receiving hospital for critically ill patients transferred to higher centers. <strong>Materials and Methods:</strong> A search of 6 electronic databases, 15 relevant journals, and the reference lists of all retrieved articles was conducted for studies comparing outcome at the receiving hospital for critically ill adult or</td>
<td>The study looks at the use of specialist personnel for hospital transfers but comes to no conclusion.</td>
</tr>
<tr>
<td>Author</td>
<td>Title</td>
<td>Journal</td>
<td>Year</td>
<td>Short Summary</td>
<td>Relevance to review</td>
</tr>
<tr>
<td>-----------------</td>
<td>----------------------------------------------------------------------</td>
<td>----------------------------------------------</td>
<td>------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-------------------------</td>
</tr>
<tr>
<td>Patients</td>
<td>Transferred to Higher Centers? A Systematic Review</td>
<td></td>
<td></td>
<td>pediatric patients transported by dedicated transport crews or tertiary-based specialists with other forms of transport personnel including referring house staff. All potentially relevant articles were retrieved in full and reviewed independently by 2 reviewers to determine eligibility for inclusion. Data were tabulated and results were summarized. <strong>Results:</strong> Six cohort studies (n = 4534) were included. When patients of equal severity were assessed, only 1 study demonstrated an improvement in outcome at the receiving hospital (survival to 6 hours) when specialist personnel transported the patients. Methodological limitations and inter study differences in participants and transport personnel precluded pooling of results. <strong>Conclusions:</strong> Current data are insufficient. The study designs used create opportunity for significant bias, preventing any useful inferences to be drawn. Further study is warranted.</td>
<td>firm conclusions on how beneficial they are.</td>
</tr>
<tr>
<td>D Belway, P Dodek, S Keenan, M Norena, H Wong</td>
<td>The Role of Transport Intervals in Outcomes for Critically Ill Patients who are Transferred to Referral Centers</td>
<td>Journal of Critical Care, Volume 23, Issue 3, Pages 287-293</td>
<td>2008</td>
<td><strong>Purpose:</strong> The aim of this study was to determine the association between transport intervals (including time from call to arrival of transport team at the sending hospital, time spent by the transport team in the sending hospital, and transport time between the sending and receiving hospital) and intensive care unit (ICU) and hospital length of stay and hospital mortality at the receiving hospital. <strong>Materials and Methods:</strong> This was a retrospective, stratified cohort study involving all patients 15 years and older who were transferred from one hospital to another of equal or larger size in British Columbia, Canada, and who spent at least 1 day in an ICU or coronary care unit (CCU) at the receiving hospital during 1999 (n = 1930). Data were obtained from 6 administrative databases and linked using generalized software. <strong>Results:</strong> After adjustment for age, sex, comorbidity, and diagnostic group, longer time from call to arrival of paramedics at the sending hospital was associated with a shorter length of ICU/CCU stay (rate ratio [RR], 0.91; 95% confidence interval [CI], 0.86-0.97) for survivors and a longer length of hospital (RR, 1.12; 95% CI, 1.05-1.21) and ICU/CCU (RR, 1.14; 95% CI, 1.04-1.25) stay.</td>
<td>Useful and recent study.</td>
</tr>
</tbody>
</table>
for non survivors in the higher-priority air transport group, and with a slightly shorter length of hospital stay (RR, 0.97; 95% CI, 0.95-0.99) for all patients in the lower-priority air transport group. Longer time spent by paramedics at the sending hospital was associated with a shorter length of hospital stay (RR, 0.79; 95% CI, 0.65-0.96) for survivors in the higher-priority air transport group. Longer time for transport between the sending and receiving hospitals was associated with a longer length of ICU/CCU stay (RR, 1.69; 95% CI, 1.26-2.27) for survivors in the higher-priority air transport group but a slightly shorter length of ICU/CCU stay (RR, 0.97; 95% CI, 0.95-0.99) for all patients in the ground transport group. There were no associations between transport times and hospital mortality.

**Conclusions:** Transport intervals are independently associated with ICU/CCU and hospital lengths of stay at the receiving hospital for critically ill adults transferred to referral centers.

**Author:** K S Berns, DG Hankins and S P Zietlow

**Title:** Comparison of Air and Ground Transport of Cardiac Patients

**Journal:** Air Medical Journal

**Volume:** 20, **Issue:** 6, **Pages:** 33-6

**Year:** 2001

**Purpose:** To investigate the outcome of cardiac patients transported by helicopter versus ground ambulance

**Setting:** A hospital-based helicopter program in southeastern Minnesota

**Methods:** Retrospective chart review assessing an 18-month period (January 1998 to June 1999). Charts were reviewed for type of cardiac diagnosis, level of pain, treatments en route, time to intervention, and length of stay (LOS). Two-hundred-sixty-six cardiac patients came by helicopter. Of the 86 turndowns, 50 came by ground ambulance; 28 records were recovered in this group. These patients composed the comparison ground group.

**Results:** Prehospital time was less for patients transported by air than ground transports (P < .001). The amount of time from the call for transport until arrival at our hospital was less for helicopter transports (P = .002). Air transports had more patients with reduced chest pain on arrival. Difference in CCU LOS was not significant (P = .94). Air patients spent an average of 2 fewer days in the hospital than did ground patients (P = .036).

**Discussion:** Helicopter transport benefits the cardiac patient with decreased chest pain as a result of more treatments en route; decreased

**Relevance to review:**

12
<table>
<thead>
<tr>
<th>Author</th>
<th>Title</th>
<th>Journal (if applicable)</th>
<th>Year</th>
<th>Short Summary</th>
<th>Relevance to review</th>
</tr>
</thead>
<tbody>
<tr>
<td>Booz, Allen, Hamilton for Department of Health, Social Services &amp; Public Safety (Belfast) and Department of Health &amp; Children (Dublin)</td>
<td>Feasibility Study on a Helicopter Emergency Medical Service (HEMS) for the Island of Ireland.</td>
<td>2004</td>
<td>In the ‘tertiary response’ role, HEMS offers fast long distance transport without dangerous and destabilising transfers, particularly for the critically ill requiring specialist tertiary care. The reviewed literature predominantly focuses on medical outcomes. It offers, in the main, a generally supportive view of helicopter use for inter-hospital transfers (‘tertiary’ and ‘secondary’ response roles) with a much less unequivocal view for ‘primary-response’ HEMS.</td>
<td>Study has a relevant literature review section. Looks at Tertiary Responses: planned urgent and rapid transfers of critically ill patients requiring specialised care between hospitals (inter-hospital transfers – often referred to as ‘air ambulance’).</td>
<td></td>
</tr>
<tr>
<td>J D Bruhn, K A Williams, R Aghababian</td>
<td>True Costs of Air Medical vs. Ground Ambulance Systems</td>
<td>Air Medical Journal Volume 12, Issue 8, Pages 262-8</td>
<td>1993</td>
<td>The economic model created in this paper replaces the existing University of Massachusetts Medical Center's New England Life Flight (NELF) helicopter ambulance service with a ground ambulance system to investigate comparative costs. The model is based on a less than 30-minute response time to the patient, similar medical team staffing and equal service area. The annual budgetary cost of the replacement ground network is $3,804,000 while the helicopter ambulance costs are $1,686,500 (based on 1991 dollars). The cost per patient transported is $4,475 for the ground system and $2,811 for the helicopter system. The comparison finds that the commonly held notion that condemns helicopters as an excessively expensive technology for patient transport is incorrect. Future research to address intermediate alternatives using paper looks at ambulance cost compared with helicopter and concludes that helicopter costs are lower. The study excludes pre-hospital retrievals.</td>
<td></td>
</tr>
<tr>
<td>Author</td>
<td>Title</td>
<td>Journal (if applicable)</td>
<td>Year</td>
<td>Short Summary</td>
<td>Relevance to review</td>
</tr>
<tr>
<td>--------</td>
<td>-------</td>
<td>-------------------------</td>
<td>------</td>
<td>---------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>Burney, L, Passini, D, Hubert, R Maio</td>
<td>Comparison of Aeromedical Crew Performance by Patient Severity and Outcome</td>
<td>Annals of Air Medicine</td>
<td>1992</td>
<td>Study purpose: One of the continuing controversies in aeromedical transport involves crew composition. Since 1987, we have used both physician/nurse (P/N) and nurse/nurse (N/N) crews to staff two identically equipped helicopter ambulances. The purpose of this study was to compare the severity of illness or injury and outcomes of patients transported by P/N and N/N crews. Design: Retrospective cohort. Methods: Data were obtained from the air ambulance and medical records of all aeromedical transfers between September 1, 1987, and August 31, 1988. Patients less than 16 years old or transferred to other hospitals were excluded. Severity of illness or injury was measured by Revised Trauma Score, APACHE-II, and Therapeutic Intervention Scoring System; outcome measures were mortality, and ICU and hospital lengths of stay. Patients were categorized as cardiac, trauma, or other. Origin of transfer (scene, emergency department, or hospital) and transfer times were included in the analysis. Measurements and main results: Six hundred fifty-nine patients were studied—418 P/N and 241 N/N. No differences were found between P/N and N/N groups with regard to sex, Revised Trauma Score, APACHE-II, or Therapeutic Intervention Scoring System, although P/N patients were younger (45.7 versus 50.9 years, P = .001), included more cardiac (40% versus 36%) and trauma (38% versus 30%) patients (P = .002), and were more likely to have been transferred from an ED (68% versus 51%) or scene (7% versus 2%) (P = .001). Mortality, ICU length of stay, and hospital length of stay of P/N and N/N patients were not different, nor was time spent at the scene or hospital. Subgroup analysis did not alter these results. Conclusion: No objective differences in outcome of patients were found between P/N and N/N teams. Although small differences were found in types of flights taken by P/N and N/N teams, there were no differences in objective measures of severity between the two teams. We find no objective evidence to prefer one crew composition over another.</td>
<td>Similar to the above study, no objective differences were found between aircrafts with physicians and those with nurses only. The studies look at transfer of patients.</td>
</tr>
<tr>
<td>Author</td>
<td>Title</td>
<td>Journal (if applicable)</td>
<td>Year</td>
<td>Short Summary</td>
<td>Relevance to review</td>
</tr>
<tr>
<td>--------</td>
<td>-------</td>
<td>-------------------------</td>
<td>------</td>
<td>---------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>16 R E Burney, L Passini, D Hubert, R Maio</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Variation in Air Medical Outcomes by Crew Composition: A Two-Year Follow-Up**

1993

**Study objective:** In a previous 1-year retrospective study, we found no differences in outcomes of patients transported by physician/nurse (P/N) and nurse/nurse (N/N) air medical crews. To confirm this finding and to identify any trends in outcome that might be associated with changes in crew composition, we prospectively collected and analyzed 2 additional years of severity and outcome data.

**Design:** Prospective cohort.

**Setting:** University hospital-based air medical program.

**Results:** Severity measured by APACHE-II, the Revised Trauma Score, and the Therapeutic Intervention Scoring System, and outcomes measured by mortality and the number of ICU and hospital days, were gathered prospectively on all adult air medical patients between July 1, 1990, and June 30, 1992. Patients less than 16 years old or those who were delivered to other hospitals were excluded. Patients were categorized as cardiac, acute trauma, and other. Origin of transfer and transfer times were included in the analysis. In all, 1,169 patients were studied--554 in the first year of the study, 615 in the second. In the first year, there were 185 P/N (33%) and 369 N/N (67%) flights. P/N patients were older (48.8 versus 44.5 years; P=.01) and were more likely to come from a scene (14% versus 5.7%; P=.001), but no differences were found with regard to sex or disease category.

Mortality, the Therapeutic Intervention Scoring System, APACHE-II, number of ICU days, and number of hospital days were not different; nor were total flight times or times spent at the hospital or scene. In the second year, 89% of flights were N/N. Differences in age or origin were not observed. Severity levels and outcomes remained unchanged. Between 1987 and 1992, the proportion of cardiac patients decreased, and overall illness severity of transported patients increased.

**Conclusion:** Two years of detailed prospective measurement of air medical patient characteristics and outcomes confirmed the initial finding.
| Author | Title | Journal (if applicable) | Year | Short Summary | Relevance to review
|-------|-------|------------------------|------|---------------|-----------------------
| P A Cameron | Helicopter Transport: Can Physicians Save Lives? | Australian and New Zealand Journal of Surgery, Vol 69, 690–691 | 1999 | This reviews other literature on outcome and skilled expertise. Garner et al. have suggested that provision of a skilled physician rather than a paramedic may reduce deaths during helicopter transport in a selected group of trauma patients. The improvement in survival may be as much as 8–19 per 100 patients treated (~40% less deaths). They suggest that this improved outcome may be due to better assessment by physicians and better use of ALS skills, such as endotracheal intubation. Physicians also have the ability to perform additional procedures such as blood transfusions. The paper does not address the issue of paramedic training. It is assumed that all paramedics are the same. New South Wales paramedics intubate without paralysis or sedation. Therefore, only deeply unconscious patients could be intubated. In other systems paramedics have access to paralysing agents and sedation. Despite these reservations, the paper by Garner et al. Provides evidence that physician-staffed helicopters may produce better outcomes for severely injured trauma patients. | Another paper looking at staff and expertise. It finds that survival rates can improve by as much as 8-19 per 100 patients treated.

<p>| A. T. Dewhurst, D. Farrar, C. Walker, P. Mason, P. Beven and J. C. Goldstone | Medical Repatriation via Fixed-Wing Air Ambulance: A Review of Patient Characteristics and Adverse Events | Anaesthesia, Volume 56, Issue 9, Pages 879±905 | 2001 | Anaesthetists are often employed as medical escorts for patients undergoing international transfer by air ambulance. There is little published data on the types of patients being transferred and on the incidence of adverse events. We performed a retrospective review of the documentation of all air ambulance transfers performed by a single company over a 2-year period followed by a prospective assessment of all high-risk patients transferred over a 1-year period. Of 483 transfers identified, 47% were defined as high-risk and 20% were of patients receiving mechanical ventilation. In the prospective group, 28% of patients required pre-transfer optimisation, 7% required a major therapeutic intervention during transfer and there was a major adverse event in 12% of transfers. There were two deaths during transport. These data support the recommendation that escorting personnel should be from an appropriate specialty, have reasonable seniority and be adequately trained and supervised. | Paper looking at hospital to hospital transfers. Finds that air personnel need to be appropriately specialised. |</p>
<table>
<thead>
<tr>
<th>Author</th>
<th>Title</th>
<th>Journal</th>
<th>Year</th>
<th>Short Summary</th>
<th>Relevance to review</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exadaktylos, Aristomenis K.; Haffejee, Farhaad; Wood, Darryl; Erasmus, Philip</td>
<td>South African Red Cross Flying Doctors Service quality and safety in the rural and remote South African Environment</td>
<td>Australian Journal of Rural Health, Volume 13, Number 2, pp. 106-110</td>
<td>2005</td>
<td><strong>Context:</strong> The South African Red Cross Air Mercy Service and its Flying Doctors Service provides health care to far flung and disadvantaged communities in South Africa. <strong>Purpose:</strong> The purpose of this article is to highlight the importance and effectiveness of the service in providing health care to a range of people who have poor or no access to certain health services in South Africa. <strong>Methods:</strong> Data and information was collected from records and statistical data of our service. Data was evaluated and compiled into a report highlighting the achievements of this organisation from its infancy to the present day. <strong>Findings:</strong> The Flying Doctor and Health Outreach Programme has made a difference in improving health care by providing specialist services, transport of patients and training of medical personnel in outlying areas of South Africa that have poor access to health care. Emergency Air Ambulance and Rescue Services have proven to be supportive in providing rapid advanced life support and rescue services to patients in emergency situations. Many lives have been saved through this service. <strong>Conclusion:</strong> The South African Red Cross Air Mercy Service plays a crucial role in delivering specialised health care to disadvantaged communities in South Africa.</td>
<td>Based in 3 locations across South Africa, the Red Cross Flying Doctors are not for profit and provide an air ambulance network, outreach and emergency service. The service provides inter hospital transfer in remote and rural parts of S Africa. This is very different to EMRS but is included as an example of other international systems in operation.</td>
</tr>
<tr>
<td>Falcone, H; Herron, H; Werman, MBonta</td>
<td>Air Medical Transport of the Injured Patient: Scene versus Referring Hospital</td>
<td>Air Med Journal</td>
<td>1995</td>
<td><strong>Introduction:</strong> In a rural service area, does the outcome of air medical patients transferred from the scene of injury differ from that of patients transferred from a primary receiving hospital? <strong>Methods:</strong> Retrospective review of all injured patients transported by air to a single trauma center during calendar year 1996. Data collected include basic patient demographics, time of injury, revised trauma score (RTS), injury severity score (ISS), probability of survival (PS), hospital length of stay (LOS), complications, disposition, and mortality. <strong>Results:</strong> Concerning trauma admissions, 594 of 1461 (40.7%) were transported by air: 363 from the scene (24.9%) and 231 from referring</td>
<td>Looks at patients who are taken to a single trauma centre compared with those taken first to a referring hospital (as with EMRS). The study found that patients who were</td>
</tr>
<tr>
<td>Author</td>
<td>Title</td>
<td>Journal (if applicable)</td>
<td>Year</td>
<td>Short Summary</td>
<td>Relevance to review</td>
</tr>
<tr>
<td>--------</td>
<td>-------</td>
<td>-------------------------</td>
<td>------</td>
<td>---------------</td>
<td>---------------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>hospitals (15.8%). These two groups were similar in demographics, injury severity, hospital LOS, and crude mortality: RTS, 6.61 versus 6.68 (P &gt; 0.05); ISS, 16.0 versus 16.0 (P &gt; 0.05); LOS = 6.9 days versus 7.3 days (P &gt; 0.05); mortality = 11.8% versus 10.8% (f &gt; 0.05). The groups differed significantly, however, in time from injury to definitive care (34.2 minutes versus 196.2 minutes, P &lt; 0.001), overall complication rate (39.1% versus 57.6%, P = 0.009), and potentially preventable deaths (PS &gt; 0.5, 11.6% versus 44%, P = 0.02).</td>
<td>transferred from a referring hospital took almost six times longer and may have suffered an increased morbidity.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Conclusion: Patient groups were similar, suggesting similar triage criteria. Patients transferred from a referring hospital took almost six times longer to reach definitive care and may have suffered an increased morbidity and mortality on this basis.</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>A Public Policy Paper by FARE</td>
<td>Air Medicine: Accessing the Future of Health Care</td>
<td>2005</td>
<td>54% of all air medical transports are hospital to hospital, 33% are scene responses, and 13% are other types (e.g. organ procurement and specialty/neonatal/pediatric team transport). Most scene responses are for injuries, but inter-facility flights (or, hospital-to-hospital transports) are often for critical illnesses, such as heart attacks or strokes requiring surgical procedures (including invasive cardiac treatment such as catheterization); acute respiratory problems requiring prolonged intensive care; spinal problems; burns; pediatric and neonatal illness complication; limb reattachment; organ transplants; and complications in high risk pregnancy. These inter-facility missions are showing patient outcome improvements as well.</td>
<td>Useful stats on the type of transportation occurring. Inter-transport tends to be for critical illnesses, (whereas pre-hospital are accidents).</td>
</tr>
<tr>
<td>22</td>
<td>M J Girotti, G Pagliarello, T R Todd, W Demajo, J Cain, P Walker, A Patterson</td>
<td>Physician-Accompanied Transport of Surgical Intensive Care Patients</td>
<td>1988</td>
<td>During a one-year period, 107 critically ill adult patients were transferred by a physician-accompanied transport system (PATS). Most patients required both tracheal intubation (82 per cent) and mechanical ventilation (71 per cent), while continuous vasopressor support was required in 27 per cent of transfers. Patients were classified as either potential organ donors (n = 21) or non donor patients (n = 86). Non donor patients had a mean time of patient transfer documented from the initial telephone contact to final arrival of the patient in the ICU of 345 ± 221 min (range 65-1350 min); the mean time the patients were out-of-hospital was 73 ± 58 min (range 5-330 min); the average distance travelled by the patient and</td>
<td>Physician accompanied transfers.</td>
</tr>
<tr>
<td>Author</td>
<td>Title</td>
<td>Journal (if applicable)</td>
<td>Year</td>
<td>Short Summary</td>
<td>Relevance to review</td>
</tr>
<tr>
<td>--------</td>
<td>-------</td>
<td>-------------------------</td>
<td>------</td>
<td>---------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>R. Hotvedt et al</td>
<td>Which Groups of Patients Benefit from Helicopter Evacuation?</td>
<td>The Lancet</td>
<td>1996</td>
<td>PATS was 342 ± 692 km (range 1-4000 km). Ultimate nonsurvivors of ICU admission (36 per cent) had shorter out-of-hospital times, shorter travel distances, and increased interventional support, as assessed by the Therapeutic Intervention Scoring System applied over the telephone and prior to departure at the referring hospital. Significant interventions were undertaken by PATS in 23 per cent of the nondonor patients prior to departure. During the transport process, there was at least a seven per cent morbidity (arrhythmia, hypotension, and vehicular difficulties) and a 0.9 mortality rate. We conclude that PATS offered significant advantages to this patient population through its ability to maintain acceptable morbidity and mortality rates while transferring patients over long distances and for prolonged periods of time.</td>
<td>The study looks at clinical outcomes for critically ill transfers in Norway.</td>
</tr>
</tbody>
</table>
hospital than if they had gone by ground transport. For 283 cases, the initial screening by the anaesthetists indicated no additional benefit compared with that obtainable by ground-ambulance transport. The main reason was that no treatment was given during the flight or early on in hospital that could not have been given otherwise. 90 cases entered the expert panel system. Of these 90, 49 cases were judged to have received no additional benefit. This left 41 (11% of the total of 370 evacuated) who were judged to have benefited, gaining 29.6 life-years. 96% of the total number of life-years gained was achieved in nine patients, six of whom were aged below 7 (four were aged 0-7 months). The life-year-gain per adult patient with cardiovascular disease was 0.54.

**Interpretation** We conclude that an emergency helicopter service can provide considerable health benefits for selected patients, at least in this rural setting. Given the costs and risks of such a service, the benefits for most patients are small.

<table>
<thead>
<tr>
<th>Author</th>
<th>Title</th>
<th>Journal (if applicable)</th>
<th>Year</th>
<th>Short Summary</th>
<th>Relevance to review</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Langhelle, HM Lossius, T Silfvast, HM Björnsson, FK Lippert, A Ersson, E Søreide</td>
<td>International EMS Systems: The Nordic Countries</td>
<td>Resuscitation Volume 61, Number 1, Pages 9–21</td>
<td>2004</td>
<td>Emergency medicine service (EMS) systems in the five Nordic countries have more similarities than differences. One similarity is the involvement of anaesthesiologists as pre-hospital physicians and their strong participation for all critically ill and injured patients in-hospital. Discrepancies do exist, however, especially within the ground and air ambulance service, and the EMS systems face several challenges. Main problems and challenges emphasized by the authors are: (1) Denmark: the dispatch centres are presently not under medical control and are without a national criteria based system. Access to on-line medical advice of a physician is not available; (2) Finland: the autonomy of the individual municipalities and their responsibility to cover for primary and specialised health care, as well as the EMS, and the lack of supporting or demanding legislation regarding the EMS; (3) Iceland is the only country that has emergency medicine (EM) as a recognised speciality but there is a need for more fully trained specialists in EM; (4) Norway: the ordinary ground ambulance is pointed out as the weakest link in the EM chain and a health reform demands extensive co-operation between the new health</td>
<td>24</td>
</tr>
<tr>
<td>Author</td>
<td>Title</td>
<td>Journal (if applicable)</td>
<td>Year</td>
<td>Short Summary</td>
<td></td>
</tr>
<tr>
<td>--------</td>
<td>-------</td>
<td>------------------------</td>
<td>------</td>
<td>---------------</td>
<td></td>
</tr>
<tr>
<td>McMonagle M, Flabouris A, Parr A, Sugrue M</td>
<td>Reducing Time to Urgent Surgery by Transporting Resources to the Trauma Patient</td>
<td>ANZ Journal of Surgery, Volume 77, Number 4, April 2007, pp. 241-246</td>
<td>2007</td>
<td>Background: Time to definitive trauma care directly influences patient survival. Patient transport (retrieval) services are essential for the transportation of remotely located trauma patients to a major trauma centre. Trauma surgical expertise can potentially be combined with the usual retrieval response (surgically supported response) and delivered to the patient before patient transportation. We identified the frequency and circumstances of such surgically supported retrievals. Methods: Retrospective review of trauma patients transported by the NRMA CareFlight, New South Wales Medical Retrieval Service, Australia, from 1999 to 2003, identifying patients who had a surgically supported retrieval response and an urgent surgical procedure carried out before patient transportation to a major trauma centre. Results: Seven hundred and forty-nine trauma inter-hospital patient transfers were identified of which 511 (68%) were categorized as urgent and 64% of which were rural based. Three (0.4%) patients had a surgically supported retrieval response and had an urgent surgical procedure carried out before patient transportation. All patients benefited from that early surgical intervention. Conclusion: A surgically supported retrieval response allows for the more timely delivery of urgent surgical care. Patients can potentially benefit from such a response. There are, however, important operational considerations in providing a surgically supported retrieval response.</td>
<td></td>
</tr>
<tr>
<td>Zafren Ken et Al</td>
<td>Outcome Assessments and Air Ambulance</td>
<td>The Lancet, Volume 347</td>
<td>1996</td>
<td>Hotvedt and colleagues (May 18, p 1362) have used proxy estimates of health status and quality-adjusted life years (QUALYs) to assess the benefits of an air-ambulance service in the retrieval of critically ill patients. The benefit was concluded to be limited to paediatric and obstetric enterprises to re-establish a nation-wide air ambulance service; (5) Sweden: to create evidence based medicine standards for treatment in emergency medicine, a better integration of all part of the chain of survival, a formalised education in EM and a nation-wide physician-staffed helicopter EMS (HEMS) cover.</td>
<td></td>
</tr>
</tbody>
</table>

Gives outcomes for air ambulance services. Finds that benefits are
<table>
<thead>
<tr>
<th>Author</th>
<th>Title</th>
<th>Journal (if applicable)</th>
<th>Year</th>
<th>Short Summary</th>
<th>Relevance to review</th>
</tr>
</thead>
<tbody>
<tr>
<td>Services</td>
<td>Issue 9018, Page 1843</td>
<td></td>
<td></td>
<td>emergencies. Hotvedt and colleagues’ conclude that helicopter evacuation benefits some patients but that-in view of the costs and risks of such a service-the benefits for most are small. However, in rural areas, it would also be important to study the costs and benefits of helicopters to the emergency medical system as a whole. The alternative risks and benefits of ground and air ambulances must be weighed. The former also crash occasionally. There may be places that are not accessible to ground ambulances, and winter road conditions may favour the use of helicopters. Once a helicopter service is available, the marginal cost of an additional mission is far lower than the average cost per missions in rural or remote areas (such as northern Norway) a helicopter system serving 80 000 people spread over 26 000 km is probably the most intelligent use of limited resources, even though it may not benefit large numbers of patients.</td>
<td>limited to paediatric and obstetric emergencies. Benefits for most are small. However, helicopter transport may be the most practical.</td>
</tr>
</tbody>
</table>
Appendix C – Risk Matrices

Option A risks

The risks of Option A refer to the risks of not having an EMRS. These are outlined as follows.
<table>
<thead>
<tr>
<th>Risk</th>
<th>Description</th>
<th>Probability</th>
<th>Size of impact</th>
<th>Mitigation measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rise in patient deaths</td>
<td>It seems clear from our fieldwork that, although very difficult to quantify, an absence of EMRS in the pilot area over the last year would undoubtedly have led to an increase in patient deaths as these people would not have been seen by a consultant in time.</td>
<td>High</td>
<td>Difficult to quantify, but likely to be high, particularly in those areas without consultants.</td>
<td>Enhancing skills and facilities locally; investment in air and land ambulances to get people to definitive care quicker.</td>
</tr>
<tr>
<td>Worse patient outcomes</td>
<td>Whereas death may be avoided, it seems likely that patient outcomes would be poorer in terms of recovery time and morbidity. Again, there seemed to be evidence from the fieldwork to support this assumption.</td>
<td>High</td>
<td>Difficult to quantify, but likely to be high, particularly in those areas without consultants.</td>
<td>Enhancing skills and facilities locally; investment in air and land ambulances to get people to definitive care quicker.</td>
</tr>
<tr>
<td>Ineffective triage</td>
<td>EMRS means that patients can get to definitive care quickly. Without it, patients are more likely to be referred to a nearby hospital for consultant assessment before transferring on to definitive care.</td>
<td>High – particularly in more remote areas</td>
<td>Probably high to high in terms of adverse outcomes.</td>
<td>Investment in air and land ambulances to get people to definitive care quicker.</td>
</tr>
<tr>
<td>Loss of health professional time in dealing with transfers</td>
<td>It seems clear from the fieldwork that many locally based health professionals have to invest considerable amounts of time in arranging a transfer and in accompanying a patient to a place of definitive care.</td>
<td>High</td>
<td>In monetary terms, probably relatively low, but may mean a loss of time for patient care and put resources under stress at busy times.</td>
<td>Better resourcing locally</td>
</tr>
<tr>
<td>Failure to recruit and retain staff</td>
<td>Health professionals may leave areas because of lack of support without EMRS</td>
<td>Medium – health professionals in a number of areas told us that they would consider leaving the local area if EMRS was disbanded.</td>
<td>Medium – would have consequences for overall patient care.</td>
<td>Programme to recruit and retain staff; enhancing staff skills and resources locally; working with staff considering leaving to assess what alternative measures could be taken.</td>
</tr>
<tr>
<td>Increased transfers</td>
<td>The pilot indicated that all of the EMRS patients would have required the Service anyway, but the EMRS advice line meant</td>
<td>Medium</td>
<td>Low – overall figure was not very high (28) and low value in monetary</td>
<td>Criteria around air transfer referrals; better training for local health professionals,</td>
</tr>
</tbody>
</table>
that a number of transfers were avoided.

terms for SAS. EMDC staff and paramedics so that unnecessary air transfers are avoided.

It seems clear from analysis of Option A risks that patient outcomes are likely to worsen and this is the key concern about disbanding EMRS. It is also clear that investment into some form of alternative provision would be required in the absence of EMRS, e.g. around staff training, local resourcing and investment in air and land ambulances so that the more serious impacts are avoided.

Option B risks

Table C.2 outlines our assessment of the main risks facing Option B
### Table C.2 Risk matrix for Option B

<table>
<thead>
<tr>
<th>Risk</th>
<th>Description</th>
<th>Probability</th>
<th>Size of impact</th>
<th>Mitigation measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loss of key staff</td>
<td>Losing key staff may prevent the Service from operating effectively.</td>
<td>Medium –</td>
<td>Medium to high – the Service is dependent on a core group of dedicated staff and the loss of these staff may see the Service deteriorate.</td>
<td>On-going programme to recruit and retain staff so loss of key staff is not as keenly felt; incentive packages to retain key staff.</td>
</tr>
<tr>
<td>Increase in case workload</td>
<td>Increased awareness of EMRS, a loss of local clinical expertise and population increases produce an increase in cases that EMRS may not have the capacity to meet.</td>
<td>Medium –</td>
<td>Medium – over the next 3-5 years.</td>
<td>Increase staffing; configuration of staff rota to ensure maximising use of staff resources.</td>
</tr>
<tr>
<td>Increase in SAS resources</td>
<td>As EMRS retrievals take twice as long as normal retrievals, this places pressure on the ability of SAS to deliver its Service</td>
<td>Medium</td>
<td>Likely to be low if just covering the West as SAS has been able to deal with the EMRS cases in the pilot without compromising its overall service.</td>
<td>Investment in air ambulances</td>
</tr>
<tr>
<td>Simultaneous transfers</td>
<td>On occasion, the Service may receive simultaneous request for retrievals. It may not be possible to respond to requests, especially with a single team, and one request may have to be delayed.</td>
<td>Medium</td>
<td>Low. Less likely to be an issue if just covering the West.</td>
<td>More consultant staff; flexibility of use of staff (e.g. case may be handled by another retrieval consultant not on clinical retrieval duties).</td>
</tr>
<tr>
<td>Affordability/Loss of funding</td>
<td>Service requires funding to continue</td>
<td>Low – funding likely to be maintained at least for this option if the evaluation is favourable</td>
<td>High – likely to see the Service disbanded</td>
<td>Results from the evaluation; use of monitoring data to demonstrate work of the Service; regular liaison with Government and the NHS.</td>
</tr>
<tr>
<td>Failure to recruit staff</td>
<td>May prevent the Service from continuing.</td>
<td>Low – sufficient staff have been recruited for</td>
<td>High - May mean that Service cannot function efficiently.</td>
<td>Programme to recruit and retain staff; introducing more staff to the Service; use of</td>
</tr>
<tr>
<td><strong>Increase in additional air transfers</strong></td>
<td>EMRS increases the number of air transfers undertaken by SAS. However, almost all of these patients would have been retrieved anyway and EMRS can avoid unnecessary transfers. Nevertheless, air transfers may increase more sharply in succeeding years if local areas are not as resourced as they are now and have to rely more on EMRS.</td>
<td>Low</td>
<td>Likely to be low, especially for a Service only based in the West. May become larger if local resources are not maintained.</td>
<td>Audit/review of aircraft use; better coordination of aircraft services; maintaining skills and facilities locally.</td>
</tr>
<tr>
<td><strong>Being used for inappropriate cases</strong></td>
<td>Not efficient use of the Service; may mean that an actual emergency is delayed.</td>
<td>Low – fieldwork did not indicate that this was a common problem, but was mentioned by several staff in two areas.</td>
<td>Likely to be low if probability remains low.</td>
<td>Consider use of tasking criteria; work with local staff to ensure they know the circumstances in which to involve EMRS; ensure that the most senior local health professional examines the patient before call-out; better resourcing locally.</td>
</tr>
<tr>
<td><strong>Adverse weather</strong></td>
<td>May prevent SAS aircraft being used.</td>
<td>Low - appears to have been a rare occurrence over the pilot period.</td>
<td>Low</td>
<td>Where necessary, may be able to use a military or rescue aircraft that are better able to deal with adverse weather. May also use land-based retrieval for mainland hospitals and sea-based retrieval for islands.</td>
</tr>
<tr>
<td><strong>Increase use of ICU beds</strong></td>
<td>Improved patient survival rates with EMRS will see increased use of ICU beds. However, early access to resuscitation by EMRS may lead to less ICU admissions and shorter ICU stay duration.</td>
<td>Low</td>
<td>Likely to be low for a Service just based in the West.</td>
<td>Audit/review of ICU bed occupancy rates of EMRS and non EMRS patients to identify the extent to which this is a problem.</td>
</tr>
</tbody>
</table>

Although there are key risks for Option B, they do seem more manageable to those present in the other options because the Service has largely been able to deal effectively with these risks over the pilot period.
**Option C risks**

Table C.3 provides our risk assessment for Option C. The risks for Options C, D and E mirror those for Option B, but there are some important differences, particularly around issues like simultaneous retrievals and capacity that need to be clearly defined.
<table>
<thead>
<tr>
<th>Risk</th>
<th>Description</th>
<th>Probability</th>
<th>Size of impact</th>
<th>Mitigation measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loss of key staff</td>
<td>May prevent the Service from operating.</td>
<td>High – most of the current team of EMRS consultants do not believe that they could continue to deliver the Service if this option is chosen.</td>
<td>High – the Service is dependent on a core group of dedicated staff and the loss of these staff may see the Service deteriorate.</td>
<td>On-going programme to recruit and retain staff so loss of key staff is not as keenly felt.</td>
</tr>
<tr>
<td>Simultaneous transfers</td>
<td>The Service may receive simultaneous requests for retrievals. It may not be possible to respond to requests, especially with a single team and an extended Service, and one request may have to be delayed or refused. This may damage the Service from a user and service provider viewpoint.</td>
<td>High. The number of such transfers is likely to be at least 50 for this option</td>
<td>High. Would see a number of transfers delayed or missed and place pressure on the Service and staff. May also worsen the reputation of the Service in the existing areas that it operates.</td>
<td>More consultant staff; flexibility of use of staff (e.g. case may be handled by another retrieval consultant not on clinical retrieval duties); better coordination of air ambulance services; investment in air ambulances.</td>
</tr>
<tr>
<td>Increase in case workload</td>
<td>Increased awareness of EMRS, a loss of local clinical expertise and population increases produce an increase in cases that EMRS may not have the capacity to meet.</td>
<td>High – will almost certainly happen with a move to a national Service.</td>
<td>High – could increase risks of simultaneous transfers and put increased workload on staff.</td>
<td>Increase staffing; configuration of staff rota to ensure maximising use of staff resources.</td>
</tr>
<tr>
<td>Increase in SAS resources</td>
<td>As EMRS retrievals take twice as long as normal retrievals, this places pressure on the ability of SAS to deliver its Service</td>
<td>Medium to high as there will be an increased number of retrievals from the pilot.</td>
<td>Medium. SAS believes that it has the capacity to undertake this additional number of retrievals, but it would be near its limit.</td>
<td>Investment in air ambulances; better coordination of air ambulance services to maximise efficiency of use.</td>
</tr>
<tr>
<td>Failure to recruit staff</td>
<td>May prevent the Service from continuing.</td>
<td>Low to medium – sufficient staff have been recruited for the pilot.</td>
<td>High - May mean that Service cannot function efficiently.</td>
<td>Programme to recruit and retain staff; introducing more staff to the Service; use of secondments and trainees.</td>
</tr>
<tr>
<td>Affordability/Loss of funding</td>
<td>Service requires funding to continue</td>
<td>Low – funding is not a large step-</td>
<td>High – likely to see the Service</td>
<td>Results from the evaluation; use of monitoring data to</td>
</tr>
<tr>
<td><strong>Being used for inappropriate cases</strong></td>
<td><strong>Not efficient use of the Service; may mean that an actual emergency is delayed.</strong></td>
<td><strong>Low – fieldwork did not indicate that this was a common problem, but was mentioned by several staff in two areas.</strong></td>
<td><strong>Low to medium as simultaneous retrievals will be more of an issue with Option C and retrieving inappropriate cases will make matters worse.</strong></td>
<td><strong>Consider use of tasking criteria; work with local staff to ensure they know the circumstances in which to involve EMRS; ensure that the most senior local health professional examines the patient before call-out; better resourcing locally; review of cases to identify if the Service is being used for these cases.</strong></td>
</tr>
<tr>
<td><strong>Increase in additional air transfers</strong></td>
<td><strong>EMRS increases the number of air transfers undertaken by SAS and Option C would see an increase on those from Option B. However, almost all of these patients would have been retrieved anyway and EMRS can avoid unnecessary transfers. Nevertheless, air transfers may increase more sharply in succeeding years if local areas are not as resourced as they are now and have to rely more on EMRS.</strong></td>
<td><strong>Low</strong></td>
<td><strong>Likely to be low as probability of this occurring regularly is low. May become larger if local resources are not maintained.</strong></td>
<td><strong>Audit/review of aircraft use; better coordination of aircraft services; maintaining skills and facilities locally.</strong></td>
</tr>
<tr>
<td><strong>Adverse weather</strong></td>
<td><strong>May prevent SAS aircraft being used.</strong></td>
<td><strong>Low - appears to have been a rare occurrence over the pilot period, but extending the Service to all Scotland may make this more of a factor.</strong></td>
<td><strong>Low</strong></td>
<td><strong>Where necessary, may be able to use a military or rescue aircraft that are better able to deal with adverse weather. May also use land-based retrieval for mainland hospitals and sea-based retrieval for islands.</strong></td>
</tr>
<tr>
<td><strong>Increase use of ICU beds</strong></td>
<td><strong>Improved patient survival rates with EMRS will see increased use of ICU beds. However, early access to resuscitation by</strong></td>
<td><strong>Low</strong></td>
<td><strong>Likely to be low even with the increased caseload.</strong></td>
<td><strong>Audit/review of ICU bed occupancy rates of EMRS and non EMRS patients to identify the</strong></td>
</tr>
</tbody>
</table>

up from Option B disbanded demonstrate work of the Service; regular liaison with Government and the NHS.
Option C seems to be the 'riskiest' option in some respects, particularly around the issue of simultaneous retrievals and the knock-on impact of this in terms of the ability to deliver the Service, as it is likely to be operating at near maximum capacity for a lot of the time, and local perceptions (and perhaps use) of the Service if it is seen to have poorer response times than at the pilot. Pressure on staff in terms of workload may also see issues emerge of recruiting and retaining staff.

Option D risks

Table C.4 provides our risk assessment for Option D.
Table C.4 Risk matrix for Option D

<table>
<thead>
<tr>
<th>Risk</th>
<th>Description</th>
<th>Probability</th>
<th>Size of impact</th>
<th>Mitigation measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase in SAS resources</td>
<td>As EMRS retrievals take twice as long as normal retrievals, this places pressure on the ability of SAS to deliver its Service</td>
<td>High, as there will be a marked increase in the number of retrievals from the pilot</td>
<td>Medium to high. SAS believes that it has the capacity to undertake additional, but it would be near or over its limit at 321 cases.</td>
<td>Investment in air ambulances and possibly buying of another aircraft; better coordination of air ambulance services to maximise efficiency of use.</td>
</tr>
<tr>
<td>Under utilisation of the Service</td>
<td>There is not a sufficient number of cases to maintain work for two clinical teams</td>
<td>Medium to high – our demand model indicates that there is likely to be under utilisation with a two team option.</td>
<td>High – could mean inefficient utilisation of staff for emergency medical care.</td>
<td>Explore extending the Service into other areas, e.g. the more isolated district general hospitals; dealing with other types of specialist care (e.g. spinal injuries); consideration of working with other air emergency retrieval services; widening scope of service to include more primary retrievals.</td>
</tr>
<tr>
<td>Failure to recruit staff</td>
<td>May prevent the Service from continuing.</td>
<td>Medium – ability to recruit two clinical teams will be more difficult.</td>
<td>High - may mean that Service cannot function properly or efficiently.</td>
<td>Programme to recruit and retain staff; introducing more staff to the Service; use of secondments and trainees; building links with hospitals in surrounding areas.</td>
</tr>
<tr>
<td>Affordability/Lack of funding</td>
<td>Service requires funding to continue</td>
<td>Medium – funding required is nearly £750,000 more than current operation and may be difficult to justify in times of budgetary cutbacks.</td>
<td>High – likely to see the Service disbanded or reduced.</td>
<td>Results from the evaluation; use of monitoring data to demonstrate work of the Service; regular liaison with Government and the NHS</td>
</tr>
<tr>
<td>Loss of key staff</td>
<td>May prevent the Service from operating.</td>
<td>Medium – there will inevitably be</td>
<td>Medium to high – the Service is</td>
<td>On-going programme to recruit and retain</td>
</tr>
</tbody>
</table>

152
<table>
<thead>
<tr>
<th>Scenario</th>
<th>Impact Description</th>
<th>Probability</th>
<th>Recommended Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Staff Turnover</strong></td>
<td>Staff turnover in a period of time is dependent on the loss of dedicated staff.</td>
<td>High</td>
<td>Configuration of staff rota to ensure maximising use of staff resources.</td>
</tr>
<tr>
<td><strong>Increased Case Workload</strong></td>
<td>Increased awareness of EMRS, a loss of local clinical expertise and population increases produce an increase in cases that EMRS may not have the capacity to meet.</td>
<td>Low to Medium</td>
<td>Configuration of staff rota to ensure maximising use of staff resources.</td>
</tr>
<tr>
<td><strong>Simultaneous Transfers</strong></td>
<td>The Service may receive simultaneous requests for retrievals. It may not be possible to respond to requests, and one request may have to be delayed.</td>
<td>Low Unlikely to be as serious an issue with two teams.</td>
<td>Configuration of staff rota to ensure maximising use of staff resources.</td>
</tr>
<tr>
<td><strong>Increase in Additional Air Transfers</strong></td>
<td>EMRS increases the number of air transfers undertaken by SAS and Option D would see a marked increase on those from Option B. However, almost all of these patients would have been retrieved anyway and EMRS can avoid unnecessary transfers. Nevertheless, air transfers may increase more sharply in succeeding years if local areas are not as resourced as they are now and have to rely more on EMRS.</td>
<td>Low</td>
<td>Audit/review of aircraft use; better coordination of aircraft services; maintaining skills and facilities locally.</td>
</tr>
<tr>
<td><strong>Being Used for Inappropriate Cases</strong></td>
<td>Not efficient use of the Service; may mean that an actual emergency is delayed.</td>
<td>Low</td>
<td>Consider use of tasking criteria; work with local staff to ensure they know the circumstances in which to involve EMRS; ensure that the most senior local health professional examines the patient before call-out; better coordination of air ambulance services.</td>
</tr>
<tr>
<td>Scenario</td>
<td>Description</td>
<td>Probability</td>
<td>Likelihood</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>-------------</td>
<td>------------</td>
</tr>
<tr>
<td>Adverse weather</td>
<td>May prevent SAS aircraft being used.</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Increase use of ICU beds</td>
<td>Improved patient survival rates with EMRS will see increased use of ICU beds. However, early access to resuscitation by EMRS may lead to less ICU admissions and shorter ICU stay duration.</td>
<td>Low</td>
<td>Likely to be low even with the increased caseload.</td>
</tr>
</tbody>
</table>

Option D is able to deal with many of the downsides of Option C by expanding the capacity of the Service. However, its main risks will be around staff recruitment as more staff will have to be recruited from the West of Scotland, and the likely over utilisation of the Service, which means that it is likely that there will be inefficient utilisation of key hospital staff unless steps are taken to explore extending the Service into other areas, which will also bring risks in terms of the scope of the Service being seen as being pushed out by local health professionals who then become more concerned about de-skilling. It may also be an expensive way of delivering medical services for people who are not acutely ill or injured.

**Option E risks**

Table C.5 provides our risk assessment for Option E.
<table>
<thead>
<tr>
<th>Risk</th>
<th>Description</th>
<th>Probability</th>
<th>Size of impact</th>
<th>Mitigation measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under utilisation of the Service</td>
<td>There is not a sufficient number of cases to maintain work for two clinical teams.</td>
<td>High – our demand model indicates that there is likely to be under utilisation with a two team option, particularly in the North.</td>
<td>High – could mean inefficient utilisation of staff for emergency medical care.</td>
<td>Consider having fewer staff on the North; explore extending the Service into other areas, e.g. the more isolated district general hospitals; dealing with other types of specialist care (e.g. spinal injuries); consideration of working with other air emergency retrieval services; widening scope of service to include more primary retrievals.</td>
</tr>
<tr>
<td>Affordability/Lack of funding</td>
<td>Service requires funding to continue</td>
<td>High – funding required is £1.2m more than current operation and may be difficult to justify in times of budgetary cutbacks.</td>
<td>High – likely to see the Service disbanded or reduced.</td>
<td>Results from the evaluation; use of monitoring data to demonstrate work of the Service; regular liaison with Government and the NHS</td>
</tr>
<tr>
<td>Increase in SAS resources</td>
<td>As EMRS retrievals take twice as long as normal retrievals, this places pressure on the ability of SAS to deliver its Service.</td>
<td>High, as there will be a marked increase in the number of retrievals from the pilot.</td>
<td>Medium to high. SAS believes that it has the capacity to undertake additional, but it would be near or over its limit at 321 cases.</td>
<td>Investment in air ambulances and possibly buying of another aircraft; better coordination of air ambulance services to maximise efficiency of use.</td>
</tr>
<tr>
<td>Failure to recruit staff</td>
<td>May prevent the Service from continuing.</td>
<td>Medium to high – ability to recruit two clinical teams will be more difficult, especially in the North as it is only likely to draw from one or two hospitals.</td>
<td>High - may mean that Service cannot function properly or efficiently.</td>
<td>Programme to recruit and retain staff; introducing more staff to the Service; use of secondments and trainees; building links with hospitals in surrounding areas.</td>
</tr>
<tr>
<td>Loss of key staff</td>
<td>May prevent the Service from operating.</td>
<td>Medium – there will inevitably be staff turnover in a period of time.</td>
<td>Medium to high – the Service is dependent on a core group of dedicated staff and the loss of these staff may see the Service deteriorate.</td>
<td>On-going programme to recruit and retain staff so loss of key staff is not as keenly felt; incentive packages to retain key staff; training programmes for existing staff.</td>
</tr>
<tr>
<td>-------------------</td>
<td>----------------------------------------</td>
<td>-------------------------------------------------</td>
<td>-----------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Increase in case workload</td>
<td>Increased awareness of EMRS, a loss of local clinical expertise and population increase produce a rise in cases that EMRS may not have the capacity to meet.</td>
<td>High – will almost certainly happen with a move to a national Service.</td>
<td>Low to medium – two clinical teams in two centres will provide more capacity.</td>
<td>Configuration of staff rota to ensure maximising use of staff resources.</td>
</tr>
<tr>
<td>Simultaneous transfers</td>
<td>The Service may receive simultaneous request for retrievals. It may not be possible to respond to requests, and one request may have to be delayed.</td>
<td>Low. Unlikely to be as serious an issue with two teams in two centres.</td>
<td>Medium. Would see a number of transfers delayed or missed and place pressure on the Service and staff, but unlikely to be a major impact if probability of occurring is low.</td>
<td>More consultant staff; flexibility of use of staff; better coordination of air ambulance services.</td>
</tr>
<tr>
<td>Increase in additional air transfers</td>
<td>EMRS increases the number of air transfers undertaken by SAS and Option E would see a marked increase on those from Option B. However, almost all of these patients would have been retrieved anyway and EMRS can avoid unnecessary transfers. Nevertheless, air transfers may increase more sharply in succeeding years if local areas are not as resourced as they are now and have to rely more on EMRS.</td>
<td>Low</td>
<td>Likely to be low as probability of this occurring regularly is low. May become larger if local resources are not maintained.</td>
<td>Audit/review of aircraft use; better coordination of aircraft services; maintaining skills and facilities locally.</td>
</tr>
<tr>
<td>Being used for inappropriate cases</td>
<td>Not efficient use of the Service; may mean that an actual emergency is delayed.</td>
<td>Low – fieldwork did not indicate that this was a common problem, but was mentioned by several staff in two areas.</td>
<td>Low as simultaneous retrievals will not be common.</td>
<td>Consider use of tasking criteria; work with local staff to ensure they know the circumstances in which to involve EMRS; ensure that the most senior local health professional</td>
</tr>
<tr>
<td>Adverse weather</td>
<td>May prevent SAS aircraft being used.</td>
<td>Low - appears to have been a rare occurrence over the pilot period, but extending the Service to all Scotland may make this more of a factor.</td>
<td>Low</td>
<td>Where necessary, may be able to use a military or rescue aircraft that are better able to deal with adverse weather. May also use land-based retrieval for mainland hospitals and sea-based retrieval for islands.</td>
</tr>
<tr>
<td>----------------</td>
<td>--------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------</td>
<td>-----</td>
<td>--------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Increase use of ICU beds</td>
<td>Improved patient survival rates with EMRS will see increased use of ICU beds. However, early access to resuscitation by EMRS may lead to less ICU admissions and shorter ICU stay duration.</td>
<td>Low</td>
<td>Likely to be low even with the increased caseload.</td>
<td>Audit/review of ICU bed occupancy rates of EMRS and non EMRS patients to identify the extent to which this is a problem.</td>
</tr>
</tbody>
</table>
Appendix D Members of overseeing bodies for the research

EMRS Project Board (at December 2009)

Alasdair Corfield, EMRS
Roger Gibbins, NHS Highland
David Heaney, Centre for Rural Health
Stephen Hearns, EMRS
David Godden, Centre for Rural Health
Jim Kersse, Scottish Ambulance Service
Pauline Howie, Scottish Ambulance Service
Jill Vickerman, Scottish Government
Hannah Keates, Scottish Government
Elizabeth Porterfield, Scottish Government
Alasdair Munro, Health Economics Research Unit
Drew Inglis, EMRS
Anne Cadman, EMRS Administrative Support
Annie Ingram, North of Scotland Planning Group
Brian Michie, NHS Western Isles
Catherine Donnelly, NHS Dumfries & Galloway
Christine Sheehy, Scottish Government
Fiona Grant, North of Scotland Planning Group
Grant Archibald, NHS Greater Glasgow & Clyde
John Boyle, DTZ
John MacLeod, NHS Highland
Mike Hall, NHS Highland
Marjorie Marshall, Scottish Government
Melanie McCollan, NHS Greater Glasgow & Clyde
Randall McRoberts, EMRS
Alasdair Newton, EMRS
Russell Whyte, DTZ
Tracy Ligema, NHS Highland
RRIG Membership (as of 16 December 2010)

Chair: Dr Roger Gibbins, Chief Executive, NHS Highland

Academy and Faculty of Royal Colleges, Chair, Professor Neil Douglas,

Association of Directors of Social Work: Mr Iain McAuley, Acting Director of Social Work, Western Isles Council

Emergency Medical Retrieval Service (EMRS) - Lead Clinician, Dr Stephen Hearns

NHS Boards And Special Health Boards
NHS Ayrshire and Arran – Mr Paul Ardin, Director of Primary Care Development, Clinical Lead
NHS Borders – Dr Eric Baijal, Director of Public Health, Dr Laura Ryan, Unscheduled Care Clinical Lead, (Primary Care), Ms Jackie Smith, Director of Performance and Planning
NHS Dumfries and Galloway – Mrs Alison Burns, Locality Manager, Stranraer
NHS Grampian – Dr Roelf Dijkhuizen, Medical Director; Mr Andrew Fowlie, General Manager, Moray CHSCP
NHS Greater Glasgow and Clyde – Dr Ian Wallace, Associate Medical Director and Mrs Sharon Adamson, Director of Acute Planning
NHS Forth Valley – Mr Eddie Macdonald, General Manager Stirling CHP
NHS Highland – Mrs A Gent, Director of Human Resources; Dr Mike Hall, Clinical Director, Argyll and Bute CHP, Mrs Gill McVicar, General Manager, Mid Highland CHP, Mr Bill McKerrow, ENT Consultant and Lead Clinician Remote and Rural Programme
NHS Lothian – Dr D Gorman, Consultant in Public Health Medicine, Ms S Mair, Director of Performance Management
NHS Orkney – David Pigott, Chief Executive, Mrs Fiona Smith, Joint Head of Personnel and Mr Martinus Roos, Medical Director, Human Resources and Mrs Rhoda Walker, Director of Nursing
NHS Shetland – Dr Ken Graham, Medical Director and Dr Sarah Taylor, Director of Public Health and Planning
NHS Tayside – Mr Bill Nicoll, General Manager, Perth and Kinross CHP
NHS Western Isles - (Team of 5 members, with 2 people attending at any one time):
  Mr Nigel Hobson, Nurse Director/Chief Operating Officer, NHS Western Isles
  Mr Gordon Jamieson, Chief Executive, NHS Western Isles
  Dr Brian Michie, Medical Director, NHS Western Isles
  Professor Andrew Sim, Consultant Surgeon, NHS Western Isles
  Dr Sheila Scott, Director of Public Health

Scottish Ambulance Service
Dr George Crookes, Medical Director
Mrs Shirley Rodger, Director of Human Resources;

NHS Education for Scotland (NES)
Professor Gillian Needham, Post Graduate Dean, North East Deanery
Mrs Pam Nicoll, Programme Director, RRHEAL, NES

NHS Quality Improvement Scotland (QIS)
Mrs Eileen Moir, Director of Nursing and Practice Development.

NHS 24 - Dr Peter Baxter, Associate Medical Director; G Stillie, Director Service Delivery

National Services Division (NSD) Mrs Kathy Collins, Nursing and Quality Advisor.

National Specialist Services (NSS) Mr Ron Macdonald, E-health Programme
North of Scotland Public Health Network (NoSPHN), Director of Public Health, NHS Highland

Patient Representation -
Mr Robin Creelman, Chair Argyll and Bute Public Partnership Forum

Regional Planning Groups:
North of Scotland Planning Group (NoSPG) - Director of Regional Planning and Workforce Development (and Project Director), Dr Annie Ingram; Regional Nursing Advisor, Mrs Betty Flynn; Remote and Rural Programme Manager, Mrs Fiona Grant.
South East and Tayside Planning Group (SEAT) Director of Regional Planning, Mrs Myra Duncan
West of Scotland Planning Group (WoSPG) Director of Regional Planning, Ms Heather Knox

Scottish Centre for Telehealth
General Manager, Mr Iain Hunter

Scottish Government Health Department (SGHD)
Director of Healthcare Policy and Strategy, Mr Derek Feeley,
Assistant Director of Healthcare Policy and Strategy, Mr Colin Cook
Assistant Director of Joint Improvement Team, Dr Margaret Whoriskey

Scottish Partnership Forum Representatives:
Royal College of Nursing, Ms Ros Derham
Unison, Ms Sandra-Dee Masson
Unison, Mr Alan Bickerstaff

University of Highlands and Islands, Millenium Institute - Mr Ian Leslie, Dean of Faculty of Health
APPENDIX E - GLOSSARY

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Full Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>A&amp;E</td>
<td>Accident &amp; Emergency</td>
</tr>
<tr>
<td>AAMS</td>
<td>Association of Air Medical Services</td>
</tr>
<tr>
<td>AMS</td>
<td>SA Red Cross Air Mercy Service</td>
</tr>
<tr>
<td>APACHE II</td>
<td>Acute Physiology and Chronic Health Evaluation II</td>
</tr>
<tr>
<td>BASICS Scotland</td>
<td>British Association for Immediate Care</td>
</tr>
<tr>
<td>CCATT</td>
<td>Critical Care Air Transport Team</td>
</tr>
<tr>
<td>CCU</td>
<td>Critical Care Unit</td>
</tr>
<tr>
<td>CHP</td>
<td>Community Health Partnership</td>
</tr>
<tr>
<td>CRH</td>
<td>Centre for Rural Health</td>
</tr>
<tr>
<td>ED</td>
<td>Emergency Department</td>
</tr>
<tr>
<td>EMDC</td>
<td>Emergency Medical Despatch Centre</td>
</tr>
<tr>
<td>EMRS</td>
<td>Emergency Medical Retrieval Service</td>
</tr>
<tr>
<td>GCS</td>
<td>Glasgow Coma Score</td>
</tr>
<tr>
<td>GP</td>
<td>General Practitioner</td>
</tr>
<tr>
<td>Green Book</td>
<td>HM Treasury Green Book: provides guidance on economic assessment</td>
</tr>
<tr>
<td>GRI</td>
<td>Glasgow Royal Infirmary</td>
</tr>
<tr>
<td>GROS</td>
<td>General Registry Office for Scotland</td>
</tr>
<tr>
<td>HDU</td>
<td>High Dependency Units</td>
</tr>
<tr>
<td>HEMS</td>
<td>Helicopter Emergency Service</td>
</tr>
<tr>
<td>HERU, University of Aberdeen</td>
<td>Health Economics Research Unit</td>
</tr>
<tr>
<td>HMNAS</td>
<td>Naval hospital gannet Prestwick</td>
</tr>
<tr>
<td>ICU</td>
<td>Intensive Care Unit</td>
</tr>
<tr>
<td>ISS</td>
<td>The Injury Severity Score (ISS) is an anatomical scoring system that provides an overall score for patients with multiple injuries. Each injury is assigned an Abbreviated Injury Scale (AIS) score and is allocated to one of six body regions (Head, Face, Chest, Abdomen, Extremities (including Pelvis), External). Only the highest AIS score in each body region is used. The three most severely injured body regions have their score squared and added together to produce the ISS score. Scores are from 0 to 75, but scores can only be derived for trauma patients.</td>
</tr>
<tr>
<td>KZN</td>
<td>KwaZulu-Natal region of South Africa</td>
</tr>
<tr>
<td>MCN</td>
<td>Managed Clinical Network</td>
</tr>
<tr>
<td>MoD</td>
<td>Ministry of Defence</td>
</tr>
<tr>
<td>NFSC</td>
<td>National Framework for Service Change</td>
</tr>
<tr>
<td>NHS ISD</td>
<td>Information &amp; Services Division</td>
</tr>
<tr>
<td>NICE</td>
<td>National Institute for Clinical Excellence</td>
</tr>
<tr>
<td>ONS</td>
<td>Office for National Statistics</td>
</tr>
<tr>
<td>QALY</td>
<td>Quality Adjusted Life Year - a commonly used outcome measure for health services and interventions</td>
</tr>
<tr>
<td>RAH</td>
<td>Royal Alexandra Hospital</td>
</tr>
<tr>
<td>RFDS</td>
<td>Royal Flying Doctors Service of Australia</td>
</tr>
<tr>
<td>RGH</td>
<td>Rural General Hospital</td>
</tr>
<tr>
<td>Retrieval</td>
<td><strong>Secondary</strong>: dispatch of a retrieval team to a referring</td>
</tr>
</tbody>
</table>
rural medical facility and retrieval to a place of definitive care.  

**Primary**: dispatch of a retrieval team to the scene of an accident and retrieval to a place of definitive care, avoiding the initial transfer to a local rural medical facility.

RIE  
Royal Infirmary of Edinburgh

RRIG  
Remote and Rural Implementation Group

RSI  
Rapid Sequence Intubation

SAPS II  
The Simplified Acute Physiology Score (SAPS) is similar to APACHE II in that it measures severity according to a range of 12 physiological variables. Scores range between 0 and 163 and a predicted mortality between 0% and 100%.

SAS  
Scottish Ambulance Service

SGHD  
Scottish Government Health Department

SGH  
Southern General Hospital

TISS  
The Therapeutic Intervention Scoring System (TISS) is another medical severity scoring system based on the assumption that very ill patients require a greater number of interventions and procedures that are more complex than patients who are less ill.

TRISS  
Trauma and Injury Severity Score methodology

WTE  
Whole Time Equivalent