

# Strategic Outline Programme for the Emergency Medical Retrieval and Transfer Service for Wales

04 July 2014



Bwrdd Iechyd  
Addysgu Powys  
Powys Teaching  
Health Board



Bwrdd Iechyd Prifysgol  
Hywel Dda  
University Health Board



Bwrdd Iechyd Prifysgol  
Betsi Cadwaladr  
University Health Board



Bwrdd Iechyd  
Aneurin Bevan  
Health Board



Bwrdd Iechyd Prifysgol  
Caerdydd a'r Fro  
Cardiff and Vale  
University Health Board



Bwrdd Iechyd Prifysgol  
Abertawe Bro Morgannwg  
University Health Board



Bwrdd Iechyd  
Cwm Taf  
Health Board

University Hospital of North Staffordshire **NHS**  
NHS Trust



Gwasanaeth Ambiwllans *Cymru*  
*Welsh Ambulance Service*



AMBIWLANS AWYR CYMRU  
WALES AIR AMBULANCE

## Abbreviations

<b>ABMU</b>	Abertawe Bro Morgannwg University
<b>BASICS</b>	British Association of Immediate Care Schemes
<b>BCUHB</b>	Betsi Cadwaladr University Health Board
<b>BJC</b>	Business Justification Case
<b>BP</b>	Benefit Point
<b>CCP</b>	Critical care paramedic
<b>CHANTS</b>	Cymru Inter Hospital Acute Neonatal Transfer Service
<b>CSF</b>	Critical Success Factor
<b>CT</b>	Core Training
<b>CVA</b>	Cerebrovascular Accident
<b>ED</b>	Emergency Department
<b>EMRS</b>	Emergency Medical Retrieval Service
<b>EMRTS</b>	Emergency Medical Retrieval Transport Service
<b>HB</b>	Health Board
<b>HEMS</b>	Helicopter Emergency Medical Services
<b>HLS</b>	Helicopter Landing Site
<b>HMS</b>	Her Majesty's Ship
<b>ICU</b>	Intensive Care Unit
<b>JRCLSC</b>	Joint Royal Colleges Liaison Service Committee
<b>KPI</b>	Key Performance Indicator
<b>LHB</b>	Local Health Boards
<b>MERIT</b>	Medical Incident Response Teams
<b>NARU</b>	National Ambulance Resilience Unit
<b>NCEPOD</b>	National Confidential Enquiry into Patient Outcome and Death
<b>NHS</b>	National Health Service
<b>NICE</b>	National Institute of Clinical Excellence
<b>NPC</b>	Net Present Cost
<b>PHEM</b>	Pre-hospital Emergency Medicine
<b>PICU</b>	Paediatric Intensive Care Unit
<b>SAMU</b>	Service d'Aide Medicale Urgence
<b>SAR</b>	Search and Rescue
<b>STEM</b>	ST Elevation Myocardial Infarction
<b>SWC</b>	South Wales Collaborative
<b>TARN</b>	Trauma Audit Research Network
<b>UEL</b>	Useful Economic Life
<b>VfM</b>	Value for Money
<b>WAACT</b>	Wales Air Ambulance Charity
<b>WAST</b>	Welsh Ambulance Service Trust
<b>WHSSC</b>	Welsh Health Specialist Services Committee

## Glossary of Terms

### **Pre-Hospital Care**

The term 'pre-hospital care' covers a wide range of medical conditions, medical interventions, clinical providers and physical locations. Medical conditions range from minor illness and injury to life threatening emergencies. Pre-hospital interventions therefore also range from simple first aid to advanced emergency care and pre-hospital emergency anaesthesia. Care providers may be lay first responders, ambulance professionals, nurses or physicians of varying backgrounds. All of this activity can take place in urban, rural or remote settings and is generally mixed with wider out-of-hospital and unscheduled care.

### **Inter-Hospital Transfer: –**

#### **Primary Transfer**

This is where a patient is retrieved from a pre-hospital environment.

#### **Secondary Transfer**

This is a planned transfer of a patient due to capacity issues or ongoing repatriation of the patient to a local facility.

#### **Hyper- Acute Secondary Transfer**

This is where a patient is retrieved from a hospital environment. This is for a time critical, life threatening condition. Due to the patient having acutely deteriorated or having self presented or transported to the hospital due to the paramedic crew making the decision that further ongoing transport would have endangered the life of the patient. This is also known as a delayed primary transfer.

### **Retrieval**

The use of expert medical teams to assess, stabilise, package and subsequently transport a patient from one site to another. The aim is replicate to the delivery of critical care that you would expect to receive any major hospital facility.

### **BASICS**

The British Association of Immediate Care Schemes was founded in 1977. This name was changed in 1980 to the British Association for Immediate Care. Immediate care is the provision of skilled medical help at the site of an accident or other medical emergency or in transit, including voluntary groups and hospital mobile medical teams.

### **Enhanced Pre-Hospital Critical Care**

Draws on the experience of hospital critical care and resuscitation and translates this into pre-hospital medical care.

### **Pre-hospital Trained Critical Care Doctor**

A doctor who has the ability to make decisions and carry out interventions outside standard paramedic practice.

### **Critical Care Paramedic**

These are paramedics who have acquired enhanced decision making and clinical skills outside JRCALC. Currently there is no national standard established for practice.

### **HEMS**

This stands for Helicopter Emergency Medical Service. This takes advantage of speed and access to difficult locations in order to reduce the time required for the patient to gain access to specialist intervention.

### Mass Casualty

A mass casualty incident (often shortened to MCI and sometimes called a multiple-casualty incident or multiple-casualty situation) is any incident in which emergency medical services resources, such as personnel and equipment, are overwhelmed by the number and severity of casualties.

### Major incident

A major incident is defined as a significant event, which demands a response beyond the routine, resulting from uncontrolled developments in the course of the operation of any establishment or transient work activity. The event may either cause, or have the potential to cause, either:

- ▶ Multiple serious injuries, cases of ill health (either immediate or delayed), or loss of life.
- ▶ Serious disruption or extensive damage to property, inside or outside the establishment.

### Pre-hospital Emergency Medicine

Pre-Hospital Emergency Medicine (PHEM) is a General Medical Council approved sub-specialty for anaesthesia and emergency medicine. As an approved sub-specialty, those who complete the sub-specialty training will have their Certificate of Completion of Training (CCT) in Anaesthetics annotated with sub-specialty of Pre-Hospital Emergency Medicine.

### Critical Care Levels of Care

A Department of Health report in 2000 entitled "Comprehensive Critical Care" defined four different levels of care encompassing patients in hospital. The definitions of these levels of care are:

#### Level 0

Patients whose needs can be met through normal ward

#### Level 1

Patients at risk of their condition deteriorating or higher levels of care whose needs can be met on advice and support from the critical care team.

#### Level 2

Patients requiring more detailed observation or intervention, single failing organ system or postoperative care, and higher levels of care.

#### Level 3

Patients requiring advanced respiratory support alone or basic respiratory support together with support of at least two organ systems. This level includes all complex patients requiring support for multi-organ failure.

High dependency can refer to level 1 or 2 whereas intensive care usually means level 2 or 3

### Injury Severity Score (ISS)

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 inc. pelvis, external). Only the highest AIS score in each body region is used. The 3 most severely injured body regions have their score squared and added together to produce the ISS score. An ISS of 9-15 implies moderate trauma and an ISS>15 implies major trauma.

### Glims

Type of lighting to light up a helicopter landing site.

# Contents

Abbreviations .....	i
Glossary of Terms .....	i
<b>1. Executive Summary .....</b>	<b>1</b>
1.1 Introduction .....	1
1.2 Strategic Environment and Case for Change .....	1
1.3 Economic Case .....	2
1.4 Commercial Case .....	2
1.5 Financial Case .....	2
1.6 Management Case .....	2
1.7 Recommendation .....	2
<b>2. Strategic Case .....</b>	<b>4</b>
2.1 Introduction .....	4
2.2 Strategic Context .....	4
2.3 National Drivers .....	4
2.6 Overview of unscheduled care across NHS in Wales .....	7
2.7 Service Baseline Position .....	7
2.8 Overview of Population Profile and Existing Activity .....	9
2.9 Overview of the Welsh Ambulance Service .....	10
2.10 Overview of the Wales Air Ambulance Charity (WAACT) .....	10
<b>3. Case for Change .....</b>	<b>11</b>
3.1 Introduction .....	11
3.2 Investment Objectives .....	11
3.5 Current Scope of the Clinical Service Model (including Demand Analysis) .....	18
3.6 Potential Scope of the Clinical Service Model .....	20
3.7 Long List of Operational Model Options .....	21
3.8 Development of Shortlisted Options for the Operational Model .....	22
3.9 Identified Shortlisted Options for the Operational Model .....	23
<b>4. The Economic Case .....</b>	<b>29</b>
4.1 Introduction .....	29
4.2 Options appraisal .....	29
4.3 Short-listed options .....	29
4.3.1 Short-listed options overview .....	29
4.3.2 Short-listed options detail .....	29
4.4 Qualitative Appraisal of Short-Listed Options .....	32
4.4.1 Benefits Analysis .....	36
4.4.2 Benefits scoring .....	36
4.4.3 Risk Analysis .....	37
4.4.4 Risks scoring .....	38
4.5 Quantitative Appraisal of Short-Listed Options .....	38
4.5.1 Economic Inputs .....	38
4.6 Economic Model Outputs .....	42
4.6.1 NPC Sensitivity analysis .....	42
4.7 Results of Economic Appraisal and Preferred Option .....	43
4.7.1 Sensitivity analysis .....	43
4.7.2 Switching point analysis .....	44
4.8 Economic Case conclusion .....	44
<b>5. Commercial Case .....</b>	<b>45</b>
5.1 Introduction .....	45
5.2 Procurement Strategy and Approach .....	45
5.3 Schedule of Capital Requirements .....	45
<b>6. Financial Case .....</b>	<b>47</b>
6.1 Introduction .....	47
6.2 Funding Assumptions .....	47
6.3 Capital Funding Requirement .....	48
6.4 Revenue Requirement .....	49
6.5 Impact on Balance Sheet and Income Statement .....	50
6.6 Stakeholder Support .....	50
6.7 Conclusion .....	50
<b>7. The Management Case .....</b>	<b>51</b>
7.1 Introduction .....	51

7.2	Programme and Project Management arrangements.....	51
7.2.1	Programme Sponsorship and Structure.....	51
7.2.2	Programme Reporting and Workstreams.....	52
7.2.3	Implementation Period.....	52
7.3	Programme Assurance and Review Process.....	52
7.4	Outline Arrangements for Benefits Realisation.....	53
7.4.1	Benefits Management Strategy.....	53
7.4.2	Benefits Realisation Plan.....	53
7.4.3	Anticipated Outcomes and Benefits.....	53
7.5	Outline Arrangements for Management of Risk.....	55
7.6	Principles of Organisational Governance.....	56
7.7	Principles of Clinical Governance.....	57
7.8	Governance Next Steps.....	58
7.8.1	Commissioning EMRTS.....	58
7.8.2	Transition58	
7.9	Use of Special Advisors.....	58
7.10	Implementation Considerations and Timeline.....	59
<b>8.</b>	<b>Conclusions and Recommendation.....</b>	<b>1</b>
<b>Appendix A</b>	<b>Evidence based review.....</b>	<b>2</b>
<b>Appendix B</b>	<b>Clinical service model and demand analysis.....</b>	<b>8</b>
<b>Appendix C</b>	<b>Operational model analysis.....</b>	<b>21</b>
<b>Appendix D</b>	<b>Clinical flows.....</b>	<b>35</b>
<b>Appendix E</b>	<b>Capital items/equipment list.....</b>	<b>63</b>
<b>Appendix F</b>	<b>Economic model.....</b>	<b>64</b>
<b>Appendix G</b>	<b>Affordability model.....</b>	<b>70</b>
<b>Appendix H</b>	<b>Letter of stakeholder support.....</b>	<b>72</b>
<b>Appendix I</b>	<b>EMRTS Terms of Reference.....</b>	<b>73</b>
<b>Appendix J</b>	<b>Benefit Beneficiaries.....</b>	<b>77</b>
<b>Appendix K</b>	<b>RPA1 - EMRTS.....</b>	<b>81</b>
<b>Appendix L</b>	<b>EMRTS proposed Data Specification and dataset.....</b>	<b>90</b>
<b>Appendix M</b>	<b>Project Board Costs.....</b>	<b>105</b>
<b>Appendix N</b>	<b>Letter of Response on Patient Flows from Cardiff and Vale LHB.....</b>	<b>106</b>
	<b>References.....</b>	<b>111</b>

# 1. Executive Summary

## 1.1 Introduction

The purpose of this Programme Case is to present proposals for the introduction of a new All Wales Emergency Medical Retrieval and Transport Service (EMRTS).

## 1.2 Strategic Environment and Case for Change

The Strategic Environment of the Programme consists of:

- ▶ National drivers for change.
- ▶ NHS Wales Service Change Plans.
- ▶ Development of Trauma Networks.
- ▶ An All Wales overview of existing emergency and acute care/pre-hospital care and secondary time critical transfers. This defines the current position and the do nothing option.
- ▶ An overview of population profile and existing activity.
- ▶ An organisational overview of WAST and the WAACT.

The vision for this service is to provide world-class pre-hospital health care to the citizens and visitors of Wales with the introduction of an effective All Wales Emergency Medical Retrieval & Transfer Service. The Service will provide advanced decision making and critical care for life or limb threatening emergencies for all those requiring transfer for time critical specialist management. This may be from scene or hospital. The new Service is designed to enhance but not replace existing transfer and retrieval services.

Effectively, this section sets out the links between this proposed investment case and:

- ▶ National policy and direction for Public Services in Wales.
- ▶ The local needs of patients in Wales to ensure equity of access.
- ▶ The overall organisational strategies for Local Health Boards, WAST, WAACT and Welsh Government.

The Case for Change meets the Welsh Government Investment Objectives namely:

- ▶ **Health gain:** improving quality of care and patient outcomes. Meeting forecast changes in demand.
- ▶ **Affordability:** given the long term revenue assumptions, there should be an explicit reference to reducing revenue costs.
- ▶ **Clinical and skills sustainability:** reducing service and workforce vulnerabilities and demonstrating solutions that are flexible and robust to a range of future scenarios.
- ▶ **Equity:** where people of highest health needs are targeted first.
- ▶ **Value for money:** demonstrating the least costly way of generating the anticipated benefits.

These Investment Objectives have been translated by the Programme into SMART objectives for the EMRTS as set down in section 3.2. The clinical need and organisational need for the service are described along with an analysis of demand for the service. The clinical model, the identified options, short-listing and high level evaluations are also set down.

### 1.3 Economic Case

The Economic Case, developed in accordance with HM Treasury guidance, sets down the comprehensive evaluation of the identified options to identify the preferred option in value for money terms. The non-financial benefits of each option are set down alongside the financial costs. The risks of each option are also evaluated in order to inform the value for money analysis. The conclusion of the economic analysis is that Option 2A offers better value for money than the other options.

### 1.4 Commercial Case

The Commercial case describes each Phase of the preferred option being progressed through a Business Justification Case (BJC) and identifies that the Programme will work with NHS Wales Procurement Services to deliver and execute appropriate procurement approaches.

### 1.5 Financial Case

The financial case sets down the funding assumptions, namely:

- ▶ The Case for capital and 'incremental' revenue costs to establish and run the EMRTS service to be funded by Welsh Government.
- ▶ Recommendation for Local Health Board's (LHB) to agree a detailed financial mechanism to account for changes in patient flow.
- ▶ LHB commitment to support Consultant Sessions release and with reimbursement as detailed in the Workforce communication circulated via Directors of Finance.
- ▶ Commitment of partner organisations to commit resources currently invested in this Programme pathway.

The Capital requirement of the Preferred Option is £1.9m and the 'incremental' revenue cost £2.9m, in addition to depreciation costs of £0.3m. These costs are requested to be funded by the Welsh Government.

### 1.6 Management Case

The Management Case details the management and governance arrangements for the successful delivery of the Programme to Cost, Time and Quality. To achieve this, the Management Case sets down the arrangements for benefit realisation and risk management over the Programme timeline.

The Management Case proposes arrangements for the interim management of the Programme, post Programme Case approval, in order to progress the development of the BJC's and the associated operational implementation planning. The Programme is working within the Welsh Government External Assurance Review Process.

### 1.7 Recommendation

The Programme Board recommend that the Health Boards, Welsh Ambulance Service (WAST) and Wales Air Ambulance Charity (WAACT) and the Welsh Government endorses the Programme Case, its preferred option, and the development of the Business Justification Case to implement the preferred option, that being Option 2A as set out below:

**Option 2A (Two bases, 12 hour air & road service, clinical lead and deputy at Caernarfon)**

<b>Two bases</b>	<b>Swansea &amp; Welshpool– air and road services over two phases occurring simultaneously in time</b>  <b>A designated clinical lead and deputy cover nominated for the Caernarfon base occurring at the same time as the Welshpool development</b>
<b>Operational</b>	Between 0800 - 2000. No overnight coverage. 1 team at each base for each shift
<b>Phase 1</b>	Swansea air and road service (operational between 0800-2000)
<b>Coverage (30 mins)</b>	12 hours: 69% population (air), 42% population (road)
<b>Phase 2</b>	Add Welshpool air and road service (operational between 0900-2100)
<b>Coverage (30 mins)</b>	13 hours: 95% population (air), 46% population (road)
<b>After 12 months of introduction of phase 1 and 2 a formal Gateway review will be conducted to strongly consider the need for further phased expansion to include the Caernarfon base and 24/7 cover in Swansea with reference to the investment objectives inc. equity</b>	

The Programme is grateful for the time, advice and support of Partner Organisations, representations and stakeholders to deliver the Programme Case.

## 2. Strategic Case

### 2.1 Introduction

The purpose of this section is to explain how the scope of the proposed project aligns with national policy and the strategic vision for Wales. It also sets out how the project supports and complements the existing business strategies of NHS Wales, Local Health Boards (LHB's)/NHS Trusts, Welsh Ambulance Service (WAST), Wales Air Ambulance Charity (WAACT), Welsh Government and NHS Wales as a whole.

In particular, this section of the Programme Case will demonstrate the strong links between policies, strategies and the drivers of joint working and how these can be used to deliver better services, more efficiently for the people of Wales.

### 2.2 Strategic Context

This section outlines the strategic context for the proposed change as follows:

- ▶ National drivers for change.
- ▶ NHS Wales Service Change Plans.
- ▶ Development of Trauma Networks.
- ▶ An All Wales overview of existing emergency and acute care/pre-hospital care and secondary time critical transfers. This defines the current position and the do nothing option.
- ▶ An overview of population profile and existing activity.
- ▶ An organisational overview of WAST and the WAACT.

The vision for this service is to provide world-class pre-hospital health care to the citizens and visitors of Wales with the introduction of an effective All Wales Emergency Medical Retrieval & Transfer Service (referred to forthwith as EMRTS). This newly commissioned clinical service will provide advanced decision making and critical care for life or limb threatening emergencies for all those requiring transfer for time critical specialist management. This may be from scene or hospital. The new service is designed to enhance but not replace existing transfer and retrieval services.

Effectively, this section sets out the links between this proposed investment case and:

- ▶ National policy and direction for Public Services in Wales.
- ▶ The local needs of patients in Wales to ensure equity of access.
- ▶ The overall organisational strategies for Local Health Boards, WAST, WAACT and Welsh Government.

This strategic context sets the scene for Case for Change set down in Section 3.0.

### 2.3 National Drivers

There are a number of national drivers relevant to the development of the EMRTS which will increasingly have an impact on the delivery of health services across Wales which are summarised below:

- ▶ **Together for Health (2012)** – This is Welsh Government's wider vision for the delivery of health services best suited to Wales but comparable with the best anywhere by 2016. It includes an integrated network of care and the requirement for developing world class quality services through use of innovative technology. It also focuses on creating a sustainable workforce, recruitment and retention and making Wales an attractive place to work.
- ▶ Within this, the aim is to develop links with the third sector to draw on its resource, flexibility and creativity (e.g. partnerships with charity organisation).

- ▶ **NHS Wales Service Change Plans** – The NHS is undergoing a series of changes focusing on the reconfiguration of acute clinical services across Wales, with the view to changing the delivery of some services. These include the South Wales Collaborative (covering LHB's in South Wales) and changes within Hywel Dda and BCUHB. The rationale for these changes is to deliver improved clinical outcomes and ensure services remain safe and sustainable in the face of challenges in the medical workforce.
- ▶ **1000 Lives Plus Campaign** - This is the national improvement programme supporting organisations and individuals to deliver the highest quality and safest healthcare for the people of Wales. The programme is delivered by Public Health Wales and Welsh Government.
- ▶ **National Unscheduled Care Programme (2010)** – The aim of this is to redesign unscheduled care processes across the total patient journey and to alleviate pressure within the system.
- ▶ **Welsh Audit Office Review of Unscheduled Care (2013)** – This highlighted rising demand and services being under severe pressure, such that performance against a number of key measures have deteriorated. It provided a series of recommendations to address these problems.

The above national drivers for change focus on all elements of the system of which optimisation of pre-hospital critical care and time critical secondary transfers is an essential component. The development of EMRTS aligns itself with the recommendations made by all of the strategies. However systems should be developed in parallel to ensure timely repatriation of patients back to their local community for ongoing care and rehabilitation. This will ensure efficient patient flow across the unscheduled care system.

Two key strategic drivers for change are described in detail below, which are particularly relevant to the development of the EMRTS.

## 2.4 NHS Wales Service Change Plans

The NHS in Wales is in era of service change and redesign to meet the demands and expectations of a changing population. The need and importance of a service being developed is emphasised by the strategic direction for specialist emergency services in Wales.

A key part of the rationale for reconfiguring some specialist services on to fewer sites is the opportunity reconfiguration provides to improve patient outcomes and service quality. 'Together for Health' highlighted that in the future the NHS in Wales would develop a smaller number of specialist centres that deliver some of the more specialised care like Emergency Medicine, Paediatrics, Neonatology and Obstetrics.

Centralising the acute episode of care is only one element of the pathway, to support it there needs to be an emergency transport system that gets patients to those specialist centres in an appropriate and timely manner. The EMRTS addresses this part of the pathway, getting patients to the urgent, quality care they require in a timely and safe manner.

Already in Wales there are pockets of the population in the more rural areas, particularly in Hywel Dda and Powys, who are unable to access through the current transport system, the clinically proven optimum pathways for cardiac disease. A reconfiguration that necessarily reduces the number of hospitals providing specialist services to improve the quality of care provided, will need to address the following problems:

- ▶ Who will stabilise critically ill or injured patients with longer journey times to definitive care?
- ▶ Who will deliver critical care to inpatients in district general hospitals with potentially limited critical care capability and transfer to definitive care?
- ▶ Will the longer journey times deplete access to local ambulance services?

All of the above concerns have been raised by the public, stakeholders or staff during the engagement and formal consultation processes that have taken place. Whilst the broad transport implications of individual reconfiguration plans have been addressed (Clinical Conveyance Group for South Wales Collaborative, 2013), the critical care needs of these patients has not. The EMRTS helps resolve all the above issues, ensuring that reconfiguration proceeds safely, and reducing inequalities in the opportunity to access healthcare in Wales.

Many of the reconfiguration plans in Wales are already being realised.

In March 2014, the South Wales Collaborative announced plans for changes to occur at the Royal Glamorgan Hospital including the following:

- ▶ In-patient paediatric services will not be delivered from this site in the future.
- ▶ Consultant-led Emergency Medicine services will not be delivered from this site in the future but implementation will require the proposed new model for a local Emergency Medicine service to be in place as the changes occur.
- ▶ Maternity and neonatal services will work closely with other units within the alliances to deliver as much safe care as locally as possible.

There are also changes within Hywel Dda Health Board, which have been partially completed. This includes the closure of overnight paediatric admissions, centralisation of neonatal services in Glangwili Hospital and the creation of a standalone midwifery led unit at Withybush Hospital. Further changes are expected as part of the Mid Wales Review. Further discussions regarding reconfiguration changes in BCU Health Board are underway but are not as developed as those in South Wales.

The EMRTS will be a key enabler of the changes occurring now and future proofing those that have yet to be determined.

## 2.5 Development of Trauma Networks

There is an intrinsic relationship between pre-hospital critical care and acute hospital care as part of an inclusive trauma network.

In 2010 a NHS clinical advisory group was formed and a report was published supporting the development of regional major trauma networks. This report was a key driver for improving trauma care. It recommended that 'enhanced care teams should be available 24/7 to provide care to major trauma patients.' In April 2012, NHS England established 16 regional trauma networks creating a series of major trauma centres surrounded by feeding trauma units. A number of quality indicators were developed on which the major trauma centres are funded.

The above advances have prompted Wales to identify the need to develop its own trauma network or risk falling behind the rest of the UK. In North Wales major trauma patients are currently taken to local trauma units and selective cases are then transferred to the major trauma centre at University Hospital, North Staffordshire as part of the West Midlands Trauma Network. Here there is an opportunity to improve direct and timely access to specialist trauma care for those identified as critically injured at the scene.

In South Wales discussions are under way (being facilitated by the South Wales Collaborative) to create the South Wales and Powys Trauma Network. The EMRTS will be a key enabler for the development of this network. Historically pre-hospital critical care and retrieval systems have been in place prior to the creation of these networks. It is essential that Wales follows this same order.

## 2.6 Overview of unscheduled care across NHS in Wales

Unscheduled care includes:

- ▶ **Unplanned care** ranging from patient attendance at Emergency Departments (ED's) and minor injuries units (MIU's).
- ▶ **Urgent telephone advice, sought in and out of hours.**
- ▶ **Emergency hospital admissions.**
- ▶ **Paramedic services.**
- ▶ **Emergency mental health or social care provision.**

The vision for unscheduled care in Wales is that people will be given help to remain independent; that it should be easy to get the right help when it is needed; and that no one should have to wait unnecessarily for the care they need. The unscheduled care system needs to be a safe, efficient and integrated service to provide effective points of access to appropriate NHS, primary, secondary, community or social services.

Unscheduled care continues to warrant significant attention by the NHS in Wales. Rising demand, particularly increasing numbers of acutely ill older patients, patient expectations and pressures on public funding have combined to require LHB's and WAST to look for radical new ways of delivering unscheduled care.

In September 2013, the Wales Audit Office acknowledged the ongoing work within NHS Wales to improve the unscheduled care service in a particularly challenging environment. Welsh Government proposed the establishment of a new NHS-led programme of work on unscheduled care to ensure that improvement could be maintained and good practice shared. As a consequence, the 'all Wales programme to support improvement in unscheduled care' was established in late 2013. Key deliverables for the programme include:

- ▶ **A new framework to enable the ambulance service to respond in a timely manner to emergencies.**
- ▶ **Enhanced support and intervention to create flow through hospitals.**

The Unscheduled Care Programme needs to be considered alongside related national programmes (e.g. Ambulance Reform Programme, and plans for major service reconfiguration in South Wales and South Powys, North Wales and Hywel Dda).

The EMRTS will enhance the range of services available to best meet the needs of the most unwell and most seriously-injured patients. It will contribute to a more comprehensive and systematic service providing accessible, responsive, high quality urgent and emergency clinical care.

## 2.7 Service Baseline Position

### 2.7.1 Pre-Hospital Care

The main provider of pre-hospital primary transport and secondary transfers is WAST. WAST is supported by a number of other organisations including LHB's, WAACT, Critical Care Networks, existing Paediatric/Neonatal retrievals services and voluntary organisations. This represents the current position and the do nothing approach.

Most patients across Wales suffering from critical illness and injury are taken to the nearest Emergency Department. A significant group of patients require treatment outside standard paramedic care as determined by the Joint Royal Colleges Liaison Service Committee (JRCALC) Guidance 2013. Treatment outside JRCALC includes:

- ▶ **Advanced airway management and anaesthesia.**
- ▶ **Surgical interventions (incl. chest procedures).**
- ▶ **Advanced resuscitation and haemorrhage control (incl. blood & clotting products).**

There are voluntary organisations (incl. BASICS schemes in South and North Wales) which provide a doctor at the scene on an *ad hoc* basis to provide care outside JRCALC. These individuals are usually activated by WAST and can provide a variable level of care at the scene. Additionally two Pre-hospital Emergency Medicine (PHEM) trainees are directly employed by WAST. Their scope of training is pre-hospital critical care and admission avoidance. There is limited advancement of critical care paramedic (CCP) practice at present.

A small number of emergency patients are currently taken by WAST directly to specialist units. These patients are mainly those suffering from a Stroke (CVA) or an ST Elevation Myocardial Infarction (STEMI) who are transferred from nearby areas directly to a Cardiac Catheterisation Laboratory in Swansea or Cardiff.

This service is not universally available across Wales as this therapy is time dependent. Large areas of Mid and West Wales are unable to access this service without deployment of an air asset.

The Civil Contingencies Act 2004 places a statutory duty on Health Boards to work in collaboration with partner organisations to prepare for the range of emergencies they may need to deal with, based upon a risk assessment. NHS Wales Emergency Planning Guidance "Medical Care at Scene of Major Incidents (2010)" describes the responsibility placed on Health Boards to provide Medical Incident Response Teams (MERIT) at incidents where medical support is required. An important feature and part of current developments is to enhance the Casualty Clearing environment, where their clinical skill set is similar to their normal working, and allows them to practice in a safe environment.

It also has to be recognised that incidents, which produce mass casualties, can create the need for advanced medical interventions for specific patients, particularly in entrapment scenarios. At present this area of expertise is limited to some individuals within BASICS Schemes. This service is not consistent or guaranteed and relies heavily on the good will of individuals.

Air transfers within the hours of darkness and in inclement weather are currently carried out by the Royal Air Force and Royal Navy Search and Rescue Squadrons from RAF Valley and RMB Chivenor in Devon. However, the military aircrafts primary role is search and rescue for downed military and civilian aircraft. Requests from the NHS for support with transfers and retrievals regardless of clinical urgency are therefore not guaranteed to be undertaken. In 2015, the military will cease to provide this service. This activity will pass to a private operator that is not contractually obliged to provide NHS cover. Any support provided will therefore likely to be undertaken at premium cost. They however will still be able to provide resilience in time of adverse weather or when the WAACT helicopter is not available.

The creation of an EMRTS is therefore required to provide specialist staff to undertake the treatment of severely injured or unwell patients at incident scenes and to co-ordinate and undertake their transfer to specialist care.

### **2.7.2 Secondary transfers**

As a consequence of critically ill and injured patients being transferred to their local ED, a substantial number of patients need to undergo a Secondary Transfer to a specialist center. Secondary transfers also occur in order to create capacity and for repatriation purposes. The transport framework for these is provided by WAST and WAACT.

Majority of the skills and therapies required for critical care transfers stand outside paramedic practice. Paramedics are therefore not specially trained to undertake critical care transfers. The paramedics ability to assist the doctor during the transfer is limited by familiarity with secondary transfer equipment, underpinning knowledge of critical care, anaesthesia and the ability to administer critical care medications.

Medical personnel for Level 2 and Level 3 adult critical care transfers are currently provided by the LHB's. These are usually junior Anaesthetic trainees with a critical care trained nurse. The South and North Wales Critical Care Networks undertake the training, governance and data collection arrangements.

In South Wales neonatal transfers are provided by CHANTS (Cymru Inter Hospital Acute Neonatal Transfer Service). The service operates twelve hours a day (8am-8pm) and is run from each of the three NICUs in South Wales are Cardiff, Newport and Swansea in turn. Each day there is a neonatal transport nurse, consultant, ambulance and driver dedicated to the service. Out of hours, there is no dedicated ambulance and time critical transfers are performed by the NICUs depending on medical/nursing and cot availability. Paediatric retrieval is provided by the paediatric intensive care unit at University Hospital Wales. This is available 24hrs a day. Both services are supported by the provision of a dedicated road ambulance by WAST, but no air asset.

In North Wales, mainly the team at Glan Clwyd Hospital performs transfers. There is also an arrangement with the Cheshire and Mersey Neonatal Network (CMNTS), supplemented by an *ad hoc* service from Arrowe Park Hospital if CMNTS are already committed, for the small number of extremely sick babies requiring time critical transfer to a regional unit in England. The North West and North Wales Paediatric Transfer Service (NWTS) provide paediatric retrieval for North Wales. The latter service has access to both road and air assets.

Time critical neonatal and paediatric transfers are currently resourced by the LHB's.

## 2.8 Overview of Population Profile and Existing Activity

The total population of Wales is 3.4million, which includes resident and transient populations. The population breakdown per LHB is shown below:

Aneurin Bevan	625,760
ABMU	585,002
Cardiff & Vale	569,605
Cwm Taf	311,457
Hywel Dda	445,353
Powys	133,000
BCUHB	830,000

(Date source: South Wales Collaborative)

Within Wales it is important to understand the epidemiology of some of the patient groups that the EMRTS is likely to be managing. This data has been taken from the best available sources. The projected workload for the EMRTS will be defined in the agreed clinical service model and section on demand analysis. The following summarises the key data:

Patient Group	Summary
<b>Trauma</b> (based on West Midlands working rate of 185 cases per million population)	<ul style="list-style-type: none"> <li>▶ Moderately severe trauma (Injury Severity Score 9-15) – approx. 634/year, this group is often over triaged pre-hospital and may be initially classified as major trauma.</li> <li>▶ Major trauma (Injury Severity Score &gt;15) – approx. 634/year</li> <li>▶ Total pre-hospital workload for patients initially classified as major trauma – approx. 1270/year. Approximately 317 of these cases are severe head injuries. (Data source: South Wales Collaborative)</li> </ul>
<b>Out of Hospital Cardiac Arrests</b>	<ul style="list-style-type: none"> <li>▶ Information obtained from WAST indicates that there are approx. 1000 cardiac arrests per year (under age of 60yrs) attended by WAST. It is unclear from this data which group would benefit from pre-hospital critical care input at the present time. (Data source: WAST coded data 2013-14)</li> </ul>
<b>Adult Critical Care Transfers</b>	<ul style="list-style-type: none"> <li>▶ Information obtained from the Critical Care Network indicates that there were 683 Level 2 and Level 3 critical care transfers between the years 2011-12. A 5 year analysis has shown that</li> </ul>

	the average number of time critical transfers (from ED's) is 150-160 per year. (Data source: Critical Care Network dataset)
<b>Neonatal Transfers</b>	▶ In South Wales, CHANTS transfers approx. 500-600 neonates per year, of which 10% require prolonged travel and are deemed time critical. North Wales transfers approx. 150 neonates per year and the number of prolonged journeys deemed time critical are also 10%. (Data source: Neonatal Network dataset)
<b>Paediatric Transfers</b>	▶ In South Wales, PICU retrieval transfers approx. 120 children per year. In North Wales, approx. 50 children per year are retrieved. (Data source: PICU retrieval and NWTS annual report 2012/13)
<b>Major Incidents and Mass Casualty Events</b>	▶ There are approximately 6 of these per year across Wales. (Data source: WAST dataset)

## 2.9 Overview of the Welsh Ambulance Service

WAST was established in 1998 following the All Wales Ambulance Service Review which recommended the creation of a single ambulance service. The trust serves a population of approximately 3.1 million people throughout Wales.

In 2007, NHS Direct Wales became part of the trust following its previous hosting arrangement with the Swansea NHS trust. Additionally WAST provides a range of medical services including unscheduled care, patient transport services, hospital transfers and emergency planning. The trusts deals with over 250,000 emergency calls per year and is funded by LHB's through the Welsh Health Specialist Services Committee (WHSSC).

Unscheduled care and patient care transport services are managed through 7 regions aligned to LHB's and each area has a head of service. More recently the patient care transport services have been commissioned by the LHB's.

The EMRTS will be a clinical service albeit with a transport component in order for it to be delivered.

## 2.10 Overview of the Wales Air Ambulance Charity (WAACT)

Since their launch on St. David's Day in 2001, the WAACT has provided Helicopter Emergency Medical Services (HEMS) to those with life threatening illness or injury in Wales having carried out over 19,000 missions in that time.

WAACT run three Eurocopter 135 helicopters currently based at Swansea, Caernarfon and Welshpool airports. The aircrafts have double paramedic crews running 12hr dayshifts 365 days a year. The charity also operates the National Children's Air Ambulance for Wales, covering both HEMS and urgent inter-hospital transfers for paediatric missions.

The Charity does not receive direct funding from central or Welsh Government. Furthermore, they do not qualify for National Lottery funding. Funds are therefore raised through charitable donations, fundraising events and membership of the Lifesaving Lottery. Major support for the charity comes from the general public and volunteers. To keep the air ambulances flying over Wales, £6 million each year is raised.

The EMRTS will add value to the existing service provided by WAACT. Furthermore it is important to recognise that there will be no change to their independence as a senior partner with the EMRTS.

### 3. Case for Change

#### 3.1 Introduction

This chapter sets out the current problems with pre-hospital critical care and secondary transfers in Wales. It also outlines the difficulties and service gaps associated with existing organisations, compared to what is occurring presently outside Wales. It provides a strong argument for introducing a world class service such as the EMRTS.

#### 3.2 Investment Objectives

There are key high level investment objectives that have been defined by Welsh Government which will be referenced throughout this business case. These include:

- ▶ **Health gain:** improving quality of care and patient outcomes. Meeting forecast changes in demand.
- ▶ **Affordability:** given the long term revenue assumptions, there should be an explicit reference to reducing revenue costs.
- ▶ **Clinical and skills sustainability:** reducing service and workforce vulnerabilities and demonstrating solutions that are flexible and robust to a range of future scenarios.
- ▶ **Equity:** where people of highest health needs are targeted first.
- ▶ **Value for money:** demonstrating the least costly way of generating the anticipated benefits.

Of these health gain, clinical and skills sustainability and equity are considered to be key investment objectives for the service and are described further as part of a SMART analysis below. Compliance with these objectives is essential if the EMRTS is to be successful. Affordability and Value for Money are critical success factors for the Programme.

<b>Health gain</b>	
Specific	To improve quality of care and outcomes for patients in Wales
Measurable	Improvements in functional outcomes (disability free life years) Improvement in survival of patients Objective improvements in clinical condition of patients  Reduction in overall length of stay and ICU stay Reduction in hospital admission
Achievable	Improvements in survival and function will be demonstrated once the complete patient pathway is defined (e.g. trauma network) The other measures are achievable solely through improvements in pre-hospital critical care and retrieval
Relevant	Health gain aligns itself with national drivers for change (section 2.3)
Time constrained	3yrs – improvements in survival and function 1yr for the other measurable outcomes listed

**Clinical and skills sustainability**

Specific	Improvements in training and skill base Enhance recruitment and retention
Measurable	Reduction in the number of unfilled substantive consultant posts in Emergency Medicine, Anaesthetics and Critical Care Reduction in the number of unfilled paramedic posts  Increase the number of Critical Care Paramedics in Wales Increase the number of PHEM trainees in Wales
Achievable	All of the above is dependent upon LHB's releasing workforce and advertising new posts
Relevant	There is a recruitment and retention crisis of consultants and paramedics in Wales
Time constrained	3yr review demonstrating improvements in the above

**Equity**

Specific	Ensure that the whole population receives adequate and timely access to specialist care in regardless of geography and strategic change
Measurable	Annual local hospital bypass (implies access to specialist care) Timeliness of access to specialist care for all patient groups Reduction in time critical secondary transfers Reduction in conveyances by the ambulance service
Achievable	All of the above is dependent is dependent on agreement of the clinical flows and creation of the networks
Relevant	There is a need to address inequality in line with national drivers for change
Time constrained	3yr review demonstrating improvements in the above

The benefits of the Programme are driven from these key investment objectives.

**3.3 Clinical Needs**

Clinical benefits and health gain are considered to be the highest priority by the project board. There are significant health gains to be achieved through the introduction of EMRTS. The evidence base for this is discussed in full in Appendix A.

**Pre-hospital critical care**

The following real case illustrates the current situation in Wales (no patient identifiable information to maintain confidentiality):

A 26yr male is assaulted in West Wales. He has sustained a significant head injury and is unconscious at the scene. A standard paramedic ambulance is deployed and the patient is taken to the local acute hospital. On arrival in the ED his windpipe is obstructed and his oxygen levels and blood pressure are very low. He is managed by a junior Emergency Department doctor and Junior Anaesthetist and after some delay the patient is transferred to the CT scanner.

A CT scan demonstrates an extensive bleed with pressure on the brain. 8hrs after injury the patient is transferred to the nearest neurosurgical facility for neurosurgical intervention. After several weeks on the intensive unit, the patient survives, but is severely disabled.

Pre-hospital critical care is an essential component of any modern day healthcare system. It involves bringing the ED resuscitation room to the patient as close to the time of injury or illness. By instituting key interventions at the scene the following benefits are realised:

- ▶ Improving the effectiveness of critical care interventions and the patient's clinical condition. This will justify transferring patients over longer distances to benefit from timely specialist intervention.
- ▶ Senior clinical decision maker's to ensure patients are taken to the appropriate hospital. This does not mean a specialist centre in all cases.
- ▶ Improvement in survival and functional outcome in major trauma and cardiac patients as described below.
- ▶ Reduce the number of secondary transfers occurring in Wales. Evidence points to a 30-50% reduction in secondary transfers with this approach, delivering the 'right patient to the right place in the right time.'

Presently the provision of pre-hospital critical care in the Wales is incomplete, unpredictable and inconsistent. A UK study from 2010 illustrates that Wales is not unique in this regard in which there is considerable regional variation in provision. This study demonstrated the presence of only one physician based pre-hospital critical care service that is operating on a 24hr basis and is largely NHS funded (London HEMS).

Outside this study EMRS Scotland operate a fully NHS funded model for the provision of critical care to rural populations in the West of Scotland.

Despite the creation of the trauma networks in England most pre-hospital critical care services still operate on voluntary basis. There are examples of guidance on governance of these services (e.g. Air Ambulance Association Framework 2013), yet these are rarely followed on a national level. Internationally there are also examples of well-developed physician based pre-hospital critical care services including Service d'Aide Medicale Urgence (SAMU, France), the German National Pre-hospital care system and Sydney HEMS.

The EMRTS will therefore be the first 24/7, NHS funded national pre-hospital critical care service in the UK to match the best in the world.

There are specific groups of patients where there is a need to improve pre-hospital outcomes in Wales. These are discussed below.

### **Major trauma**

A crucial link in the chain of survival from major trauma is pre-hospital critical care. The evidence for this in the context of major trauma is now well established. The main leaders in this field have been the British Army and their Medical Emergency Response Team (MERT) developed from the war in Afghanistan. Morrison et al showed a 30% reduction in mortality in this system as opposed to the American advanced paramedic system. This reduction in mortality was shown for all injury sub-groups above an Injury Severity Score of 10. They also showed that the casualties were considerably more stable on arrival at the hospital as opposed to the systems. This is particular relevant to Wales as the transfer times would be similar. (Apodaca A et al, 2013).

In recent years numerous papers have demonstrated an improvement in survival in the civilian setting from major trauma. A systematic review of controlled studies of physicians working in pre-hospital care demonstrated a significant improvement in survival (Botker MT et al, 2009).

Although the standard of care for major trauma patient is improving since the introduction of the English trauma networks, Wales is falling behind and commissioners should take note of the National Confidential Enquiry into Patient Outcome and Death (NCEPOD) reported in 2007. The report documents that 18% of severely head injured patients (such as in the case described above) arrive in hospital with a partially or fully blocked windpipe and 42% arrive in hospital with inadequate oxygen levels. Patients receiving this standard of pre-hospital care have twice the chance of dying compared to patients receiving higher standards care. The NCEPOD report described the level of pre-hospital care these patients require:

'Patients with severe head injury require early definitive airway control and rapid delivery to a centre with on-site neurosurgical capability. This implies regional planning of trauma services, including pre-hospital physician involvement and reconfiguration of services.'

Further to this the Department of Health (DH) published guidance in 2010 for ambulance services, primary care trusts and strategic health authorities informing them of their responsibility to provide 'Major Emergency Response Incident Teams' (MERIT) on a 24/7 basis. The DH advises that MERIT be made up of experienced doctors supported by other clinicians and that the development of MERITs will facilitate the establishment and operation of trauma networks in the pre-hospital treatment and care of critically ill patients. The following anonymised case illustrates the value of pre-hospital critical care in the context of a trauma network:

A 29yr old male was involved in a road traffic accident in 2012. His journey from the roadside to recovery demonstrates the necessity for timely, high-quality care of complex patients. In the early hours of one morning this patient was involved in a collision between his car and a heavy goods vehicle. He sustained injuries to his head, chest, pelvis and lower limbs. He was unconscious and his windpipe became blocked. On scene information passed to a central coordination hub at ambulance control allowed timely mobilisation of a pre-hospital critical care team, to support the ambulance crews already *en route*.

On arrival a pre-hospital trained doctor and critical care paramedic administered immediate critical care interventions to save his life. He was given powerful drugs to allow a breathing tube to be placed in his windpipe, followed by a hole in his chest to relieve a punctured lung. Instead of being taken to the nearest hospital, the team escorted the patient directly to the regional trauma centre where he could benefit from specialist service not available in a local acute hospital. This prevented unnecessary and potentially fatal delays in him receiving specialised surgical care. The patient has made a full recovery and is planning to return to work soon.

Thus far creation of the trauma networks in England can only be described as a success. This year TARN reported a 41% improvement in survival since the establishment of these networks. The provision of pre-hospital care has significantly contributed to adhering to the quality indicators and this improvement in outcome. Indeed high quality pre-hospital critical care drives better in-hospital care for these patients. However it is too early in the creation of these networks to demonstrate an improvement in functional outcome.

Internationally more developed trauma networks such as the Victorian State Trauma Service in Australia have started to show improvements in functional outcome. This service also includes an integrated pre-hospital critical care system and the ability to perform hyper-acute secondary transfers. A 10yr study from this network demonstrated a reduction in the incidence of road transport related deaths, whereas the incidence of hospitalised major trauma increased. Years of life lost decreased by 43% and years lived with disability increased by 32%, with an overall 28% reduction in disability adjusted life years over the time period. There was also cost saving per case of A\$633,446. Whilst the impact of aggressive pre-hospital care is difficult to isolate, it is clear that an improvement in survival does not necessarily equate to an increase in the burden of disease.

Evidence consistently demonstrates that severely injured patients are 15-20% less likely to die if admitted to a major trauma centre than if admitted to other hospitals (Celso et al, 2006). However this must be balanced with ensuring trauma units are able to maintain their clinical exposure and skill base and that the patient arrives at the Trauma Centre alive. In Wales the patients will be required to travel large distances to access this Trauma Network unlike in England (London HEMS average travel time 9 mins).

A service like EMRTS is imperative for 3 reasons.

1. Quality - to drive quality and allow the patient to arrive alive despite having travelled further.
2. Timeliness - to allow the patients to travel from further in the same time frame.
3. Access - by increasing access to more of the population this allows the resources to be concentrated and hospital service to improve.

### **Cardiac conditions**

In order to meet national standards for the management of Myocardial Infarction (Heart Attack) patients should be taken to a cardiac centre capable of performing primary coronary intervention (NICE guidance, 2013) as outcomes are significantly improved with this approach. This is in line with the aspirations of Together for Health. Presently equity of access to these services, in particular for rural Wales is not universal, despite the presence of cardiac networks.

With regard to patients suffering from out of hospital cardiac arrests, data generated from critical care teams shows a return of spontaneous circulation rate of 30-40% compared to 10-20% with standard care. Presently a sub-group of these patients is not gaining access to primary coronary intervention in Wales, which confers a survival benefit in this group. These patients often undergo secondary transfer to cardiac centres by which time it is often too late.

Enhanced tasking under EMRTS and critical care has the potential to confer a survival benefit for above patient groups.

### **Adult Secondary Transfers**

As discussed above, pre-hospital critical care reduces secondary transfer rates. However it is accepted that patients will still be triaged by the ambulance service to their local hospital or deteriorate whilst there. The requirement to rapidly transfer some of these patients to specialist care cannot be underemphasised. However data suggests that there are significant delays occurring in transferring these patients, which can be partially explained by the lack of resources available. An analysis of the Trauma Audit Research Network (TARN) for Morriston Hospital, Swansea demonstrated an average 8hr delay in the transfer of severe head injuries. Furthermore the impact of denuding the in-hospital resource to conduct these transfers places increased pressure on the anaesthetic and critical care departments and their staff.

There are also areas in which the quality of care can be improved. An audit was conducted of acute brain injured patients in Wales who were subject to inter-hospital transfer to a neurosurgical facility in 2012. This showed that a large percentage of patients were transferred by junior anaesthetists (at CT level), there was a failure to undertake neuro-protective measures in 40% of cases and generally inaccurate documentation of transfers.

It is clear that in centres that have a high rate of transfers out, the local resource cannot cope with the demand. This has resulted in timeliness and quality of these transfers suffering. There is an opportunity for EMRTS to support existing structures providing that the clinical governance arrangements and timeliness of response exceeds that of the local resource.

### **Neonatal and Maternal Transfers**

As a result of service redesign in some parts of Wales, there is likely to be an increase in the number of Midwifery Led Units (MLU's). Neonatal transfer services in Wales do not cover standalone MLUs. The British Association of Perinatal Medicine, Neonatal support for standalone midwifery led units - Framework for Practice (2011) advises that 'the fastest way for a mother or baby to travel to the nearest appropriate hospital maybe by 999 ambulance, accompanied by the midwife who leads on and delivers any required newborn resuscitation and stabilisation procedures, whilst supported by the ambulance personnel.' Given the increased number of MLUs and distances in Wales, a need has been identified to provide enhanced stabilisation and transfer, for both mother and baby, to consultant led units.

In Wales Neonatal transfer services do not have access to air support and due to the distances involved between neonatal units; the team can experience journey times of over 1hr or more for time critical retrievals. Therefore there is a need to support the neonatal teams in reaching the referral units in a timelier manner.

#### **Paediatric Transfers**

In South Wales paediatric intensive care retrieval is conducted by the on call consultant for paediatric intensive care. This places considerable pressure on the unit in terms of medical and nursing resource. There is an opportunity for a reduction in retrieval workload by improving pre-hospital critical care as outlined above. This clearly has both clinical and organisational benefits.

#### **Major Incidents and Mass Casualty Events**

Presently there is no provision of dedicated pre-hospital critical care teams and medical advisors in Wales for major incidents and mass casualty events. Wales relies on volunteer organisations (e.g. BASICS) and in-hospital response to this. These largely informal arrangements have provided medical support at several incidents including the Raglan coach crash, the Port Talbot steelworks explosion and recently the hit and run incident in Cardiff. The continuing terrorist threat and need to improve arrangements for dealing with a mass casualty event necessitate a need to formalise the medical response in order to ensure that a medical capability is always available to support the ambulance response.

It should be noted that Welsh Government guidance was one of the first to recognise the need to develop medical support for a mass casualty incident as a separate component to critical care provision as both can feature in a major incident environment. Strengthening of the current arrangements will deliver a more robust, resilient service. Wales is developing a similar process to that of the National Ambulance Resilience Unit (NARU) in NHS England, which could incorporate the EMRTS.

#### **Coordination and Tasking**

In Wales, there is no dedicated interrogation of 999 calls for pre-hospital critical care tasking. This has a number of implications including:

- ▶ Missed activation leading to a lack of pre-hospital critical care.
- ▶ Delayed activation resulting in patient deterioration prior to intervention. This has been a significant problem when activating in-hospital Mobile Medical Teams.
- ▶ Inappropriate activation leading to misuse of resources and a high percentage of aborted missions. Currently this is 50% for WAACT compared to the national average of 20%.

For secondary transfers there is a lack of communication and coordination of response between referring and receiving hospitals. Consequently the appropriateness and efficiency of transfer is often inconsistent.

In both cases the quality of patient care and experience is affected.

### **3.4 Organisational Needs**

#### **Recruitment and Retention of Workforce**

Wales has significant problems in recruiting and retaining medical staff especially in specialties such as Emergency Medicine. The current situation is at crisis point with a total shortfall of 25 senior doctors across the 3 main ED's in Wales against College of Emergency Medicine standards. Many unfilled posts are currently being covered by costly locum expenditure. This is equally true for the other specialities of Anaesthetics, Critical Care and Paediatrics who are all attempting to expand their services. Furthermore there is a limited scope for PHEM trainees to take up consultant posts with PHEM integrated into their job plans once they qualify in their parent specialty.

The key to breaking this cycle is to ensure that new and existing job plans are made more attractive. This will allow LHB's to retain their existing medical workforce and attract experienced individuals from outside Wales. For example 75% of doctors who provide pre-hospital care within the West Midlands trained in that region (Porter *et al*, 2004). Recently Bangor ED has established a pre-hospital programme to help address its shortage of middle grade doctors.

WAST itself is struggling to recruit and retain staff with sickness rates at their highest ever.

Therefore there is clearly a need to improve recruitment and retention of both doctors and paramedics by attracting high quality individuals to work for services such as the EMRTS. For doctors this also means supporting their parent speciality.

### **Welsh Ambulance Service**

The most recent review of WAST was conducted by Professor Siobhan McClelland and was published in April 2013. Some of the relevant recommendations are highlighted below changes to the ambulance service need to be addressed:

- ▶ Welsh Government and NHS Wales should agree that Emergency Medical Services (EMS) be operated as a clinical service and embedded in the unscheduled care system.
- ▶ Robust workforce planning should be put in place to deliver an upskilled and modernised EMS workforce enabling greater levels of autonomy and clinical decision making. This should be developed in partnership with the NHS, Higher Education Institutions and Regulatory Organisations.
- ▶ There are considerable benefits associated with alternative care pathways - not least for patients – and all parties should work together to accelerate their development as a priority.
- ▶ Consideration should be given to introducing incentive based targets, for example a non-conveyance or appropriate rate target to incentivise greater development.
- ▶ More joined up and granular data is required across the patient journey through primary, community, acute and social care.

There are clearly multiple factors at play that have contributed to the problems identified by the review. However due to the significant number of lengthy critical care transfers presently occurring in Wales, ambulances and their personnel continue to be denuded thus reducing the resource for responding to 999 calls locally. There is an urgent need to address this issue.

### **Wales Air Ambulance Charity Trust (WAACT)**

Throughout the UK, many air ambulance charities are moving away from the traditional model of rapidly transferring patients to hospital (the 'scoop and run' approach) to a critical care model. In the latter the aircraft is used to quickly deploy expertise and specialist equipment to the patient in order to provide critical care as close to the time of injury or illness. These changes are consistent with the charities vision of doctors working on their air ambulances and the vision of providing 24hr operational coverage across Wales.

There is also a pressing need to reduce the current rate of aborted missions by improving tasking of the air ambulances (see section 3.3.1). A PDSA is currently being undertaken to establish the best workforce configuration for HEMS deployment in Wales.

### **Organisations involved in Training and Education**

In Wales the ambulance service and the Wales Deanery sponsor the provision of Pre-Hospital Emergency Medicine (PHEM) training. PHEM was created in 2013 and is a new sub-speciality in the UK governed by the Intercollegiate Board of Pre-Hospital Emergency Medicine. In order to achieve the requirements of the curriculum significant clinical and educational supervision of trainees is required. Trainees also need to be exposed to robust, well organised clinical governance systems. Whilst progress has been made to establish

PHEM training in Wales, there is considerable scope of improvement with regard to the above.

The scope of paramedic practice and development is also changing, with the introduction of critical care paramedics (CCP's) in many parts of the UK. There is clearly a need to develop this within Wales in line with the overarching CCP competency framework that has been locally developed. However whilst it is recognised that provision of critical care is associated with a better patient outcome the evidence for paramedic only critical care teams is lacking (see Appendix A). The majority of the evidence for a paramedic only critical care team is based on cost analysis compared to a doctor/paramedic critical care team. Thus the EMRTS will fully support the development of the critical care paramedic roles in Wales.

The EMRTS will utilise Consultants from relevant specialties of Emergency Medicine, Anaesthetics and Critical Care working alongside these critical care paramedics.

### 3.5 Current Scope of the Clinical Service Model (including Demand Analysis)

This section provides an overview of the agreed clinical service model and estimated demand analysis, which has been evaluated by a wide group of stakeholder. It outlines the scope of the clinical service model in order to deliver the investment objectives and meet the current needs of the Welsh population. Details of the above are provided in Appendix B.

Scope	Description
<b>Pre-hospital critical care</b>	<ul style="list-style-type: none"> <li>▶ Pre-hospital critical care for all age groups (i.e. any intervention/decision that is carried outside standard paramedic practice).</li> </ul> <p>Approximately 800 patient contacts per base per year.            Major trauma (South Wales) – approximately 612 patients per year.            Major trauma (North Wales) – approximately 270 patients per year.            Data sources: WAACT dataset and population modelling (South Wales Collaborative)</p>
<b>Time critical adult retrieval</b>	<ul style="list-style-type: none"> <li>▶ Support existing structures in place to undertake time critical, life or limb threatening adult transfers from peripheral centres (inc. Emergency Departments, Minor Injury Units and Surgical Units) requiring specialist intervention at the receiving hospital.</li> <li>▶ This is currently 150-160 patients per year from ED's across Wales.</li> <li>▶ EMRTS will undertake inter-ICU transfers if time critical and life or limb threatening (e.g. a neurosurgical patient transferred to ICU and is then accepted for neurosurgery).</li> <li>▶ EMRTS will <b>not</b> undertake non-time critical secondary transfers and repatriations. The service will <b>not</b> replace existing structures in place to transfer these patients. (Data source: Critical Care Network dataset)</li> </ul>
<b>Neonatal Retrieval</b>	<ul style="list-style-type: none"> <li>▶ EMRTS will provide an <b>enhancement</b> of pre-hospital critical care (both for neonates born at home and those delivered in standalone midwifery led units - MLUs). Currently this is provided by a 999 response. This would ensure movement of these neonates directly to neonatal units using either an air or road asset. This is difficult to quantify further until reconfiguration plans are fully realised across Wales, but likely to be approximately 60 patients per year.</li> <li>▶ For babies already in neonatal units, requiring time critical transfer where the journey time by road is equal to or exceeding 1hr from base to referral unit, the helicopter utilised by the EMRTS could be used to rapidly transfer the neonatal team (CHANTS – South Wales) to the referring unit. The neonatal team would then stabilise the neonate and</li> </ul>

	<p>could transfer to the receiving unit using their own existing road asset mobilised at the same time as the helicopter. Thus EMRTS would be only providing the transport platform; neonatal teams would continue to provide the clinical care. There are currently 50-60 patients per year which fall into this category (during daylight hours). (Data source: Neonatal Network dataset)</p>
<b>Paediatric Retrieval</b>	<ul style="list-style-type: none"> <li>▶ EMRTS will provide an enhancement of pre-hospital paediatric critical care. This would ensure movement of appropriate paediatric cases directly to specialist centres (by air or road asset). This equates to approximately 10.4% of the current PICU retrieval workload in South Wales (12 cases per year).</li> <li>▶ EMRTS could assist with two areas of paediatric retrieval:</li> <li>▶ Time critical transfers for specialised intervention currently undertaken by the referring hospital (EMRTS providing the air or road asset and clinical care).</li> <li>▶ Back up option in the event that the existing paediatric retrieval service is not available due to factors such as workload, weather or technical problems with vehicles. EMRTS could act as an independent team or provide the air asset support to the paediatric retrieval service. (Data source: PICU retrieval dataset)</li> </ul>
<b>Maternity</b>	<ul style="list-style-type: none"> <li>▶ EMRTS would support midwife units by stabilising women and transfer them to a consultant led delivery unit. The mode of transport (air or road) will be determined on a case by case basis. Numbers are likely to be small.</li> <li>▶ This does <b>not</b> include delivery related problems (incl. pain relief and failure to progress) unless classified as time critical and life threatening to mother or foetus. The conditions covered will be clearly defined in a standard operating procedure.</li> </ul>
<b>Role of the 'top cover' EMRTS consultant</b>	<ul style="list-style-type: none"> <li>▶ Remote senior support for registrars (inc. pre-hospital emergency medicine trainees) and new consultants working for EMRTS.</li> <li>▶ For retrieval facilitate a remote conference call between referring and receiving unit to appropriately triage the correct resource to the tasking. This to occur for neonatal, paediatric and adult retrieval. Based on current data 220 calls per year.</li> <li>▶ Remote advice for peripheral unit (e.g. MUI) on immediate management of the patient whilst appropriate resource is being deployed.</li> <li>▶ Provide a medical advisor role at major incidents or mass casualty events. This would be approximately 6 times a year for the medical advisor role (WAST source). Discussions are pending on this area. (Data source: WAST dataset)</li> </ul>
<b>Co-ordination and dispatch</b>	<ul style="list-style-type: none"> <li>▶ Tasking of the EMRTS will occur following a 999 call, a request for assistance from an ambulance crew or a request for retrieval from a peripheral hospital.</li> <li>▶ These requests will be received via a WAST Clinical Contact Centre. During peak hours a Critical Care Paramedic will be present in the CCC to receive incoming calls, select appropriate 999 calls and provide further interrogation of the caller or attending ambulance crew to ensure intelligent appropriate EMRTS taskings. Requests for retrieval of a patient from a peripheral hospital will be passed to the 'top cover' consultant on duty for clinician to clinician discussion.</li> <li>▶ During periods of lower demand, including overnight, the road based EMRTS team will be able to self-task via remote access to the WAST incident stack.</li> </ul>

	<ul style="list-style-type: none"> <li>▶ In addition to this self-tasking the WAST secondary triage clinicians will direct any requests for EMRTS activation direct to the on duty EMRTS team. The 'top cover' consultant will be available to coordinate retrieval taskings overnight.</li> </ul>
<p><b>Key differences between North and South Wales clinical service model</b></p>	<ul style="list-style-type: none"> <li>▶ Following stakeholder engagement in North Wales, several recommendations regarding the North Wales clinical service model have been made. Largely the model is identical to South Wales, with the following differences noted: <ul style="list-style-type: none"> <li><b>Pre-hospital critical care</b> <ul style="list-style-type: none"> <li>▶ Same as South Wales. Clinical flows and commissioning to change for major trauma leading to direct transfers to UHNS.</li> </ul> </li> <li><b>Time-critical adult retrieval</b> <ul style="list-style-type: none"> <li>▶ As per South Wales.</li> </ul> </li> <li><b>Neonatal retrieval</b> <ul style="list-style-type: none"> <li>▶ Retrieval from midwifery-led units. Reconfiguration of maternity services in North Wales has not yet proceeded at the same pace as South Wales. The EMRTS in North Wales will not be involved in neonatal retrieval from the outset. This position will be reviewed on a regular basis.</li> <li>▶ However EMRTS would support the movement of time-critical cases where road times to the referring unit exceed 60mins. In this case the helicopter used by EMRTS would be able to transfer neonatal teams to referring unit as appropriate.</li> </ul> </li> <li><b>Paediatric retrieval</b> <ul style="list-style-type: none"> <li>▶ Pre-hospital care as per South Wales.</li> </ul> </li> <li><b>Time-critical transfers:</b> <ul style="list-style-type: none"> <li>▶ Where existing paediatric transfer service cannot respond, and where use of EMRTS will result in significant time-savings, then EMRTS will undertake the transfer. This will generally be at the request of the paediatric transfer service, in consultation with the referring clinician.</li> <li>▶ PICU retrievals: EMRTS can provide support with aircraft and logistics as required for NWTs.</li> <li>▶ As per South Wales, EMRTS in North Wales would not undertake inter-PICU retrievals or repatriations.</li> </ul> </li> <li><b>Maternity</b> <ul style="list-style-type: none"> <li>▶ As per South Wales and being clear on the scope of practice.</li> </ul> </li> </ul> </li> </ul>

### 3.6 Potential Scope of the Clinical Service Model

As service requirements change in line with the strategic direction of Wales, opportunities for the future scope of the EMRTS will emerge. These are outlined below, but will only be attainable if a comprehensive operational model is developed.

### Medium term scope and objectives

Scope	Description
Expansion of clinical governance framework	To cover all physicians providing pre-hospital care in Wales.
Non-time critical adult retrieval	This would include inter-ICU transfers to support bed capacity management strategies.
Paediatric intensive care retrieval	To achieve sustainability of paediatric intensive care in Wales.
Provision of medical support at events	This would include any activity with the potential to require critical care.

### Long term scope and objectives

Scope	Description
Physician response units	The EMRTS governance framework to support HB specific physician response units to promote care in the home and community based therapy.
Integration with other emergency services	Sharing clinical governance framework with other emergency services in Wales (e.g. coastguard rescue, police and fire rescue).
International critical care retrieval and repatriation	Extending of the resource of the EMRTS to encompass international workload through the utilisation of fixed wing aircrafts.
Creation of a single UK wide pre-hospital critical care and retrieval service	Standardisation of governance across the UK to ensure consistency of care and practice.

These aspects of Potential Scope will be considered by the Programme Board through a full appraisal of Benefits, Value for Money and Affordability at future points in the programme.

## 3.7 Long List of Operational Model Options

This section draws together a broad list of options which have been developed by the core Programme Team. These have included or excluded on the basis of whether they meet the key investment objectives.

Brief description	Rationale	Outcome
Outsource the EMRTS to an external private sector provider and enter in service level agreement	Excluded on affordability, value for money and clinical and skills sustainability	No
Utilise Search and Rescue from the Royal Navy and Air force as main asset for the EMRTS	Excluded on health gain (EMRTS not their core function), affordability and value for money	No
Vehicular based service only	Loose equity and a reduction in potential health gain	No
Each Health Board has its own aero-medical service	Excluded on affordability and value for money No equity	No
Use of police helicopters	Excluded on health gain (EMRTS not their core function), affordability and value for money	No
Outsource to another retrieval service outside Wales	Excluded on affordability, value for money and clinical and skills sustainability	No
Utilisation of WAACT aircrafts and modified vehicles tasked from a central coordination hub with Critical Care Paramedics	Excluded on health gain, equity and clinical skills and sustainability	No
Utilisation of WAACT aircrafts and modified vehicles tasked from a central coordination hub with senior grade doctors and Critical Care Paramedics	Excluded on clinical and skills sustainability Some reduction in health gain	No
Utilisation of WAACT aircrafts and modified vehicles tasked from a central coordination hub with Consultant grade doctors and Critical Care Paramedics	Promotes health gain, equity, clinical and skills sustainability, affordability (see Appendix A for evidenced based review)	Yes

The only Operational Model option that met the key investment objectives from the review process has been taken forward for further detailed analysis of the delivery options and an economic appraisal is set out in section 4.0. These delivery options have been described as a series of shortlisted options for the operational model.

### 3.8 Development of Shortlisted Options for the Operational Model

The following has been considered for each shortlisted option:

#### Dependencies

There are a number of key factors on which delivery of the business case and the successful implementation of the EMRTS operational model is dependent:

- ▶ The utilisation of the existing Wales Air Ambulances and air bases.
- ▶ The future movement of these air bases which may occur.
- ▶ Utilisation of the central coordination hub provided by WAST.
- ▶ The release of workforce by each LHB in order to cover the required sessions.
- ▶ The agreement of a single appropriate host organisation and clear lines of organisational, operational, clinical and financial accountability with other stakeholders.

#### Baseline assumptions for each shortlisted option

- ▶ That each base will run a pre-hospital trained critical care doctor (Consultant level) AND Critical Care Paramedic team for all Clinical tasking's.

- ▶ Each model utilises existing WAACT bases in Swansea, Welshpool and Caernarfon.
- ▶ Each air base will have a road asset attached to it for either overnight provision (as described) or when the aircraft is not operational or use not appropriate (e.g. local tasking). The road asset will have the ability to convey the patient, thus not denuding the local ambulance resource.
- ▶ The central coordination hub will be located in Cwmbran (as described above).
- ▶ The suggested timescales for introduction of each phase will be described in section.

### Current scope of shortlisted options

- ▶ Options must consider the range of scope available:
  - Minimum scope – at least 12 hour service for South & Mid Wales.
  - Intermediate scope – at least 12 hour service covering the full population of Wales.
  - Maximum scope – 24 hour service covering full population of Wales.
- ▶ The requirement for 24/7 deliverability to support the reconfiguration plans of acute services across South & West Wales (in particular the South Wales Collaborative and Hywel Dda).
- ▶ During the development of the initial proposal a phased approach to the introduction of the operational model was adopted. This received strong support from key stakeholders for the following reasons:
  - Recruitment – will enable the workforce to develop over time.
  - Justify the expansion of the service based on the level of activity and outcomes.
  - Ensure that the service expands at a manageable rate.
- ▶ After each phase there will be a formal Gateway review in order to achieve all the critical success factors.
- ▶ The opportunity to explore night flying capability (inc. utility of night hospital landing sites and night HEMS) as part of the delivering a 24/7 Air Service.

### Qualitative evaluation of options

In order to develop these options a number of factors have been dynamically modelled in order to determine which operating model is most appropriate for the above range of services:

- ▶ *Expected level of demand*
- ▶ *Operating hours of the service*
- ▶ *Geographical and population coverage*

Detailed analysis of the above is provided in Appendix C.

## 3.9 Identified Shortlisted Options for the Operational Model

This section sets out the six options for delivery of this model. The definition of coverage is taken from the percentage of population that can be reached within 30 minutes, by air and road respectively (see Appendix C). The key advantages and disadvantages of each option are also presented.

**Option 1 – Do nothing. Continue with current service**

This option is presented as a standard control that assumes no change from the current operational model and existing service plans.

**Option 2 (“Do Minimum”)**

<b>Two bases</b>	(Swansea & Welshpool– air and road) <b>over two phases</b>
<b>Operational</b>	Swansea – 0700-1900, Welshpool – 0900-2100, no overnight coverage, 1 team at each base for each shift
<b>Phase 1</b>	Swansea air and road service (operational between 0700-1900)
<b>Coverage (30 mins)</b>	12 hours: 69% population (air), 42% population (road)
<b>Phase 2</b>	Add Welshpool air and road service (operational between 0900-2100)
<b>Coverage (30 mins)</b>	12 hours: 95% population (air), 46% population (road)

**Advantages**

- ▶ Service introduction aligned with areas of current strategic change.
- ▶ Benefits of phasing model over 2 phases.
- ▶ Excellent population coverage of Wales from 2 bases.

**Disadvantages**

- ▶ No scope to expand to 24/7 service in South Wales and Caernarfon base. Consequently lack of equity over a 24hr period.
- ▶ No dedicated road service in South East Wales.

**Option 2A (Two bases, 12 hour air & road service, clinical lead and deputy at Caernarfon)**

<b>Two bases</b>	<b>Swansea &amp; Welshpool– air and road services over two phases occurring simultaneously in time</b>  <b>A designated clinical lead and deputy cover nominated for the Caernarfon base occurring at the same time as the Welshpool development</b>
<b>Operational</b>	Between 0800 - 2000. No overnight coverage. 1 team at each base for each shift
<b>Phase 1</b>	Swansea air and road service (operational between 0800-2000)
<b>Coverage (30 mins)</b>	12 hours: 69% population (air), 42% population (road)
<b>Phase 2</b>	Add Welshpool air and road service (operational between 0900-2100)
<b>Coverage (30 mins)</b>	13 hours: 95% population (air), 46% population (road)
<b>After 12 months of introduction of phase 1 and 2 a formal Gateway review will be conducted to strongly consider the need for further phased expansion to include the Caernarfon base and 24/7 cover in Swansea with reference to the investment objectives inc. equity</b>	

**Advantages**

- ▶ Simultaneous introduction of Swansea and Welshpool bases with the following benefits:
  - ▶ Provision of an equitable clinical service provision for North and South Wales.
  - ▶ Provide cross-cover between air assets during periods of highest activity (see demand analysis).

- ▶ To utilise the workforce being provided by University Hospital of North Staffordshire (Stoke) to establish the Welshpool service.
- ▶ Opportunity to evaluate need for expansion of service.
- ▶ Clinical lead in Caernarfon when introducing the Welshpool service to 'bridge the gap' until a full service is established. This will be to ensure equity of access for the North West Wales population, support paramedic development and determine the requirements for expansion based on demand. This will also support the alignment of clinical governance arrangements and promote recruitment of medical personal in North West Wales.

**Disadvantages**

- ▶ Initially lack of equity over a 24hr period.
- ▶ Risk of lack of expansion to 24/7 in Swansea and Caernarfon base without Gateway review.

**Option 3 (Two bases, with 24 hour service)**

<b>Two bases</b>	(Swansea & Welshpool – air and road) <b>over two phases</b>
<b>Operational</b>	24 hours (air and/or road). 1 team at each base for each shift
<b>Phase 1a</b>	Swansea air & road (0700-1900), then Swansea road (1900-0700)
<b>Phase 1b</b>	Swansea air & road (24hrs) with night flying capability between hospital landing sites (HLS)
<b>Phase 1c</b>	Swansea air & road (24hrs) with night HEMS capability from non-hospital landing sites
<b>Coverage (30 mins)</b>	24 hours: 69% population (air), 42% population (road)
<b>Phase 2</b>	Add Welshpool air and road service (operational between 0900-2100)
<b>Coverage (30 mins)</b>	95% population (air) by day, 46% population (road) by day

*NOTE:*

*If there is any significant delay in the introduction of the Welshpool service the Swansea service will need to be altered such that the late service in Swansea commences early, thus providing 2 teams available for simultaneous call during periods of highest activity.*

**Advantages**

- ▶ Service introduction aligned with areas of current strategic change inc. early inclusion of 24/7 coverage in South Wales.
- ▶ Opportunity to overlap shifts in South Wales for peak demand in activity.
- ▶ Benefits of phasing model over 2 phases.
- ▶ Early introduction of night flying capability.

**Disadvantages**

- ▶ Delay in phasing of Welshpool service leading to reduction in equity and difficulties in recruitment/retention in North Wales
- ▶ No scope for development of Caernarfon.

**Option 4 (Three bases with 24 hours)**

<b>Three bases</b>	(Swansea, Welshpool & Caernarfon – air and road) <b>over two phases</b>
<b>Operational</b>	South Wales: 24 hours / North Wales: 12hrs (air and/or road)
<b>Phase 1</b>	Swansea air & road (0700-1900), then Swansea road (1900-0700) Welshpool air and road service (0900-2100)

<b>Coverage (30 mins)</b>	Designated clinical lead for Caernarfon, but no additional investment 12 hours: 95% population (air), 46% population (road) 24 hours: 42% population (road)
<b>Phase 2 (options)</b>	Add Caernarfon air and road service (0900-2100)
	Add Swansea night flying capability between hospital landing sites (HLS)
	Add Swansea night HEMS capability from non-hospital landing sites
<b>Coverage (30 mins)</b>	12 hours: 100% population (air), 60% population (road) 24 hours: 69% population (air), 60% population (road)

**NOTE:**

*If there is any significant delay in the introduction of the Welshpool service the Swansea service will need to be altered such that the late service in Swansea commences early, thus providing 2 teams available for simultaneous call during periods of highest activity.*

**Advantages**

- ▶ Service introduction aligned with areas of current strategic change inc. early inclusion of 24/7 coverage in South Wales.
- ▶ Early equity in terms of coverage across Wales.
- ▶ Opportunity to overlap shifts in South Wales for peak demand in activity.
- ▶ Benefits of phasing model over 2 phases.
- ▶ Addition of Caernarfon increases coverage of population by 5% but accessibility of North West Wales can be limited by geography and bad weather. There are also fluctuations in population due to tourist activity.

**Disadvantages**

- ▶ No dedicated road service in South East Wales.

<b>Option 5 (Four bases with 24 hours)</b>	
<b>Four bases</b>	(Swansea, Welshpool, Caernarfon & Cwmbran – air /road) <b>over three phases</b>
<b>Operational</b>	South Wales: 24 hours/North Wales: 12hrs (air and/or road)
<b>Phase 1</b>	Swansea air and road service (operational between 0700-1900) Cwmbran road service (operational between 1500-0300)
<b>Coverage (30 mins)</b>	20 hours: 69% population (air), 55% population (road)
<b>Phase 2</b>	Add Welshpool air and road service (0900-2100)
<b>Coverage (30 mins)</b>	12 hours: 100% population (air), 60% population (road) 24 hours: 69% population (air), 60% population (road)
<b>Phase 3</b>	Add Caernarfon air and road service (operational between 0900-2100) Extend Swansea road service to 24/7
<b>Coverage</b>	24 hours: 100% population (air), 67% population (road)

**Advantages**

- ▶ Service introduction aligned with areas of current strategic change inc. early inclusion of 20hrs coverage in South Wales.
- ▶ SE road service to service main urban population.
- ▶ Overlapping shifts in South Wales for peak demand in activity.
- ▶ Benefits of phasing model over 3 phases.

- ▶ Addition of Caernarfon increases coverage of population by only 5% but accessibility of North West Wales can be limited by geography and bad weather. There are also fluctuations in population due to tourist activity.

#### **Disadvantages**

- ▶ Lack of early equity of coverage across Wales.

### **3.10 High Level Evaluation of the Shortlisted Options**

The material points from a high level evaluation of the shortlisted options are as follows:

- ▶ Peak activity is between 3pm-6pm for pre-hospital taskings and 12pm-9pm for adult retrieval. This supports the operational hours of the service and strongly reinforces the introduction of Swansea base in parallel with the Welshpool base
- ▶ Current evidence suggests that there is no requirement for an overnight service in North Wales. This is based on demand analysis and projected availability of workforce.
- ▶ The introduction of a Caernarfon base will also support the hyper-acute transfers occurring from Bangor (second highest number in Wales).
- ▶ The majority of Wales can be covered within 30mins by air (incl. 6mins activation time) from Swansea and Welshpool bases. There is an overlap between these two bases providing resilience for cross covering simultaneous calls.
- ▶ From the Swansea base, all of South Wales is covered within a 30min by air. This will provide additional support for taskings in Hywel Dda and Powys once overnight coverage is provided by the Swansea base as part of option 3 and 4.
- ▶ A significant part of North Wales can also be covered within 45mins by air from Swansea thus providing additional resilience once the phasing of option 3 and 4 is fully realised.
- ▶ For all options forward location of the Swansea road asset at Morriston Hospital provides the greatest coverage (of both urban and rural populations) compared to Cwmbran, Bridgend or Cardiff. This optimal location offers the best opportunity to rendezvous with paramedic crews on the periphery of the isochrones within an acceptable time frame (model of interception). This will be particularly beneficial when responding to taskings in Hywel Dda and Powys.
- ▶ Options 2, 2A, 3 and 4 do not include a road service in Cwmbran. In the development of the EMRTS the establishment of a single South Wales base would be preferable in terms of control of governance, logistics and cost. However in the event of the aircraft not being available or overnight (for options 3 and 4), coverage of SE Wales could be provided by the following forward location of the car on the M4 corridor, interception with Welsh Ambulance Service crews through rendezvous points and cross-cover by Welshpool during operational hours.
- ▶ There is reasonable coverage (using the 30min isochrones) by road from Welshpool, allowing timely access to taskings within Powys.

In terms of the above evaluation of shortlisted options, option 4 offers the best coverage of Wales. However this is subject to further analysis through objective qualitative and quantitative appraisal. A full economic evaluation is undertaken on these options and presented in Section 4.0.

### 3.11 Future Potential Scope of the Operational Model

As service requirements change in line with the strategic direction of Wales opportunities for the future scope of the EMRTS will emerge. These are outlined below:

Scope	Description
Organised utility of other available air assets	Integration of the EMRTS through utility of a wide range of existing and future air assets (inc. HMS Coastguard and UK SAR) to provide resilience to the agreed operational model.
Provision of a dedicated transfer aircraft	This would be utilised for neonatal, paediatric and adult transfers.
Extension of operational boundaries of the service	This would include operational activity in England to provide mutual aid.
Extension of operational framework to include international retrieval	Operational model extending to utilisation of fixed wing aircrafts.

These opportunities will be considered by the Programme Board in due course at future points in the programme.

## 4. The Economic Case

### 4.1 Introduction

This Economic Case has been developed in accordance with HM Treasury guidance in order to determine which of the options for achieving the stated strategic objectives offers the best Value for Money, based on both qualitative and quantitative analysis.

### 4.2 Options appraisal

The long listing and short listing process undertaken by the Programme Board is set down in Section 3.

### 4.3 Short-listed options

#### 4.3.1 Short-listed options overview

The short-listed options have been developed during a series of stakeholder workshops giving consideration to workforce, clinical and operational factors which are set out in detail in Section 3. The short-list of four options set out below were identified by key stakeholders during meetings mid-May and subsequently approved by the Project Board at a meeting on 2 June 2014.

**Option 2** (Do Minimum: 2 Bases, 12 hour service)

**Option 3** (2 Bases, 24 hour service)

**Option 4** (3 Bases, 24 hour service)

**Option 5** (4 Bases, 24 hour service)

A fifth option was added following the Project Board Meeting held on 19 June 2014:

**Option 2A** (2 bases, 12 hour air & road service, clinical lead and deputy at Caernarfon )

This additional option was included in the appraisal as an enhancement to the Do Minimum Option by generating more benefits and improved Value for Money.

Option 1 (Do Nothing) was not considered a viable option as it failed to achieve the investment objectives of Health Gain, Clinical and skills sustainability or Equity. Option 2 (Do Minimum) has been included as the reference case for appraising Value for Money.

In accordance with HM Treasury Greenbook guidance on Options Appraisals for Outline Business Cases, each of the short-listed options has been subject to both qualitative and quantitative options appraisal as set out in the following sections.

#### 4.3.2 Short-listed options detail

The short-listed options are described in more detail below:

<b>Option 1 – Do nothing. Continue with current service</b>	
This option is presented as a standard control that assumes no change from the current operational model and existing service plans.	
<b>Option 2 (“Do Minimum”)</b>	
<b>Two bases</b>	(Swansea & Welshpool– air and road) <b>over two phases</b>
<b>Operational</b>	Swansea – 0700-1900, Welshpool – 0900-2100, no overnight coverage, 1 team at each base for each shift
<b>Phase 1</b>	Swansea air and road service (operational between 0700-1900)
<b>Coverage (30 mins)</b>	12 hours: 69% population (air), 42% population (road)
<b>Phase 2</b>	Add Welshpool air and road service (operational between 0900-2100)
<b>Coverage (30 mins)</b>	12 hours: 95% population (air), 46% population (road)

**Advantages**

- ▶ Service introduction aligned with areas of current strategic change.
- ▶ Benefits of phasing model over 2 phases.
- ▶ Excellent population coverage of Wales from 2 bases.

**Disadvantages**

- ▶ No scope to expand to 24/7 service in South Wales and Caernarfon base. Consequently lack of equity over a 24hr period.
- ▶ No dedicated road service in South East Wales.

**Option 2A (Two bases, 12 hour air & road service, clinical lead and deputy at Caernarfon )**

<b>Two bases</b>	<b>Swansea &amp; Welshpool– air and road services over two phases occurring simultaneously in time</b>  <b>A designated clinical lead and deputy cover nominated for the Caernarfon base occurring at the same time as the Welshpool development</b>
<b>Operational</b>	Between 0800 - 2000. No overnight coverage. 1 team at each base for each shift
<b>Phase 1</b>	Swansea air and road service (operational between 0800-2000)
<b>Coverage (30 mins)</b>	12 hours: 69% population (air), 42% population (road)
<b>Phase 2</b>	Add Welshpool air and road service (operational between 0900-2100)
<b>Coverage (30 mins)</b>	13 hours: 95% population (air), 46% population (road)
<b>After 12 months of introduction of phase 1 and 2 a formal Gateway review will be conducted to strongly consider the need for further phased expansion to include the Caernarfon base and 24/7 cover in Swansea with reference to the investment objectives inc. equity</b>	

**Advantages**

- ▶ Simultaneous introduction of Swansea and Welshpool bases with the following benefits:
  - ▶ Provision of an equitable clinical service provision for North and South Wales.
  - ▶ Provide cross-cover between air assets during periods of highest activity (see demand analysis).
  - ▶ To utilise the workforce being provided by University Hospital of North Staffordshire (Stoke) to establish the Welshpool service.
- ▶ Opportunity to evaluate need for expansion of service.
- ▶ Clinical lead in Caernarfon when introducing the Welshpool service to ‘bridge the gap’ until a full service is established. This will be to ensure equity of access for the North West Wales population, support paramedic development and determine the requirements for expansion based on demand. This will also support the alignment of clinical governance arrangements and promote recruitment of medical personal in North West Wales.

**Disadvantages**

- ▶ Initially lack of equity over a 24hr period.
- ▶ Risk of lack of expansion to 24/7 in Swansea and Caernarfon base without Gateway review.

**Option 3 (Two bases, with 24 hour service)**

<b>Two bases</b>	(Swansea & Welshpool – air and road) <b>over two phases</b>
<b>Operational</b>	24 hours (air and/or road). 1 team at each base for each shift
<b>Phase 1a</b>	Swansea air & road (0700-1900), then Swansea road (1900-0700)
<b>Phase 1b</b>	Swansea air & road (24hrs) with night flying capability between hospital landing sites (HLS)
<b>Phase 1c</b>	Swansea air & road (24hrs) with night HEMS capability from non-hospital landing sites
<b>Coverage (30 mins)</b>	24 hours: 69% population (air), 42% population (road)
<b>Phase 2</b>	Add Welshpool air and road service (operational between 0900-2100)
<b>Coverage (30 mins)</b>	95% population (air) by day, 46% population (road) by day

*NOTE: If there is any significant delay in the introduction of the Welshpool service the Swansea service will need to be altered such that the late service in Swansea commences early, thus providing 2 teams available for simultaneous call during periods of highest activity.*

**Advantages**

- ▶ Service introduction aligned with areas of current strategic change inc. early inclusion of 24/7 coverage in South Wales.
- ▶ Opportunity to overlap shifts in South Wales for peak demand in activity.
- ▶ Benefits of phasing model over 2 phases.
- ▶ Early introduction of night flying capability.

**Disadvantages**

- ▶ Delay in phasing of Welshpool service leading to reduction in equity and difficulties in recruitment/retention in North Wales
- ▶ No scope for development of Caernarfon.

**Option 4 (Three bases with 24 hours)**

<b>Three bases</b>	(Swansea, Welshpool & Caernarfon – air and road) <b>over two phases</b>
<b>Operational</b>	South Wales: 24 hours / North Wales: 12hrs (air and/or road)
<b>Phase 1</b>	Swansea air & road (0700-1900), then Swansea road (1900-0700) Welshpool air and road service (0900-2100) Designated clinical lead for Caernarfon, but no additional investment
<b>Coverage (30 mins)</b>	12 hours: 95% population (air), 46% population (road) 24 hours: 42% population (road)
<b>Phase 2 (options)</b>	Add Caernarfon air and road service (0900-2100)  Add Swansea night flying capability between hospital landing sites (HLS)  Add Swansea night HEMS capability from non-hospital landing sites
<b>Coverage (30 mins)</b>	12 hours: 100% population (air), 60% population (road)  24 hours: 69% population (air), 60% population (road)

*NOTE: If there is any significant delay in the introduction of the Welshpool service the Swansea service will need to be altered such that the late service in Swansea commences early, thus providing 2 teams available for simultaneous call during periods of highest activity.*

**Advantages**

- ▶ Service introduction aligned with areas of current strategic change inc. early inclusion of 24/7 coverage in South Wales.
- ▶ Early equity in terms of coverage across Wales.
- ▶ Opportunity to overlap shifts in South Wales for peak demand in activity.
- ▶ Benefits of phasing model over 2 phases.
- ▶ Addition of Caernarfon increases coverage of population by only 5% but accessibility of North West Wales can be limited by geography and bad weather. There are also fluctuations in population due to tourist activity.

**Disadvantages**

- ▶ No dedicated road service in South East Wales.

<b>Option 5 (Four bases with 24 hours)</b>	
<b>Four bases</b>	(Swansea, Welshpool, Caernarfon & Cwmbran – air /road) <b>over three phases</b>
<b>Operational</b>	South Wales: 24 hours/North Wales: 12hrs (air and/or road)
<b>Phase 1</b>	Swansea air and road service (operational between 0700-1900) Cwmbran road service (operational between 1500-0300)
<b>Coverage (30 mins)</b>	20 hours: 69% population (air), 55% population (road)
<b>Phase 2</b>	Add Welshpool air and road service (0900-2100)
<b>Coverage (30 mins)</b>	12 hours: 100% population (air), 60% population (road) 24 hours: 69% population (air), 60% population (road)
<b>Phase 3</b>	Add Caernarfon air and road service (operational between 0900-2100) Extend Swansea road service to 24/7
<b>Coverage</b>	24 hours: 100% population (air), 67% population (road)

## 4.4 Qualitative Appraisal of Short-Listed Options

The benefits and risks of this project have been developed through the stakeholder engagement process set out in the Case for Change in Section 3. This process identified a wide range of potential benefits and risks associated with the development of the EMRTS. These have been subject to appraisal and each of the short-listed options has been allocated a benefit and risk score as set out in the following sections.

Beneficiary	Benefit
<ul style="list-style-type: none"> <li>▶ Welsh population</li> <li>▶ Welsh Government</li> <li>▶ NHS Wales</li> <li>▶ LHB's</li> </ul>	<p><b>Reduce health inequity</b> – Ensure that no population group receive substandard health care as a result of reconfiguration or geography.</p> <p><b>Geographical Inequity</b></p> <ul style="list-style-type: none"> <li>▶ <i>Triage and transport the patient to the correct receiving facility irrespective of where in Wales they are injured or become seriously ill.</i></li> <li>▶ <i>Support reconfiguration plans across Wales to proceed safely and effectively.</i></li> <li>▶ <i>Maintains and promotes patient confidence in the reconfiguration process.</i></li> </ul> <p><b>Improved access for Trauma and Critical Care</b></p> <ul style="list-style-type: none"> <li>▶ <i>Support the development of the South Wales and Powys Trauma Network and promote existing links between North Wales and Stoke Major Trauma Centre.</i></li> <li>▶ <i>Improve equity of access for specialised services, specifically cardiac, stroke and rehabilitation networks.</i></li> <li>▶ <i>Support reconfiguration of acute emergency, neonatal, paediatric and maternity services through the EMRTS provision.</i></li> </ul> <p><b>Language inequity</b></p> <ul style="list-style-type: none"> <li>▶ <i>Explore instigation of bilingual coordination hub.</i></li> </ul>
<ul style="list-style-type: none"> <li>▶ Welsh population</li> <li>▶ NHS Wales</li> <li>▶ LHB's</li> <li>▶ WAST</li> </ul>	<p><b>Quality assurance in Clinical Care</b> – measurable improvement in quality of services.</p> <p><b>Senior decision making capability through consultant led care direct from point of injury leading to:</b></p> <ul style="list-style-type: none"> <li>▶ Increased provision of evidenced based critical care interventions prior to, and during primary and secondary care transfers.</li> <li>▶ Sustainable improvements in survival and morbidity from major trauma, cardiac disease, stroke and severe sepsis through provision of EMRTS.</li> <li>▶ Meet and exceed UK and International standards for trauma provision and care.</li> <li>▶ Reduction in reported adverse events through improvements in patient care during transit.</li> <li>▶ Improved and sustainable functional outcomes and reduction in disability and impairment.</li> <li>▶ Provide a senior medical advisor for major incidents and mass casualty incidents.</li> </ul> <p><b>Improved patient flows</b></p> <ul style="list-style-type: none"> <li>▶ Reductions in secondary conveyance by a second ambulance resource.</li> <li>▶ A tangible reduction in transport time during secondary retrieval leading to earlier arrival at the specialist receiving facility.</li> <li>▶ Free staff groups for other work in primary referring hospital that ordinarily would have undertaken transfer.</li> <li>▶ Reduction in transport time for neonatal and paediatric retrieval teams for time critical cases leading to improved outcome in these groups.</li> </ul>

- ▶ Welsh population
- ▶ NHS Wales
- ▶ LHB's
- ▶ WAST
- ▶ Welsh Air Ambulance Charity Trust

**Economic benefits – demonstrating sustainable and continuing savings as a result of improvement in clinical care.**

**To the Welsh population as a whole:**

- ▶ *Enhanced recovery of patients and earlier return to working status.*
- ▶ *Increased disability adjusted life years and its associated economic benefit.*

**To the Welsh NHS as a whole:**

- ▶ *Reduced overall cost of rehabilitation through correct triage, treatment and transport resulting from:*
- ▶ *Reduced length of stay for all, particularly the elderly patient.*
- ▶ *Reduction in waiting times and faster turnover for rehabilitation beds.*
- ▶ *Reduction in ED waiting times.*
- ▶ *Improvement in Ambulance service response times.*
- ▶ *Reduction in ICU length of stay for trauma patients.*

**Individual Health boards**

- ▶ *Reduced ED attendances leading to reduction in ED waiting time targets.*
- ▶ *Improved recruitment and retention thereby reducing expenditure on locums to fill unfilled posts.*
- ▶ *Reduced time critical secondary transfers by HB's leading to better utilisation of anaesthetic staff.*
- ▶ *Ability for EMRTS to initiate emergency anaesthesia in rural facilities where there is no inherent facility.*
- ▶ *Improved mortality/morbidity for specific HB patients as a result of utility of EMRTS.*

**Welsh Ambulance Service**

- ▶ *Direct discharge of patients at scene and reduction in conveyance to ED freeing up resources.*
- ▶ *Reduction in number of separate time critical secondary transfers*
- ▶ *Enhanced training of paramedics through CCP programme and direct on the job training by pre-hospital specialist having widespread benefits to population.*
- ▶ *Improved response times.*

**Wales Air Ambulance Charity Trust**

- ▶ *Enhanced support for the charity through inclusion in a sustainable quality assured and benchmarked pre-hospital system demonstrating better outcomes of the patients it transports and delivers from Neonates to Adults.*
- ▶ *Reduction in stand-down rates for air ambulance charity leading to improved revenue retention.*

<ul style="list-style-type: none"> <li>▶ NHS Wales</li> <li>▶ LHB's</li> <li>▶ Welsh Ambulance Service</li> <li>▶ Welsh Air Ambulance Charity Trust</li> <li>▶ Fire Service</li> <li>▶ Police Service</li> <li>▶ Maritime Coastguard Agency</li> <li>▶ Military</li> </ul>	<p><b>Workforce planning and development – increased opportunity to train and educate staff.</b></p> <ul style="list-style-type: none"> <li>▶ Specialty specific recruitment and retention of high quality candidates to Wales which is currently suffering a significant recruitment problem particularly in Emergency Medicine.</li> <li>▶ On the job learning benefit to wider population of WAST personnel through involvement in pre-hospital critical care cases and subsequent debrief with EMRTS personnel at scene and at clinical governance days.</li> <li>▶ Support National Pre-hospital Emergency Medicine (PHEM) training in Wales.</li> <li>▶ Support the development of Critical Care Paramedics (CCP's) in Wales.</li> <li>▶ Extended working and training with other pre-hospital groups such as HART, Fire service, HMS Coastguard paramedics and Police teams through joint training initiatives.</li> <li>▶ Opportunities for WAST, Coastguard and Military Paramedics, medical students and junior doctors to gain exposure and training with EMRTS through the provision of observer shifts.</li> </ul>
<ul style="list-style-type: none"> <li>▶ Local community (inc. rural)</li> <li>▶ Primary care</li> </ul>	<p><b>Vertical integration with community &amp; primary care</b> - Ensure improved integration with local community health providers.</p> <ul style="list-style-type: none"> <li>▶ Related to reducing health inequity is integration by serving rural populations which currently lack access to specialist care.</li> <li>▶ Supporting GP where emergencies occur in Minor Injury Units.</li> </ul>
<ul style="list-style-type: none"> <li>▶ Welsh population</li> <li>▶ Welsh Government</li> <li>▶ NHS Wales</li> <li>▶ Health boards</li> <li>▶ WAST</li> <li>▶ Welsh Air Ambulance Charity Trust</li> </ul>	<p><b>Alignment with commissioners/stakeholder priorities</b> – ensure key stakeholder objectives are aligned with the proposal.</p> <ul style="list-style-type: none"> <li>▶ The phasing of EMRTS will support the proposed reconfiguration plans in Wales.</li> <li>▶ It is an essential enabler of the early reconfiguration of acute services in South Wales and an integral part of the changes being considered by Hywel Dda HB.</li> <li>▶ It underpins the successful development of the South Wales &amp; Powys Trauma Network under the South Wales Collaborative.</li> <li>▶ Allows the Air Ambulance Charity to transform from the traditional UK Paramedic model of care into a Physician led critical care service aligning with international standards and public perception.</li> <li>▶ Help WAST realise its clinical reform programme.</li> </ul>
<ul style="list-style-type: none"> <li>▶ Welsh population</li> <li>▶ NHS Wales</li> <li>▶ LHB's</li> <li>▶ Welsh Ambulance Service</li> <li>▶ Welsh Air Ambulance Charity Trust</li> </ul>	<p><b>Technical deliverability</b> – option is practically deliverable from a technical perspective.</p> <ul style="list-style-type: none"> <li>▶ Utilisation of existing infrastructure (e.g. WAACT helicopters, bases, pilots) and personnel (WAST paramedics).</li> <li>▶ The development of a central coordination hub has already commenced.</li> <li>▶ Several consultants already job planned and wide interest from high quality candidates outside Wales.</li> <li>▶ Ensuring that the lead organisation will have proven and sustainable ability to deliver the clinical governance framework for critical care doctors, procurement of critical care equipment and control of blood products and drugs that are not currently in use.</li> </ul>

#### 4.4.1 Benefits Analysis

During workshops on 2 and 28 April 2014, the stakeholder attendees undertook to consider those benefits would be most appropriate for appraising the EMRTS short-listed option. The following sets out the benefits criteria identified by stakeholders and validated by the Programme Board:

Criteria	Description
1.Reduce health inequality	Ensure that no groups are discriminated against as a result of reconfiguration - take the right person to the right place in the right time.
2.Improve quality of clinical services	Measurable improvement in the quality of services.
3.Increased ability to train and educate staff	Increased opportunities to develop and train staff.
4.Increased ability to undertake clinical research	Develop opportunities to expand the Trust's clinical research.
5.Improvement in recruitment and retention	Ensure opportunities are maximised to recruit and retain the best staff.
6.Vertical integration with community and primary care	Ensure improved integration with local community health providers.
7.Alignment with commissioners / stakeholders priorities	Ensure key stakeholders objectives are aligned with the Trust.
8.Technical Deliverability	Option is practically deliverable from a technical perspective.

#### 4.4.2 Benefits scoring

The short-listed options have been scored against the above benefit criteria using the following methodology:

Score	Description
0	Unacceptable, does not satisfy criterion
1	Partially satisfies criterion but with significant deficiencies compared to current service provision
2	Partially satisfies criterion but with modest deficiencies compared to current service provision
3	Satisfactory, satisfies criterion to the same extent as current service provision
4	Satisfies criterion with some enhancements relative to current service provision
5	Satisfies criterion with material enhancements relative to current service provision

Benefits criteria have been weighted below and scored against each option. The weighting for each criteria has been multiplied by each score to arrive at an overall score. Totals for each option are then provided.

Key Benefit	Weighting (%)	Option 2	Option 2A	Option 3	Option 4	Option 5
1.Reduce health inequality	20	2	2.5	3	4	5
2.Improve quality of clinical services	25	3	3.5	4	5	5
3.Increased ability to train and educate staff	5	2	2	3	4	4
4.Increased ability to undertake clinical research	5	2	2	3	4	3
5.Improvement in recruitment and retention	10	2	2.5	3	4	4
6.Vertical integration with community & primary care	5	2	2	3	4	5
7.Alignment with stakeholder / commissioner priorities	15	2	2	3	4	4
8.Technical deliverability	15	3	3	3	2	1
<b>Total Score</b>		<b>18</b>	<b>19.5</b>	<b>25</b>	<b>31</b>	<b>31</b>
<b>Weighted Score</b>		<b>240</b>	<b>267.5</b>	<b>325</b>	<b>395</b>	<b>385</b>
<b>Rank</b>		<b>5</b>	<b>4</b>	<b>3</b>	<b>1</b>	<b>2</b>

The benefits analysis indicates that Option 4 would deliver the highest level of benefits, with Option 5 being only marginally lower. Option 3 ranks in the middle of all the options with the Do Minimum Option and Option 2A delivering significantly lower levels of benefit across all criteria.

### 4.4.3 Risk Analysis

The output of stakeholder engagement on risk identified the seven key risk categories described below.

Risk Criteria	Rationale	Mitigation
Clinical	Risk that EMRTS is not able to deliver improved clinical outcomes.	<p>Ensure the clinical service model is achievable by analysing potential demand on the service.</p> <p>Work with all stakeholders incl. clinicians to ensure the clinical service model is matched with the skill base of the EMRTS workforce.</p> <p>Work with LHB's to understand implications for changes in clinical flows.</p>
Operational	Failure to align the operational model to the clinical requirements may lead to actual and perceived failure of the service.	<p>Phased introduction of operational model.</p> <p>Consultation with all stakeholders and demand analysis to ensure adequate coverage.</p> <p>Cross referencing with clinical service model.</p>
Technological	Reliance on multiple stakeholders for provision of technological support leading to an increased risk of technological failure.	<p>Ensure that the technological input of all stakeholders and their interface is clearly understood from the outset.</p>
Financial	Risk that project cannot be delivered within available funding envelope or that WAAC is no longer able to finance its support for the service.	<p>Liaise with Welsh Government and incorporate capital/revenue affordability limits into financial evaluation.</p> <p>Engage with all LHBs and WAST to understand financial impact of workforce/clinical flow.</p> <p>Engagement with WAAC to understand the robustness of the support available.</p>

Stakeholder/ Commissioning	Risk that failure of stakeholder engagement leads to poor operational performance (actual failure) or unrealistic expectations (perceived failure).	Active engagement with stakeholders ref: workforce model/clinical model/operational model/anticipated clinical flows/commissioning arrangements to ensure the expected impact of the EMRTS is understood and approved in advance of business case submission.
Reputation	Risk that individual personalities/interactions or failures further down the care pathway damage EMRTS.	Recognition of the importance of interactions across stakeholder groups during the business case process.
Project	Risk that complex stakeholder engagement leads to failure to achieve the timetable leading to scope creep/undeliverable benefits.	Project Board to be aware of possible scope creep/lack of engagement. Coordination with wider reconfiguration across Wales (e.g. South Wales Collaborative).
Workforce Management/ Capacity Planning	Risk that the workforce model/capacity planning is not appropriate to deliver clinical benefits. Insufficient support from LHBs to deliver required number of sessions.	Obtain agreement and approval of LHBs/WAST regarding workforce commitments and expected patient flow impact in advance of submitting the business case.

#### 4.4.4 Risks scoring

Each of the risk categories has been allocated a score between 0 (no risk) and 5 (high risk) after consideration of mitigating actions, as summarised in the table below.

Key risks	Weighting (%)	Do Minimum	Option 2A	Option 3	Option 4	Option 5
Clinical	15	3	2.5	3	1	2
Operational	20	1	1.5	2	2	4
Technological	5	2	2	3	3	4
Financial	20	2	2	3	4	4
Stakeholder	30	2	2	2	3	3
Reputation	5	3	3	3	2	2
Project	5	2	2	2	3	4
Total Score		<b>15</b>	<b>15</b>	<b>18</b>	<b>18</b>	<b>23</b>
Weighted Score		<b>200.0</b>	<b>202.5</b>	<b>245.0</b>	<b>265.0</b>	<b>330.0</b>
Rank		<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>

The risk analysis indicates that the level of risk increases proportionately to the number of bases incorporated into the EMRTS, with the Do Minimum Option offering the lowest risk profile and Option 5 the highest.

### 4.5 Quantitative Appraisal of Short-Listed Options

The quantitative appraisal of short-listed options has been based on Net Present Cost ('NPC'). The NPC of each option has been calculated using standard discounted cashflow techniques to reflect the cost of each option over the full appraisal period in current prices, in accordance with HM Treasury guidance.

The appraisal period incorporates a partial first period plus 10 full years of operations from the start of Phase 1.

Cost inputs are estimates only, based on the assumptions set out in the following sections.

#### 4.5.1 Economic Inputs

The NPC model developed for this business case follows generally accepted and Department of Health guidance on economic modelling for business case options appraisal.

Cost are estimated in current prices and the standard 3.5% (real) discount rate has been used.

It has been assumed that all cost index is in line with general inflation and no differential inflation has been applied.

Initial capital cost and life-cycle costs exclude VAT, inflation and contingency allowances but include an adjustment for optimism bias (explained in more detail below).

Revenue costs exclude VAT, inflation, depreciation and net contribution from public sector bodies.

Transition years are included in revenue costs and are the costs required to deliver the service.

The EMRTS is a new service and it has been agreed that the economic model will be developed on an incremental cost basis.

It has been assumed that:

- ▶ relevant direct costs already borne by LHBs / WAST / WAAC will continue to be funded (e.g. existing CCPs and helicopter and base operating costs).
- ▶ Consultant sessions provided for the EMRTS service will be funded by EMRTS with the assumption that Health Boards will release relevant sessions and use funding provided to backfill and meet own service needs. The cost of any non EMRTS sessions for any new posts will be funded by the host Health Board.
- ▶ the impact of changes to patient flows (including repatriation costs) is outside the scope of the case, the strategic outline programme case does not cover or include the cost or impact of changes to patient flow but recognises the need for Health Boards to develop an appropriate mechanism to ensure that net receiving boards are appropriately funded for any additional activity / flying time.
- ▶ the helicopters will continue to be owned and operated by WAA.
- ▶ increased helicopter running / maintenance costs will be borne by WAAC.
- ▶ WAAC has capacity to absorb increased activity.
- ▶ helicopter base premises will continue to be available for use by medical staff / increased number of road vehicles with no additional costs.
- ▶ the communications hub will be located at Cwmbrian with no additional infrastructure costs for buildings and IT.
- ▶ other overhead and support costs to be covered by relevant host organisation as per current service configuration.

#### 4.5.1.1 Key Dates

The dates for capital expenditure is assumed to be incurred in the same month as the start of operations for each element as set out below:

	Option 2	Option 2A	Option 3	Option 4	Option 5
<b>Set Up Costs</b>	Feb-15	Feb-15	Feb-15	Feb-15	Feb-15
<b>Top Cover</b>	Feb-15	Feb-15	Feb-15	Feb-15	Feb-15
<b>Management</b>	Feb-15	Feb-15	Feb-15	Feb-15	Feb-15
<b>Coordination Hub</b>	Feb-15	Feb-15	Feb-15	Feb-15	Feb-15
<b>Swansea Day Air &amp; Road</b>	Feb-15	Feb-15	Feb-15	Feb-15	Feb-15
<b>Swansea Night Road</b>	-	-	Feb-15	Apr-15	-
<b>Swansea HLS</b>	-	-	Feb-16	Apr-16	-
<b>Swansea HEMS</b>	-	-	Aug-16	Apr-17	-
<b>Welshpool Day Air &amp; Road</b>	Feb-16	Feb-15	Feb-17	Apr-15	Apr-15
<b>Caernarfon Clinical Lead</b>	-	Feb-15	-	Apr-15	-
<b>Caernarfon Air &amp; Road</b>	-	-	-	Apr-17	Apr-17
<b>Cwmbrian Road</b>	-	-	-	-	Apr-15

### 4.5.1.2 Capital Costs

As stated above, initial capital costs and life-cycle costs exclude VAT, inflation and contingency allowances but include an adjustment for optimism bias.

The capital cost per unit and Useful Economic Life (UEL) of each asset category are set out below. A detailed equipment list is attached at Appendix E.

Capital	Cost per Unit £000	UEL (Years)
Road Vehicle	76.8	7
Vehicle Equipment (Road and Air)	77.9	5
Data collection infrastructure	71.3	5
Equipment required to support HLS to HLS service	55.0	5
Equipment required to support HEMS service	250.0	5
GLIMS lighting	35.0	5
Drugs Cabinet	70.0	5
Neonatal Equipment	100.0	5
Training Equipment	31.0	5

It has been assumed that assets will be replaced at the end of their Useful Economic Life, with the capital investment being the subject of a BJC to be developed by the host organisation.

#### Optimism Bias

Optimism bias has been included in the capital costs as a requirement to make explicit, upward adjustments to costs to counteract the known tendency for the costs of projects to be underestimated, particularly in the early stages of developing and costing projects (e.g. SOC and OBC).

The procurement of road vehicles and equipment for the EMRTS service is neither complex nor innovative. There is a well-established procurement route and a supplier framework. The project team and stakeholders have a good understanding of the project's requirements and WAST has been closely involved with a wider stakeholder group in the development of the equipment list which is attached to this business case at Appendix D.

Optimism Bias has therefore been assumed at 10%, being the lower bound for equipment capital expenditure. The Optimism Bias assumption has been subject to sensitivity testing, as set out later in this chapter, and has been found not to materially influence the outcome of the economic analysis.

### 4.5.1.3 Clinical Revenue Costs

Clinical Revenue Costs consist of staff salary and training costs.

Only paramedic costs additional to the existing current establishment at WAST have been included in the model as it has been assumed that WAST will continue to fund the existing service. The current establishment is for 15 paramedics at Band 5 and 1 supervisor at Band 7.

The following assumptions have been applied to the workforce costs in the model:

#### Consultants

- ▶ Top of scale consultant with on costs.
- ▶ 3.2 session per 12 hour shift.
- ▶ 12 hours payment per 12 hours shift worked at base or hub and 12 hours payment per 24 hours Top Cover provided.
- ▶ Session costs based on a 7 DCC and 3 SPA Job Plan and 42 weeks availability per annum.

### **Paramedics**

- ▶ Top of scale band 6.
- ▶ 12 hours per shift, 7 days per week.
- ▶ Additional posts: between 3 and 6 posts depending on the option.

### **Training**

- ▶ Paramedic CC £7,000 per post (for 2 year course), £1,600 per post for all other staff.
- ▶ General allowance £20,000 to cover all other clinical training.

#### **4.5.1.4 Non-clinical Revenue Costs**

Non-clinical Revenue Costs include the operation of the road vehicles and coordination hub, Only the helicopter running costs incurred to extend the Swansea service to a 24 hour service (night flights) are included in the economic model. WAACT has confirmed that it will continue to fund the existing service on the proposed operating hours.

It is assumed that there are no additional costs associated with IT & communication or building & running costs at any of the sites and the Coordination hub.

### **Operational management and support**

- ▶ New posts based on 1 x band 8b, 1 x band 8a, 1 x band 6.
- ▶ Clinical Director payments based on 4 sessions.

### **Coordination hub administration / data collection**

- ▶ New posts at Band 6.
- ▶ 10 sessions per week, 5 days per week.

### **Road vehicle running costs per vehicle**

- ▶ 150,000 miles per annum at 30 mpg.
- ▶ Insurance estimated at £1,000.
- ▶ Maintenance estimated at £2,000.

### **Equipment Maintenance**

- ▶ Maintenance is included at 10% of the capital cost of the asset per annum.

### **Set up costs**

- ▶ Set up costs are included under each option to cover the cost of induction, uniform and training based on £2,000 per post.

### **Contingency**

- ▶ A contingency of 10% of the total cost has been included for each base.

#### **4.5.1.5 Quantifiable benefits**

The EMRTS is creating a new, additive, service. Potential cash releasing opportunities will come through indirect changes to pathways rather than direct cost reduction. The pathway consequences of the business case are being considered as an exercise that falls beyond the scope of this business case.

The EMRTS is expected to deliver improved efficiencies which will be measurable as improved health outcomes rather than resource efficiencies. The work carried out on estimation of benefits has been proportionate to the relatively modest capital and revenue investment on which this business case is based. Cash releasing benefits are not expected to be material to the economic evaluation and have not been quantified, whilst wider economic benefits have been excluded from the evaluation on the grounds of proportionality.

The Project Team has identified a number of potential LHB specific benefits which have been shared with the respective Directors of Finance. These are excluded from the economic model which has been developed on an All-Wales basis.

The resultant modest change in patient flow may result in exporting Health Boards being able to release benefits. They will be required to manage this internally in order to meet the financial responsibility of their Patients with importing Health Boards. See Appendix D for Clinical Flow information.

## 4.6 Economic Model Outputs

The outputs of the Economic Model are summarised below:

Net Present Cost	Do minimum £000	Option 2A £000	Option 3 £000	Option 4 £000	Option 5 £000
Phase 1A	17,667	26,624	25,479	34,011	25,919
Phase 1B	-	-	2,128	-	-
Phase 1C	-	-	648	-	-
Phase 2	7,754	-	6,889	8,866	8,179
Phase 3	-	-	-	-	11,033
<b>Total</b>	<b>25,421</b>	<b>26,624</b>	<b>35,144</b>	<b>42,877</b>	<b>45,131</b>

### 4.6.1 NPC Sensitivity analysis

The NPC of each option has been subject to sensitivity analysis, the results of which are set out in the table below.

NPC £000	Do minimum	%	Option 2A	%	Option 3	%	Option 4	%	Option 5	%
Base Case	25,421		26,624		35,144		42,877		45,131	
Capex (including lifecycle) +10%	25,666	0.96	26,880	0.96	35,439	0.84	43,269	0.91	45,557	0.94
Capex (including lifecycle) -10%	25,176	(0.96)	26,368	(0.96)	34,849	(0.84)	42,486	(0.91)	44,705	(0.94)
Optimism Bias 20%	25,644	0.88	26,856	0.87	35,412	0.76	43,233	0.83	45,518	0.86
Optimism Bias 0%	25,198	(0.88)	26,391	(0.87)	34,876	(0.76)	42,522	(0.83)	44,743	(0.86)
Revenue +10%	27,664	8.83	28,976	8.84	38,306	9.00	46,702	8.92	49,127	8.86
Revenue -10%	23,178	(8.83)	24,271	(8.84)	31,982	(9.00)	39,053	(8.92)	41,134	(8.86)
Staff cost inflation +1%	25,887	1.83	27,095	1.77	35,820	1.92	43,677	1.86	45,996	1.92
Staff cost inflation -1%	24,963	(1.80)	26,161	(1.74)	34,481	(1.89)	42,092	(1.83)	44,281	(1.88)
Maintenance Costs +5%	25,485	0.25	26,690	0.25	35,925	2.22	43,928	2.45	46,275	2.54
Maintenance Costs -5%	25,357	(0.25)	26,558	(0.25)	34,363	(2.22)	41,827	(2.45)	43,986	(2.54)
HEMS equipment UEL increased	n/a	n/a	n/a	n/a	34,995	(0.42)	42,733	(0.34)	n/a	n/a

The results of the sensitivity analysis indicate that the NPC of each option is relatively insensitive to changes in the capex / optimism bias assumptions, but more sensitive to changes in the assumed revenue costs.

An increase in the revenue costs of 10% would result in an increase in the NPC of the affected options of between 8.83% and 9.00%.

## 4.7 Results of Economic Appraisal and Preferred Option

The table below summarises the NPC, Benefits Points and Risk score of each option and ranks the options according to their NPC per Benefit Point:

	<b>NPC (£000)</b>	<b>Rank</b>	<b>Benefits Points</b>	<b>Rank</b>	<b>Risk Score</b>	<b>Rank</b>	<b>NPC / BP</b>	<b>Rank</b>
Do minimum	25,421	1	240	5	200	1	105.92	2
Option 2A	26,624	2	267.5	4	200	2	99.53	1
Option 3	35,144	3	325	3	245	3	108.14	3
Option 4	42,877	4	395	1	265	4	108.55	4
Option 5	45,131	5	385	2	330	5	117.22	5

Option 2A has the lowest NPC per Benefit Point and the second lowest risk score (only 2.5 points higher than the Do Minimum Option). The combined qualitative and quantitative appraisal therefore indicates that Option 2A offers the best value for money.

Option 2A achieves a number of key benefits at a lower cost and lower risk than Option 4 (the option with the highest level of benefits) and Option 3 (the second highest ranked option excluding the Do Minimum Option).

After consideration of both Qualitative and Quantitative appraisal, the Project Board proposed Option 2A as the Preferred Option.

### 4.7.1 Sensitivity analysis

The results of the Economic Appraisal have been subject to sensitivity analysis. The Preferred Option has been proposed on the basis of both Qualitative and Quantitative analysis, however, for the purposes of sensitivity testing we have compared the NPC per Benefit Point of Option 2A (the Preferred Option) to the Do Minimum Option (the second ranked option) and Option 3 (the highest scoring option not based on Do Minimum).

<b>NPC per Benefit Point</b>	<b>Option 2A</b>	<b>Do Minimum</b>	<b>% VfM</b>	<b>Option 2A</b>	<b>Option 3</b>	<b>% VfM</b>
Base Case	99.53	105.92	<b>6.04%</b>	99.53	108.14	<b>8.31%</b>
Capex (including lifecycle) +10%	100.48	106.94	<b>6.04%</b>	100.48	109.04	<b>8.27%</b>
Capex (including lifecycle) -10%	98.57	104.90	<b>6.03%</b>	98.57	107.23	<b>8.36%</b>
Optimism Bias 20%	100.40	106.85	<b>6.04%</b>	100.40	108.96	<b>8.27%</b>
Optimism Bias 0%	98.66	104.99	<b>6.03%</b>	98.66	107.31	<b>8.35%</b>
Revenue +10%	108.32	115.27	<b>6.03%</b>	108.32	117.86	<b>8.38%</b>
Revenue -10%	90.73	96.57	<b>6.05%</b>	90.73	98.41	<b>8.23%</b>
Staff costs + 10%	101.29	107.86	<b>6.10%</b>	101.29	110.22	<b>8.40%</b>
Staff costs - 10%	97.80	104.01	<b>5.97%</b>	97.80	106.09	<b>8.22%</b>
Maintenance Costs 15% of capex	99.77	106.19	<b>6.04%</b>	99.77	110.54	<b>10.28%</b>
Maintenance Costs 5% of capex	99.28	105.65	<b>6.03%</b>	99.28	105.73	<b>6.24%</b>
HEMS equipment UEL > 10 years	99.53	105.92	<b>6.04%</b>	99.53	107.68	<b>8.00%</b>

The results of the sensitivity analysis indicate that the NPC of each option is relatively insensitive to changes in the capex / optimism bias assumptions, but more sensitive to changes in the assumed revenue costs.

An increase in the revenue costs of 10% would result in an increase in the NPC of the affected options of between 8.83% and 9.00%.

## 4.7.2 Switching point analysis

Switching point analysis has been used to establish by how much the underlying costs and benefit point assumptions of the Preferred Option would have to move before an alternative option would become the Preferred Option. The qualitative and quantitative assessment of Value for Money has taken into consideration cost, benefit and risk scores. For the purposes of this switching point analysis we have considered only “Net Present Cost per Benefit Point”.

The table below sets out the change in Option 2A assumptions that would be required for Option 2A to no longer be the preferred Option:

Switching points:		
Capex	£1.6m	98%
Annual Revenue Costs	£202k	7%
Benefit Points	(16)	(6%)

The results above indicate that in order for the Option 2A to no longer have the lowest NPC / BP then:

- ▶ the capital costs of Option 2A would need to increase by £1.6m (98%).
- ▶ the revenue costs of Option 2A would need to increase by £202k per annum (7%).
- ▶ the benefits of Option 2A would need reduce by 16k (6%).

In these circumstances, the Do Minimum Option would have the lowest NPC / BP.

### 4.7.2.1 Switching point conclusions

This indicates that the assumptions underpinning the above options would need to be significantly changed before the Value for Money analysis would indicate an alternative option as the Preferred Option. The capex assumptions could change 98%, whilst revenue costs could move by 7%.

Similarly, the benefits scores could move by 6% before the conclusions of the Value for Money analysis changed.

## 4.8 Economic Case conclusion

Option 2A has been demonstrated to offer the best Value for Money based on qualitative and quantitative appraisal. This result has been subject to sensitivity testing and switching point analysis and is considered robust

The Project Board confirmed Option 2A as the Preferred Option at a meeting held on 30 June 2014.

## **5. Commercial Case**

### **5.1 Introduction**

The Commercial Strategy for this Programme involves each Phase being progressed through a Business Justification Case (BJC) and this element of the process will set down the competitive tendering process required for capital assets.

The capital asset element of the Programme is relatively modest and limited to specific Medical and Technical Equipment and Transport infrastructure. The BJCs will specify, in detail, the requirement for each Phase and the procurement process demonstrating Value for Money.

### **5.2 Procurement Strategy and Approach**

Each Phase within the Programme will require a Business Justification Case (BJC), with the scale of case being determined by the level of investment required. The Programme Board will work in conjunction with NHS Wales Procurement Service to develop and execute appropriate procurement approaches that ensures:

- ▶ Best value.
- ▶ Adherence to Standing Orders & Standing Financial Instructions.
- ▶ Compliance with EU/UK Procurement Regulations as appropriate.
- ▶ Procurement is undertaken in a timely & controlled manner.

Each Phase will develop its own Procurement Plan based on the requirements and will include, but not be limited to:

- ▶ Identification of the most appropriate procurement route.
- ▶ Developing the Specification of Requirements.
- ▶ Procuring the requirement.
- ▶ Concluding the contract/commercial deal.
- ▶ Providing the basis for any ongoing contract management.

The Programme will take advice of NHS Wales Procurement during the Procurement process in order to ensure that best practice is applied and Value for Money for the procurement process delivered.

### **5.3 Schedule of Capital Requirements**

Detailed below is the schedule of Capital requirements for each of the Phases of the Preferred Option:-

Commercial Case

Capital Equipment	Purchase Price (Exc VAT)	Purchase Price Inc VAT	Av Life	Top Cover / Mgt Hub		Swansea		Welshpool	
	£	£		No	£	No	£	No	£
Vehicle Purchase and Conversion									
Vehicle	43,366	52,039							
Ambulance conversion	13,500	16,200							
Ambulance fit (Terrafix, AVL etc)	20,000	24,000							
<b>Total</b>	<b>76,866</b>	<b>92,239</b>	<b>7</b>	<b>1</b>	<b>92,239</b>	<b>2</b>	<b>184,477</b>	<b>2</b>	<b>184,477</b>
Vehicle and Helicopter Equipment									
Pac Rac	200	240							
Ferno Scoop	500	600							
Stretcher	2,000	2,400							
Monitoring	21,067	25,280							
Syringe drivers x4	3,980	4,776							
Airtraq rigid fibreoptic laryngoscope x4 2 small/2 Large	120	144							
Emma in line digital end tidal CO2 monitor	995	1,194							
Pulse oximetry monitor	100	120							
Suction unit	705	846							
iStat 9000 arterial blood gas monitor	5,000	6,000							
Lucas chest compression device	6,600	7,920							
Ventilator	15,000	18,000							
Ventilator	239	287							
Ventilator	100	120							
Crede Cube Blood transfer box	500	600							
Thomas pack x2	900	1,080							
Vacuum splints x1	424	509							
Sager splint SX405	397	476							
Kendric Traction Device	100	120							
Pedi Pak spine board	300	360							
EZIO bone drill /humeral /Adult/Paed IO	400	480							
Gigli saw	20	24							
Large trauma scissors	80	96							
Buddy lite fluid warmer x2	3,200	3,840							
Germa flight suits	600	720							
HAIX Airpower X1Cross-tech Safety Rescue Boots	160	192							
MSA USAR Helmet	180	216							
Gloves	40	48							
Contingency - Blood/Pharm/Sundries	14,000	16,800							
<b>Total</b>	<b>77,907</b>	<b>93,488</b>	<b>5</b>	<b>1</b>	<b>93,488</b>	<b>3</b>	<b>280,465</b>	<b>3</b>	<b>280,465</b>
Data Collection & Infrastructure (As per Working Group Paper)	71,250	85,500	5	1	85,500	0	0	0	0
OmniceII Drug Cabinet	70,000	84,000	5	0	0	1	84,000	1	84,000
Glim Lighting	35,000	42,000	3	0	0	1	42,000	0	0
Training Equipment	31,000	37,200	5	0	0	1	37,200	1	37,200
Neonates Equipment									
1. Airborne Aviator incubator; the incubator chassis includes storage for two E-cylinders which can be adapted to take CD cylinders.									
2. Customer to supply Hamilton T1 ventilator									
3. SLE to supply mount for fixing Hamilton T1 to Aviator chassis									
4. Customer to supply Hamilton Tempus pro monitor with pole mount									
5. SLE to supply pole mount for fixing Tempus pro monitor									
6. Customer to supply CME T34 infusion pumps									
7. SLE to investigate mounting solution with CME									
8. Laerdal LCSU4 compact battery powered suction in air transfer mounting									
9. Neo-pod lightweight neonatal humidifier									
10. All of the above to be mounted on Airborne TS air-transport stretcher with fittings for Aerolite interior of EC135 helicopter									
11. SLE to obtain Supplemental Type Certificate (STC) from Aerolite (Switzerland) for the above system for a defined aircraft from the Wales Air ambulance fleet.									
<b>Total Neonates Equipment</b>	<b>100,000</b>	<b>120,000</b>	<b>5</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>120,000</b>	<b>1</b>	<b>120,000</b>
<b>Total</b>					<b>271,227</b>		<b>748,143</b>		<b>706,143</b>

Note:-  
 All cost as per information and quotes received  
 VAT added at 20%

As stated above, the Capital requirements of the Programme are relatively modest.

## 6. Financial Case

### 6.1 Introduction

This section assesses the overall affordability and funding of the project including the indicative implications of implementing the preferred options.

The Preferred Option is summarised below for reference:

<b>Option 2A (Two bases, 12 hour air &amp; road service, clinical lead and deputy at Caernarfon)</b>	
<b>Two bases</b>	<b>Swansea &amp; Welshpool– air and road services over two phases occurring simultaneously in time</b>  <b>A designated clinical lead and deputy cover nominated for the Caernarfon base occurring at the same time as the Welshpool development</b>
<b>Operational</b>	Between 0800 - 2000. No overnight coverage. 1 team at each base for each shift
<b>Phase 1</b>	Swansea air and road service (operational between 0800-2000)
<b>Coverage (30 mins)</b>	12 hours: 69% population (air), 42% population (road)
<b>Phase 2</b>	Add Welshpool air and road service (operational between 0900-2100)
<b>Coverage (30 mins)</b>	13 hours: 95% population (air), 46% population (road)
<b>After 12 months of introduction of phase 1 and 2 a formal Gateway review will be conducted to strongly consider the need for further phased expansion to include the Caernarfon base and 24/7 cover in Swansea with reference to the investment objectives inc. equity</b>	

### 6.2 Funding Assumptions

The Strategic Outline Programme case is a bid to the Minister and Welsh Government for a capital and revenue development to establish an EMRTS service in Wales. This is an enhanced service and the additional incremental costs form the basis of the affordability analysis and funding requirement (from Welsh Government) as set out in this Finance Case.

The case has been developed by the EMRTS Project Board, this is a multi-disciplinary team made up of representatives from Health Boards in Wales, WAST, WAA, North Staffordshire Foundation Trust, WG and EY.

There is a requirement for Health Boards to release relevant Consultant Sessions to support the EMRTS service, these sessions will be reimbursed at an appropriate rate to enable the host organisations to fund backfill arrangements for their own services (including DCC and SPA sessions). Health Boards will be required to fund the balance of any non EMRTS sessions in job plans for any new related posts created. There is a list of interested people who would like to contribute sessions for the service and on the basis that these can be backfilled by host organisations within the funding available, there are sufficient consultant sessions available within the affordability envelope set out below.

The impact of the proposed service on Patient Flows has been forecast (in patient numbers) for each Health Board with indicative costs for the potential impact. The costs and impact of the changes in flow are outside of this case being submitted and the assumption and expectation is that Health Boards will develop an appropriate agreed mechanism to ensure that receiving organisations are appropriately reimbursed for any additional activity, this has been recognised by All Wales Director of Finance group. Indicative work has been completed by Cardiff & Vale as included in Appendix N.

WAST and WAACT have confirmed that they will continue to fund and operate against the current service configuration, the current cost of Paramedics (16wte), Coordination Centre, Helicopter running costs (including potential additional flying time) and maintenance and air base running costs will continue to be met and funded on an ongoing basis by the relevant organisation. The additional cost of establishing and running the EMRTS service above this baseline is included in the case (additional CCP's, Training, Equipment, HLS Lighting).

### 6.3 Capital Funding Requirement

For the purposes of affordability modelling, capital costs are inclusive of VAT, Optimism Bias and inflation (assumed at 2.5% per annum), in accordance with HM Treasury Greenbook guidance. Capital items are assumed to be replaced at the end of their Useful Economic Life.

The table below sets out the estimated capital funding requirement of the scheme over the next 10 years:

<b>Capital and Lifecycle Costs by base</b>	<b>FY15</b>	<b>FY16</b>	<b>FY 17</b>	<b>FY18</b>	<b>FY19</b>	<b>FY20</b>	<b>FY21</b>	<b>FY22</b>	<b>FY23</b>	<b>FY24</b>
General Inflation %	<b>0.00%</b>	<b>2.50%</b>								
	<b>£000</b>									
Top Cover Team, Management & Hub	271	0	0	0	0	203	0	110	0	0
Swansea	748	0	0	0	0	638	0	219	0	0
Welshpool	706	0	0	0	0	590	0	219	0	0
Optimism Bias	173	0	0	0	0	143	0	55	0	0
<b>Total</b>	<b>1,898</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1,574</b>	<b>0</b>	<b>603</b>	<b>0</b>	<b>0</b>

<b>Capital and Lifecycle Costs by type</b>	<b>FY15</b>	<b>FY16</b>	<b>FY 17</b>	<b>FY18</b>	<b>FY19</b>	<b>FY20</b>	<b>FY21</b>	<b>FY22</b>	<b>FY23</b>	<b>FY24</b>
	<b>£000</b>	<b>£000</b>	<b>£000</b>	<b>£000</b>	<b>£000</b>	<b>£000</b>	<b>£000</b>	<b>£000</b>	<b>£000</b>	<b>£000</b>
Road Vehicles	461	0	0	0	0	0	0	548	0	0
Medical equipment	654	0	0	0	0	740	0	0	0	0
GLIMS Lighting	42	0	0	0	0	48	0	0	0	0
Data infrastructure	86	0	0	0	0	97	0	0	0	0
Drug cabinet	168	0	0	0	0	190	0	0	0	0
Training equipment	74	0	0	0	0	84	0	0	0	0
Neonates equipment	240	0	0	0	0	272	0	0	0	0
Optimism bias	173	0	0	0	0	143	0	55	0	0
<b>Total</b>	<b>1,898</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1,574</b>	<b>0</b>	<b>603</b>	<b>0</b>	<b>0</b>
<b>Funded by:</b>										
<b>Welsh Government Capital Funding</b>	<b>1,898</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1,574</b>	<b>0</b>	<b>603</b>	<b>0</b>	<b>0</b>

The capital requirement of the Preferred Option is estimated to be £1.9 million in 2014/15. Lifecycle replacement of the assets at the end of their UEL is estimated at £1.6m after 5 years and a further £0.6m after 7 years (including inflation at 2.5% per annum). It is anticipated that lifecycle replacement of individual assets will be subject to a BJC at the time of procurement. A detailed list of equipment is attached at Appendix E.

## 6.4 Revenue Requirement

For the purposes of affordability modelling, revenues costs are inclusive of VAT, contingency, depreciation, capital charges and inflation, in accordance with HM Treasury Greenbook guidance.

The Preferred Option is a new service that has been developed on an incremental cost basis.

Revenue Cost by Site	FY15 £000	FY16 £000	FY 17 £000	FY18 £000	FY19 £000	FY20 £000	FY21 £000	FY22 £000	FY23 £000	FY24 £000
<b>General Inflation %</b>	<b>0%</b>	<b>2.5%</b>	<b>2.5%</b>	<b>2.5%</b>	<b>2.5%</b>	<b>2.5%</b>	<b>2.5%</b>	<b>2.5%</b>	<b>2.5%</b>	<b>2.5%</b>
<b>Salary Inflation %</b>	<b>0%</b>	<b>1.0%</b>	<b>1.0%</b>	<b>2.5%</b>						
Swansea Air & Road 7am-7pm	328	1,079	1,097	1,125	1,153	1,182	1,211	1,242	1,273	1,305
Welshpool Air & Road 7am-7pm	204	1,045	1,060	1,087	1,114	1,143	1,172	1,201	1,232	1,263
Caernarfon Clinical Lead and Deputy	4	36	36	37	37	38	39	39	40	40
Coordination Hub	203	1,052	1,065	1,092	1,119	1,147	1,176	1,205	1,235	1,266
<b>Total</b>	<b>739</b>	<b>3,212</b>	<b>3,258</b>	<b>3,341</b>	<b>3,423</b>	<b>3,510</b>	<b>3,598</b>	<b>3,687</b>	<b>3,780</b>	<b>3,874</b>
<b>Funded by:</b>										
<b>Welsh Government Revenue Funding</b>	<b>739</b>	<b>3,212</b>	<b>3,258</b>	<b>3,341</b>	<b>3,423</b>	<b>3,510</b>	<b>3,598</b>	<b>3,687</b>	<b>3,780</b>	<b>3,874</b>

Revenue by category	FY15 £000	FY16 £000	FY 17 £000	FY18 £000	FY19 £000	FY20 £000	FY21 £000	FY22 £000	FY23 £000	FY24 £000
Staff costs	530	2,228	2,251	2,307	2,365	2,424	2,485	2,547	2,610	2,676
Vehicle running costs	8	50	51	52	54	55	57	58	59	61
Consumables	37	226	231	237	243	249	255	262	268	275
Maintenance and depreciation	87	511	525	540	551	566	580	593	611	624
Contingency	77	197	200	205	210	216	221	227	232	238
<b>Total revenue costs including depreciation</b>	<b>739</b>	<b>3,212</b>	<b>3,258</b>	<b>3,341</b>	<b>3,423</b>	<b>3,510</b>	<b>3,598</b>	<b>3,687</b>	<b>3,780</b>	<b>3,874</b>
Depreciation	56	344	353	362	371	380	388	392	409	419
<b>Total revenue costs before depreciation</b>	<b>683</b>	<b>2,868</b>	<b>2,905</b>	<b>2,979</b>	<b>3,052</b>	<b>3,130</b>	<b>3,210</b>	<b>3,295</b>	<b>3,371</b>	<b>3,455</b>

- ▶ General inflation is assumed to be 2.5% throughout the evaluation period. Salary costs are assumed to increase at just 1% until 2018/19.
- ▶ The first period (2014/15) is a partial period and includes set up costs plus two months of operational costs, based on mobilisation in February 2014 to commence service in March 2015.
- ▶ Depreciation is assumed to be applied on a straight line basis over the Useful Economic Life of the asset.
- ▶ Salary costs include additional staff to manage hosting arrangements / governance matters.
- ▶ Revenue costs are shown in total less depreciation to be funded in the usual method as per NHS finance regime.

## 6.5 Impact on Balance Sheet and Income Statement

The assumption is that the host organisation (when identified) will include all EMRTS service assets and liabilities within their own balance sheet and all income and expenditure will be included in the overall income and expenditure position of the organisation.

The hosted EMRTS service will be disclosed as a separate operating segment within the notes to the accounts, this will mean that the service value and income and expenditure performance is identified.

Treasury management for the service will be included in the host overall management arrangements.

The modest capital investment required for this strategic programme means that balance sheet implications are considered to be inconsequential.

## 6.6 Stakeholder Support

Partner Organisations and stakeholder support in principal has been obtained via the organisation representatives on the Programme Board.

Endorsement received from the All Wales Directors of Planning and Directors of Finance groups for the Clinical Service Model, agreed Operational Model and the affordability approach set down in the Financial Case.

Formal Organisational support is sought simultaneously with submission of the case as identified in Appendix H.

## 6.7 Conclusion

Both the revenue and capital implications of the proposed EMRTS have been considered and reflected in the projects Long Term Financial Plan. The Long Term Financial Plan is based on the assumption that the scheme to be fully funded by Welsh Government and is therefore considered affordable from a capital and revenue perspective.

The funding requirement from Welsh Government is summarised below:

<b>EMRTS Funding Requirement</b>	<b>FY15 £000</b>	<b>FY16 £000</b>	<b>FY 17 £000</b>	<b>FY18 £000</b>	<b>FY19 £000</b>	<b>FY20 £000</b>	<b>FY21 £000</b>	<b>FY22 £000</b>	<b>FY23 £000</b>	<b>FY24 £000</b>
<b>Capital</b>	1,898	0	0	0	0	1,574	0	603	0	0
<b>Revenue</b>	683	2,868	2,905	2,979	3,052	3,130	3,210	3,295	3,371	3,455

Transition costs of continuing with the programme for six months are £109k as set out in Appendix M.

It has been assumed that depreciation will be funded in the usual way as per the NHS finance regime.

## 7. The Management Case

### 7.1 Introduction

The Management Case details the management and governance arrangements for the successful delivery of the Programme to Cost, Time and Quality.

To achieve this, the Management Case sets down the arrangements for benefit realisation and risk management over the Programme timeline.

The Management Case proposes arrangements for the interim management of the Programme, post Programme Case approval, in order to progress the development of the BJC's and the associated operational implementation planning.

The Programme will transfer responsibility to the lead 'host' organisation once that body has been identified by the Commissioning process.

The lead 'host' organisation will be responsible for the full implementation and benefits realisation of the Programme and will discharge their responsibilities within their Governance and Management arrangements. Notwithstanding the above, the Programme will continue to be managed in accordance with the arrangements for benefits realisation and stakeholder engagement set down in this Programme Case.

The investment process is being organised and managed in accordance with guidance contained in the Capital Investment Manual and is consistent with the Office of Government Commerce's Managing Successful Programme's standard.

The Programme is working within the Welsh Government External Assurance Review Process.

### 7.2 Programme and Project Management arrangements

#### 7.2.1 Programme Sponsorship and Structure

It is recommended that the Programme will continue to be facilitated by ABMU until such time that the 'host' organisation is defined, at which point accountability will be transferred to that respective organisation. The Programme Board will continue with a review of the existing Membership and Terms of Reference.

The Senior Responsible Owner for the Programme is Dr Grant Robinson, Unscheduled Care Lead for Wales. Pending approval of this case, the Programme Directors will be Dr Dindi Gill and Dr Rhys Thomas, who will have responsibility for managing the overall delivery of this Programme of modernisation until the identification of the lead 'host' organisation. The Programme Directors will be supported by the following resources:

- ▶ Programme Manager and Business consultant – this will require an interview.
- ▶ Pete Hopgood, Financial Resource Manager, who will be responsible for the financial input into the BJCs
- ▶ Secretarial support
- ▶ Communications Officer

In addition Huw Llewellyn, Assistant Director of Finance, ABMU, will act as advisor to the Programme until the hosting arrangements are confirmed.

The resourcing of the 'interim' Programme arrangements are set down in the Financial Case.

## 7.2.2 Programme Reporting and Workstreams

To ensure delivery, the Programme Board will meet monthly and will receive as appropriate monthly Highlight reports, which document:

- ▶ Progress against key deliverables.
- ▶ Achievements planned for the period but not completed.
- ▶ Achievements planned for the next period.
- ▶ Programme risks, by category and recording mitigating actions.
- ▶ Programme issues and identifying actions.
- ▶ Programme milestones and forecast completion date, recording confidence and status
- ▶ Programme Director comments.

A number of work streams will need to be developed by the Programme Board including:

- ▶ A **Clinical Reference** group (maximum 6-8 members) to carry out work quickly and effectively to develop the clinical governance framework.
- ▶ An **Operational model** group.
- ▶ **Workforce** group.
- ▶ **Swansea Phase Project** group.
- ▶ **Welshpool Phase Project** group.

It is important to highlight the role of the two implementation phase project groups in delivering the two phases.

The Structure has been developed in order to have the most appropriate reporting lines while ensuring that there is a sufficient capacity and processes in place to control the delivery of the Programme.

## 7.2.3 Implementation Period

Subject to Programme approval, it is anticipated that implementation and benefits realisation of the preferred option will be managed over a three year period. It is anticipated that the 'interim' Programme arrangements will be revisited upon the identification of the lead organisational 'host'. The Programme Implementation Considerations and Implementation timeline are set down in Section 7.10.

## 7.3 Programme Assurance and Review Process

The Programme is being overseen by the EMRTS Programme Board, chaired by Dr Grant Robinson, Unscheduled Care Lead for Wales. This Board will include Health Boards in Wales, WAST and the Air Ambulance Charity. It will also include relevant third party representation with experience in delivering such services. The Project Board will report regularly to the All Wales Chief Executives.

The Post Project Evaluation Strategy for this programme will, where appropriate, be carried out for each Phase of the programme.

The submitting Health Board has a successful track record in delivering capital programmes to time and cost and also utilising investment to deliver service improvement. It is proposed that once the lead organisational 'host' for the provision of this service is identified then the Programme would be subject to the Capital Monitoring and Management functions of the Organisation's Capital Investment Sub Committee of the Board.

Well established and effective collaborative working is key to the delivery of this type of complex service and the Programme and 'host' needs to foster and facilitate this way of working. The role of the Programme Director is key to this collaborative approach.

The Programme has had useful discussions with Welsh Government on the most appropriate use of Gateway Reviews under the External Assurance Review Process. The Senior Responsible Officer has completed the Welsh Government's Risk Assessment Form Part 1 (RPA1) for submission to the Welsh Government. At this stage, the Programme would

anticipate a potential gateway review prior to the submission of the BJC and also at the end of the first year of implementation.

This Gateway review will include prospective data collection to objectively evaluate the need for expansion to include the Caernarfon base and 24/7 cover in Swansea. This will include a formal review of the benefits realisation plan and provide assurance against the timelines for these. In particular the lead and deputy lead clinicians in Caernarfon will help support this data and benefits assessment.

## 7.4 Outline Arrangements for Benefits Realisation

### 7.4.1 Benefits Management Strategy

The Programme Board recognises the clear need to establish a set of metrics, by which the benefits of the Programme can be assessed. A central goal of the benefit management process is to bring structure, accountability, clarity and discipline to the definition and delivery of the benefits inherent in the Programme.

Whilst it is recognised that the benefits arising from implementing new pathways can be challenging, a suite of measures will be developed within the BJCs to provide key assurance on benefits realisation. A Benefits Realisation Plan will be developed, during the next stage of implementation, in order that measurable outcomes can be identified and appropriately measured and monitored.

A workshop is planned, to be facilitated by Welsh Government experts, to ensure the robustness of this element of the process for inclusion within the BJC.

### 7.4.2 Benefits Realisation Plan

The benefits for the Programme have been detailed in Section 3.0. These will form the basis for the Benefits Profiles that will be developed alongside a Benefits Realisation Plan. The Benefits Realisation Plan will act as an overview of the main milestones detailed in each Benefit Profile. It serves as a management tool to monitor, track and manage the collective set of benefits associated with each of the Phases. It will provide a focus to help keep track of what needs to be done, when and by whom, to manage the successful realisation of benefits. It will also include the identification of dependencies to understand where the achievement of one benefit is dependent on the realisation of another.

As stated above, a workshop is planned, to be facilitated by Welsh Government experts, to ensure the robustness of this element of the process for inclusion within the BJC.

### 7.4.3 Anticipated Outcomes and Benefits

The anticipated outcomes and benefits for this stage of the Programme have been detailed in the table below. These are supported by a provisional set of benefit measures.

The expectation is that the anticipated outcomes of the overall Programme will be delivered within a three year period. To capitalise on early opportunities, each Phase will be tasked to identify a series of quick wins, which can be implemented from month three onwards, in line with the proposed Implementation Plan, key benefits milestones will occur at months 3, 12 and 36 months. These are as follows:

- ▶ **Short term (3 months)** – identification of quick wins, for immediate implementation.
- ▶ **Medium term (12 months)** – implementation of the new models of care / pathways and the realisation of benefits.
- ▶ **Long term (36 months)** – demonstration of effectiveness and outcomes of new service.

It is expected that the benefits to the health and social care economy will flow from:

Criteria	Description
1.Reduce health inequality	Ensure that no groups are discriminated against as a result of reconfiguration - take the right person to the right place in the right time.
2.Improve quality of clinical services	Measurable improvement in the quality of services.
3.Increased ability to train and educate staff	Increased opportunities to develop and train staff.
4.Increased ability to undertake clinical research	Develop opportunities to expand the Trust's clinical research.
5.Improvement in recruitment and retention	Ensure opportunities are maximised to recruit and retain the best staff.
6.Vertical integration with community and primary care	Ensure improved integration with local community health providers.
7.Alignment with commissioners / stakeholders priorities	Ensure key stakeholders objectives are aligned with the Trust.
8.Technical Deliverability	Option is practically deliverable from a technical perspective.

The benefits measures and timescale for delivery of the key benefits are set down in the table below:

Benefit	Measure	Timescale
Reduce health inequality	Annual local hospital bypass (implies access to specialist care)	3ys
	Timeliness of access to specialist care for all patient groups	
	Reduction in time critical secondary transfers	
	Reduction in conveyances by the ambulance service	
Improve quality of clinical services	Improvements in functional outcomes (disability free life years)	3yrs for function and survival 1yr for others
	Improvement in survival of patients	
	Objective improvements in clinical condition of patients	
	Reduction in overall length of stay and ICU stay	
Increased ability to train and educate staff	Reduction in hospital admission Increase the number of Critical Care Paramedics in Wales	3yrs
	Increase the number of PHEM trainees in Wales	

Improvement in recruitment and retention of medical workforce	Reduction in the number of unfilled substantive consultant posts in Emergency Medicine, Anaesthetics and Critical Care	3yrs
	Reduction in the number of unfilled paramedic posts	

## 7.5 Outline Arrangements for Management of Risk

The Programme is complex and involves all seven Welsh Health Boards, WAST, the Air Ambulance Charity and other delivery partners from NHS England. The Programme is an enabler for other Change Programmes, such as the Major Trauma Programme, and Health Boards' service reconfiguration plans.

The Programme has been clear in identifying the scope of its remit and the inter-dependencies of the Programme with other Change Programmes and with partner organisations.

Significant efforts have been made to communicate and engage with all Partner organisations and Clinical Networks to ensure alignment with their Service Plans and to identify, and manage, any associated risks.

The Programme has also worked closely with the South Wales Collaborative (SWC) in terms of modelling patient flows that falls within their remit and other Boards and Networks for other Patient flows.

The forward management of risk will primarily be effected by the identification of a lead organisational 'host' for the new service through which delivery, governance arrangements and risk management will be undertaken.

The Programme Board has undertaken a risk identification process through a facilitated workshop of partner organisations and stakeholders. A summary of this work is set down below.

Risk Criteria	Rationale	Mitigation
Clinical	Risk that EMRTS is not able to deliver improved clinical outcomes.	Ensure the clinical service model is achievable by analysing potential demand on the service.
Operational	Failure to align the operational model to the clinical requirements may lead to actual and perceived failure of the service.	Phased introduction of operational model.
Technological	Reliance on multiple stakeholders for provision of technological support leading to an increased risk of technological failure.	Ensure that the technological input of all stakeholders and their interface is clearly understood from the outset.
Financial	Risk that project cannot be delivered within available funding envelope or that WAAC is no longer able to finance its support for the service.	Liaise with Welsh Government and incorporate capital/revenue affordability limits into financial evaluation.

Stakeholder/ Commissioning	Risk that failure of stakeholder engagement leads to poor operational performance (actual failure) or unrealistic expectations (perceived failure).	Active engagement with stakeholders ref: workforce model/clinical model/operational model/anticipated clinical flows/commissioning arrangements to ensure the expected impact of the EMRTS is understood and approved in advance of business case submission.
Reputation	Risk that individual personalities/interactions or failures further down the care pathway damage EMRTS.	Recognition of the importance of interactions across stakeholder groups during the business case process.
Project	Risk that complex stakeholder engagement leads to failure to achieve the timetable leading to scope creep/undeliverable benefits.	Project Board to be aware of possible scope creep/lack of engagement.
Workforce Management/ Capacity Planning	Risk that the workforce model/capacity planning is not appropriate to deliver clinical benefits. Insufficient support from LHBs to deliver required number of sessions.	Obtain agreement and approval of LHBs/WAST regarding workforce commitments and expected patient flow impact in advance of submitting the business case.

The Risk Management Plan for the Programme will be developed on a Phased basis to ensure the local nature of the risks can be captured, refined and managed.

The Programme has submitted the RPA 1 form to the Integrated Assurance Hub as required and is attached Appendix K.

## 7.6 Principles of Organisational Governance

In order to discharge the governance and accountability requirements of a new EMRTS, there are a number of key governance and accountability matters which will need to be addressed. A stakeholder workshop was held in April 2014, to identify the key issues in this area. There was a wide ranging discussion on the key principles of governance, and associated importance of these elements, using guidance within the “Good Governance Institute”.

The following are the key Governance and Accountability issues identified from the discussion:

- ▶ Needs to be Patient-centred
- ▶ Clinical governance should be a central priority
- ▶ Multiple agencies – need to interface with all other partners
- ▶ Need for one organisation to “own” the “provider” side
- ▶ The governance model should be wider than trauma
- ▶ The EMRTS service be led by one organisation
- ▶ Need to enable links with WAACT
- ▶ Clear Flow of funding required
- ▶ Need for “the entity” to make independent (clinical) decisions
- ▶ Clarity of roles of different stakeholders
- ▶ Need to ensure the service is “commissioned” (i.e. may be handed to one organisation to commission on behalf of NHS Wales)
- ▶ Consider and manage strengths of existing stakeholders

Following identification and extensive discussion of the issues, it was agreed that there were three key perspectives to consider in the potential governance arrangements of the new service.

“Provider”	“Commissioner”	“Management of the service”
Potential options 1. Health Board 2. WAST 3. WAACT  Organisational accountability for delivery and performance	Who should lead (WHSSC/Ambulance Commissioner)?	Management of clinical governance issues
	Need for buy-in from Health Boards, and Partners – which option will best do this?	Contract of employment (who is the prime)
	Oversee delivery of benefits across LHBs and also impact of the flow	Different workforce groups, with varying issues to manage and co-ordinate (e.g. pilots, paramedics, doctors)
	Manage interface with other Commissioner Programmes	Financial Flows to be managed and Partner SLAs to be established.

The BJC will develop these key perspectives on potential governance arrangements and identify proposals for implementation.

## 7.7 Principles of Clinical Governance

The EMRTS will need to develop a robust clinical governance framework and a clear process of medical accountability within its host organisation. It will be the responsibility of the Clinical Reference Group to develop these arrangements on behalf of the Programme. Particular consideration will be required to the following areas some of which are outlined in the Association of Air Ambulances – Framework for a High Performing Air Ambulance Service 2013:

- Creation of a local Clinical Advisory group
- Standard operating procedures – based on best practice and adherence checked through the local external clinical advisory group and clinical audit
- Training, appraisal and clinical governance days
- Medicine management
- Data procurement and analysis – a new data collection system designed to include capture of ‘measurable benefits’, adherence with key performance indicators, outcome analysis and strategic planning of the service (i.e. future expansion). Please see Appendix L for reference.
- Risk and critical incident management – a robust clinical incident reporting system
- Complaints and disciplinary procedures – through existing procedures within the host organisation

The Clinical Governance Framework will need to be established and approved by the ‘host’ organisation prior to the introduction of the service taking into account the above considerations.

## 7.8 Governance Next Steps

### 7.8.1 Commissioning EMRTS

The Programme Board has discussed, and agreed, the importance of robust commissioning arrangements being in place for the National Clinical Service. The Programme Board has recommended that the benefits of different Commissioning hosts, and models, be explored at a workshop during the BJC development phase of the Programme. The Programme Board intend to evaluate the options and make a recommendation on the way forward in the BJC.

Informal discussions with experts in commissioning have been undertaken to facilitate their input during the next stage of the governance arrangements work.

### 7.8.2 Transition

In the period between approval of this Programme Case and go-live of the service, and in parallel with a decision on commissioning the service, it is proposed that the Programme Board maintain their leadership and oversight of the set-up of the service. This will involve review of the current Programme Board membership, to ensure adequate representation from key stakeholders.

The structure of the Programme Governance will also be reviewed to incorporate a Clinical Reference Group reporting to the Programme Board. As the Programme moves into detailed operational planning, it is also recommended that separate operational model and workforce workstreams are set up, to consider more fully clinical pathways (including repatriation protocols) and, for workforce, to consider the impact of WAST/Critical Care Paramedic (CCP) modernisation and confirmation from LHBs on medical workforce. Two implementation Phase Projects will also be established.

The cost of continuing with the Programme Board in the transition period is included in Appendix M.

## 7.9 Use of Special Advisors

Given the specialist nature of this service, and its role with NHS Wales' Strategic Development of services, the Programme has made extensive use of Special Advisors throughout its work programme. The Special Advisors listed below have been fundamental to the assurance of the Programme.

<b>South Wales Collaborative</b> Paul Hollard Chris Turley Rosemary Fletcher Marie Davies	<b>University Hospital North Staffordshire NHS Trust</b> Peter Oakley, Clinical Lead for Major Trauma  <b>South Western Ambulance Service NHS Trust</b> Phillip Cowburn, Medical Director, Acute Care  <b>Emergency Medical Retrieval Scotland</b> Stephen Hearn, Clinical Lead  <b>Trauma Audit Research Network Co-ordinators</b> Susan Evans (ABMU) Susannah Coles (C&V)
<b>Welsh Ambulance Service</b> Richard Lee	<b>Critical Care Network Manager</b> Sue O'Keefe
<b>Wales Neonatal Network</b> Jean Matthes Claire Richards	<b>PICU Retrieval (South Wales)</b> Malcolm Gajraj Alison Oliver

**ABMU Maternity**  
Jeremy Gasson

**ABMU Health Board**  
Rob Dawes  
David Rawlinson  
Sharon Vickery

These Specialist Advisors are in addition to the significant involvement of Partner Organisations, and Stakeholders, within the Programme Board, Workshops and structured dialogue.

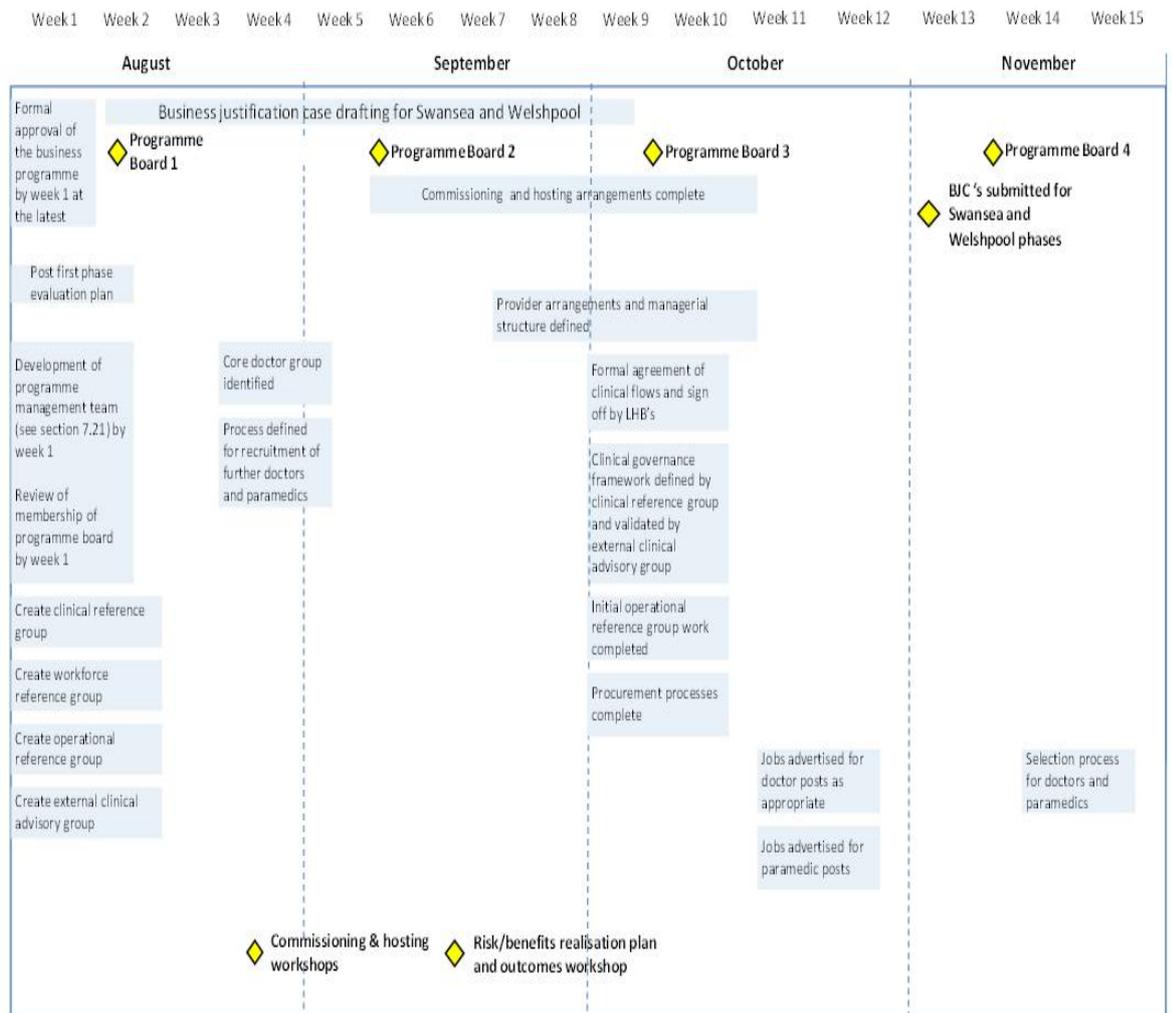
In addition, the Programme has also benefited from the professional advice of Ernst & Young, particularly in relation to the Economic Case and Financial Cases.

## **7.10 Implementation Considerations and Timeline**

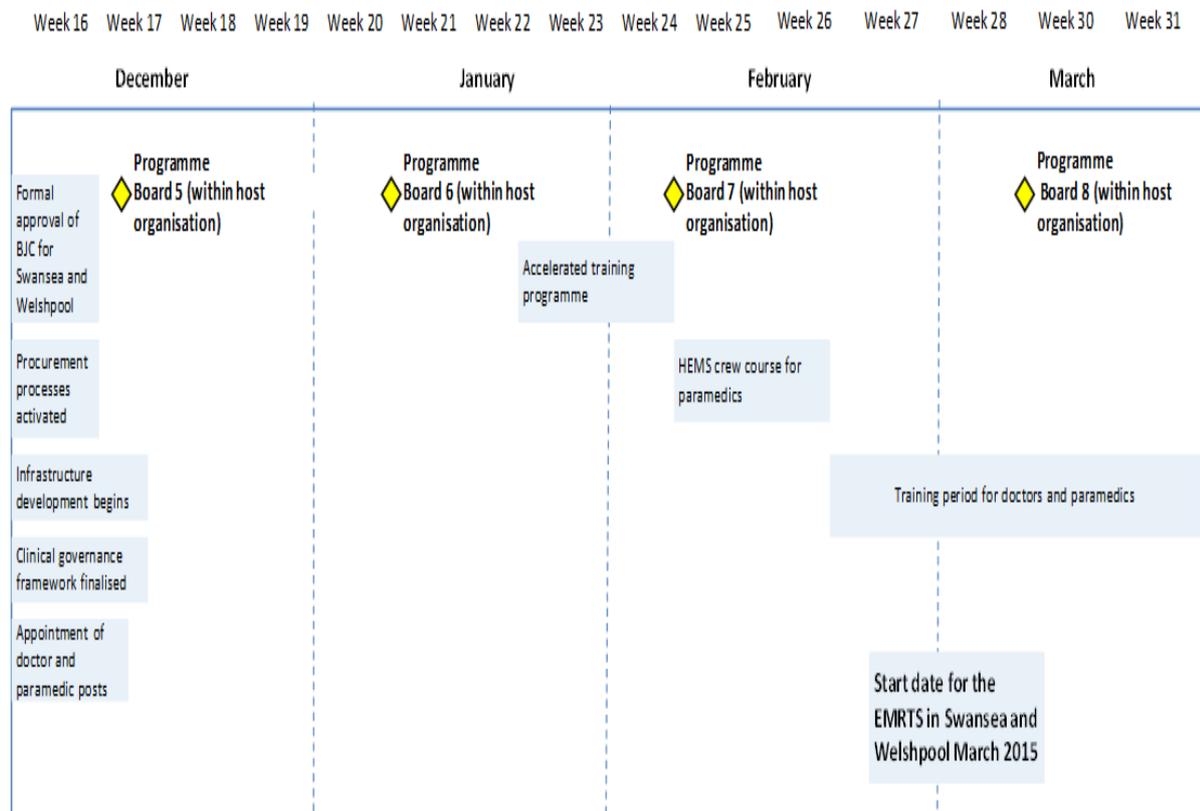
Section 7.2 sets down the proposed Programme and Project Management arrangements to deliver the preferred option.

The graphic below sets down the implementation timeline of the Programme. The key components of the BJC stage, and the two implementation phases, can be seen.

## EMRTS Implementation Plan



## EMRTS Implementation Plan



It is important to highlight that the Preferred Option has the lowest risk of all the short-listed options and this is an important factor given the Workforce, Operational and Clinical issues that require to be managed during the establishment Phases of the Programme.

It is also important to recognise that the Preferred Option, once implemented, acts as a strong foundation for any further extensions of service that the Programme may determine at future review points, particularly after 12 months.

The delivery of the timeline will require strong and effective clinical leadership, the resources of a Programme Manager to co-ordinate delivery, preparation and the operational refinements of planning required within a BJC, and also financial, capital planning, procurement and secretarial support and input into the BJC, procurement process and the significant required engagement with Programme Partners and Stakeholders.

The Clinical workforce arrangements will also necessitate appropriate Medical HR input into this aspect of the Programme.

## 8. Conclusions and Recommendation

The Programme Board was established, at the request of the Welsh Government, to deliver a Programme Case for the Emergency Retrieval and Transfer Service (EMRTS).

The Programme Board is comprised of Partner Organisations and Special Advisors to the Programme. The Board has undertaken dialogue across NHS Wales, and beyond, in the development of the Programme Case.

The Programme Board has undertaken a detailed evaluation of the options available to deliver on Emergency Medical Retrieval and Transfer Service and concluded that the Preferred Option in value for money terms is Option 2A.

### Option 2A (Two bases, 12 hour air & road service, clinical lead and deputy at Caernarfon)

<b>Two bases</b>	<b>Swansea &amp; Welshpool– air and road services over two phases occurring simultaneously in time</b>  <b>A designated clinical lead and deputy cover nominated for the Caernarfon base occurring at the same time as the Welshpool development</b>
<b>Operational</b>	Between 0800 - 2000. No overnight coverage. 1 team at each base for each shift
<b>Phase 1</b>	Swansea air and road service (operational between 0800-2000)
<b>Coverage (30 mins)</b>	12 hours: 69% population (air), 42% population (road)
<b>Phase 2</b>	Add Welshpool air and road service (operational between 0900-2100)
<b>Coverage (30 mins)</b>	13 hours: 95% population (air), 46% population (road)
<b>After 12 months of introduction of phase 1 and 2 a formal Gateway review will be conducted to strongly consider the need for further phased expansion to include the Caernarfon base and 24/7 cover in Swansea with reference to the investment objectives inc. equity</b>	

The Programme Board recommends that the Health Boards, Welsh Ambulance Service (WAST), Wales Air Ambulance Charity (WAACT) and Welsh Government endorses the Programme Case, its preferred option, and the development of the Business Justification Case to implement the Preferred Option.

The Programme would like to thank all contributors for their time and advice in developing this complex and challenging programme case.

## Appendix A Evidence based review

Reference	Type of study/aim	Key results	Conclusions
<b>Comparison between doctor led and Critical Care Paramedic (CCP) delivered models of care</b>			
Vopelius Feldt JV, Wood, J, Bengler J. <i>EMJ</i> 2013	Systematic review to determine effectiveness of different clinical models of care 12 papers (1 Randomised Control Trial, RCT level 2 and 11 retrospective level 3)	CCP vs. Physician led service – 5 papers, 3/5 demonstrated improved outcomes with physician led service. 2 showed no difference. CCP vs. Standard paramedic service – 4 additional papers, 2 studies showed benefit, 1 equivocal and 1 no benefit (significant limitations) Additional CCP skills – 1 RCT showed benefit in head injuries	Limited evidence to support the concept of paramedic-delivered pre-hospital critical care. The only CCP trial showing benefit was with a procedure (Rapid Sequence Induction) that UK non-physicians cannot undertake. This further demonstrates that the doctor led model leads to improved outcomes in head injury
<b>Systematic reviews focusing on difference between doctor and paramedic care on survival</b>			
Botker MT, Bakke SA, Christensen EF, Scand J Trauma 2009	Systematic review comparing survival with pre-hospital physician treatment vs. treatment by paramedic personnel in trauma and acute illness, 26 studies	9/19 studies in trauma conferred a survival benefit of physician treatment compared to paramedic treatment 4/5 studies of cardiac arrest, physician treatment increased survival 2 unselected studies showed a survival benefit for acute myocardial infarction and respiratory distress	Few controlled studies with varying quality, however a survival benefit seen most in trauma and cardiac arrest patients with physician treatment. 3 times more likely to survive if treated by a critical care doctor on scene.
Ollerton JE, Rickards AC, Davis PS. <i>JR Army Med Corps</i> 2007	Systematic review to determine composition and response of Pre-hospital Medical Emergency Response Teams (MERT) 15 articles (1 RCT – level 2)	1 RCT and several cohort studies support role of doctors pre-hospital	Improved survival in victims of severe trauma when a doctor with critical care skills deployed with MERT
Ringburg AN, Thomas SH, Steyerberg EW <i>et al. Air Med J</i> 2009	Systematic review give an overview of literature on the survival benefits of HEMS	16 met the inclusion criteria. All indicated that HEMS assistance contributed to increased survival Between 1.1 and 12.1 additional survivors were recorded for every 100 HEMS uses A combination of four reliable studies shows overall mortality reduction of 2.7 additional lives saved per 100 HEMS deployments, all used a doctors/paramedic model	Literature shows a clear positive effect on survival associated with HEMS assistance

Jayaraman S, Sethi D. <i>The Cochrane Library</i> 2010	Systematic review (level 2/3) to quantify the impact of Advanced Life Support (ALS) -trained ambulance crews versus crews without ALS training on reducing mortality and morbidity in trauma patients	1 controlled before-and-after trial, 1 uncontrolled before-and-after study, 1 RCT None demonstrated evidence to support ALS training for pre-hospital personnel In the uncontrolled before and after study, sub-group analysis showed increase in mortality among patients who had a Glasgow Coma Scale <9 and received care from ALS trained ambulance crews. When the pre-hospital trauma score was taken into mortality in the patients receiving care from ALS trained crews increased significantly	At this time, the evidence indicates that there is no benefit of advanced life support training for ambulance crews
--	---	---	---

**Prospective and retrospective cohort studies comparing doctor and paramedic care on survival**

Apodaca AN, Morrison JJ <i>et al. Shock</i> 2013	Retrospective performance evaluation examining the prehospital and admission shock index of three discreet FAME platforms transporting casualties from the point of injury (POI) to a Role III MTF in Helmand, Southern Afghanistan, over a 2-year period (June 2009 to June 2011)	An improvement in the admission SI was observed across all platforms in the lowest ISS bin. Within the middle bin, both the MERT and PEDRO groups saw improved shock index on admission, but not the DUSTOFF group. This trend was continued only in the MERT group for the highest ISS bin (1.39 T 0.62 vs. 1.09 T 0.42; P = 0.001), whereas a deterioration was identified in the PEDRO group. The use of a Forward Evacuation platform with a greater clinical capability is associated with an improved hemodynamic status in critical casualties. The ideal prehospital triage should endeavor to match patient need with clinical capability	Distinct mortality advantage of critical care doctor on the battlefield
Morrison JJ, Oh J, DuBose JJ, <i>Ann Surg</i> 2013	Retrospective registry review (level 3) comparing mortality from evacuation with Conventional Military Retrieval (CMR) methods to those evacuated with an Advanced Medical Retrieval (AMR) capability.	In this mid-ISS bracket mortality was lower in the AMR than the CMR group (12.2% vs. 18.2%; p=0.035). In the high ISS category (51-75) (n=75; 4.6%) time to operation was lower in the AMR than the CMR group (66±77 vs. 113±122; p=0.013) but there was no difference in mortality	Conventional platforms are effective in most casualties with low injury severity. Much improved outcomes for severely injured patients (ISS >24) when treated by UK critical care Physician staffed system (MERT) compared to US special forces paramedics with extended skills.  The Welsh EMRTS model is based on the UK MERT model.

Hesselfeldt R, Steinmetz J, Jans H <i>et al. Acta Anaesthesiol Scand</i> 2013	Prospective, controlled observational study (level 3) before and after introduction of physician staffed HEMS	1788 patients, reduction of secondary transfers from 50% to 34% after implementation, reduced time to definitive care ( $p < 0.01$ ) and reduction in 30 day mortality ( $p = 0.02$ )	Implementation of a physician based HEMS were associated with significant reduction in time to the trauma centre for severely injured patients. Also observed significantly reduced proportions of secondary transfers and 30-day mortality
Roudsari BS, Nathens AB, Cameron P <i>et al. Injury</i> 2007	International multicentre, retrospective review (level 3) comparing trauma outcomes between physician operated EMS vs. technician operated EMS	Early trauma fatality rate was significantly lower in physician EMS systems compared with technician EMS systems (OR: 0.70, 95% CI: 0.54-0.91)	Findings suggest that pre-hospital trauma care systems that dispatch a physician to the scene may be associated with lower early trauma fatality rates, but not necessarily with significantly better outcomes on other clinical measures
Yeguiayan JM, Garrigue D, Binquet C, <i>Crit Care</i> 2011	French prospective, multicentre cohort study (level 3) to compare medical pre-hospital system (doctors and nurse) with non-medical pre-hospital management on 30-day mortality from trauma	After adjustment for clinical status and ISS, significant 30-day reduction in mortality ( $p = 0.03$ ) in medical pre-hospital system compared to non-medical system	This study suggests that medical pre-hospital management is associated with a significant reduction in 30-day mortality in trauma
Gomes E, Aruajo R, Carneiro A. <i>Resuscitation</i> 2010	Portuguese retrospective registry review (level 3) to determine survival in trauma by physician led pre-hospital care vs. in hospital care	Mortality 20% for pre-hospital group vs. 38% for hospital group Patients whose life-threatening events were corrected only at the trauma centre had an odds of death 3.3 times greater than those from the pre-hospital group	In trauma patients requiring transfer to a trauma centre, pre-hospital interventions to treat life-threatening events may significantly decrease mortality when compared to similar interventions performed later at the trauma centre
De Jongh MAC <i>et al. Injury</i> 2012	Retrospective (level 3) evaluation of HEMS (doctor/nurse service) on trauma mortality and the effect of pre-hospital time on the association between HEMS and mortality. Carried out in the Netherlands	The risk of in-hospital mortality was non-significantly higher for patients with TBI (traumatic brain injury) in the HEMS/EMS group (OR = 1.3; 95% CI 0.6–2.7; NNT: - 15) compared to the EMS-only group and non-significantly lower for patients without TBI (OR = 0.9; 95% CI 0.3–2.5; NNT: 129)	HEMS treatment is associated with a non-significantly higher risk of in-hospital mortality for patients with TBI and a non-significantly lower risk for patients without TBI. This increased risk of mortality in TBI patients is attributable to the increased pre-hospital time. These results indicate that HEMS does not have a positive impact on survival

**Retrospective cohort studies looking at safety of Rapid Sequence Induction by doctor/paramedic model**

Mcqueen C, Crombie N, Hulme J. <i>EMJ</i> 2013	Retrospective (level 3) review RSI (drug assisted intubation) data of doctor/paramedic medical emergency response incident teams in West Midlands	142 RSI's (13.8% of scene attendances) over 12mths, 1 case of failed intubation managed with a supra glottic airway. Laryngoscopy performed by CCP in 37% of cases, with similar grade of intubation obtained by CCP and doctors	This study demonstrates that operation within a system that provides high levels of exposure, underpinned by comprehensive and robust training and governance frameworks, promotes levels of performance in successful pre-hospital RSI regardless of base speciality or profession
Chester A, Keefe N, Mauger J, Lockey D. <i>EMJ</i> 2013	Retrospective review of RSI by doctor-paramedic model (level 3), rural and suburban environment (already tested in urban environment)	16mth period, 763 cases, 88 RSI's, no failed intubations, acceptable on scene times	Demonstrated the successful introduction of a pre-hospital care RSI SOP, already tested in the urban trauma environment, to a rural and suburban air ambulance service operating a fulltime doctor – paramedic model
Gunning M, O'Loughlin E, Fletcher M. <i>EMJ</i> 2009	Retrospective (level 3) review of RSI by doctor/paramedic team (Care flight Medical Services, Queensland, Australia)	114 patients over a 9mth period, intubation success rate of 97%, 6 patients successfully intubated by doctor when paramedic failed	Well-trained doctor paramedic teams, utilising standardised operating procedures can safely perform rapid sequence induction and intubation in the pre-hospital and emergency environment. Complication rates similar to in hospital rates and other pre-hospital services
<b>Cost effectiveness and wider economic benefits of doctor led service</b>			
Taylor C, Jan S, Curtis K <i>et al. Injury</i> 2012	Evaluation of the cost-effectiveness of a physician-staffed HEMS intervention in combination with treatment at a major trauma centre versus ground ambulance or indirect transport (via a referral hospital) in New South Wales, Australia	HEMS to more costly but more effective at reducing in-hospital mortality leading to a cost per life saved of \$1,566,379, \$533,781 and \$519,787 in all patients, patients with serious injury and patients with TBI respectively. When modelled over a patient's lifetime, the improved mortality associated with HEMS led to a cost per life year saved of \$96,524, \$50,035 and \$49,159 in the three patient groups respectively	HEMS intervention is associated with improved mortality in trauma patients, especially in patients with serious injury and TBI. The improved benefit of HEMS in patients with serious injury and TBI leads to improved estimated cost-effectiveness
Ringburg AN, Polinder S, Meulman TJ <i>et al. BJS</i> 2009	Prospective cohort study (level 3) to investigate the cost-effectiveness of physician staffed HEMS assistance compared with emergency medical services (EMS)	Over 4-year study interval, HEMS assistance saved a total of 29 additional lives No statistically significant differences in quality of life were found between assistance with HEMS or with EMS The sensitivity analysis showed a cost-effectiveness ratio between 16 000 Euros and 62 000 Euros	In the Netherlands, the costs of HEMS assistance per QALY remain below the acceptance threshold. HEMS should therefore be considered as cost effective

Hyde P. South Central Strategic Health Authority 2010	Pre-hospital critical care pilot project	3mths in Hampshire, physician led, supported by paramedics 27% discharged at scene, estimated annual saving to ambulance service of £260,000 & ED's of £125,000 38% of patients were transferred directly to a specialist centre with NO patient requiring secondary transfer For trauma & medical patients, median reduction of 2 ICU days, total of £167,328 savings during pilot and estimated annual saving of £3.2m in Hampshire alone	Significant wider economic benefits for health care services
Gabbe BJ <i>et al. Ann Surg</i> 2014	10 retrospective trauma registry review	This demonstrated a reduction in the incidence of road transport related deaths, whereas the incidence of hospitalised major trauma increased. Years of life lost decreased by 43% and years lived with disability increased by 32%, with an overall 28% reduction in disability adjusted life years over the time period. There was also cost saving per case of A\$633,446.	Whilst the impact of aggressive pre-hospital care is difficult to isolate, it is clear that an improvement in survival does not necessarily equate to an increase in the burden of disease.
<b>Miscellaneous papers</b>			
Hyde P, Mackenzie R, Ng G <i>et al. EMJ</i> 2011	Postal and telephone questionnaire to identify the current availability and utilisation of physician-based pre-hospital critical care across England, Wales and Northern Ireland	London only region with NHS funded 24hr physician led critical care availability Apart from Wales and South West, all other regions have charity funded, physician led critical care services (either immediately or possible available)	Wide geographical variation in the availability of physician led pre-hospital critical care
Littlewood N, Parker A, Hearn S <i>et al. Injury</i> 2009	Telephone questionnaire to establish and compare the tasking criteria, dispatch arrangements and crew configuration for all helicopter ambulance services in the UK	Replies were received from all 16 UK air ambulance services Crew configuration varies between services. 9 services had paramedic only crew, 3 had physician/paramedic crew and 4 had a paramedic crew with variable physician input Only 2 of the 16 services used a paramedic in the dispatch process. There were 67 different tasking criteria used for air ambulance dispatch across all air ambulances	Given the financial burden and physical risk of air ambulance use, there should be a more standardised approach to the tasking, dispatch and crew configuration of air ambulances in the UK

Mcqueen C, Apps R, Mason F <i>et al.</i> <i>EMJ</i> 2013	Case review (level 4) providing evidence of interception model , needs for central coordination hub and use of RV points	As given	As given
--	--	----------	----------

### Key findings supporting the doctor/paramedic model for EMRTS from the evidence review

1. This is not a systematic review of all available literature but has been developed to assist stakeholders make informed decisions about the clinical model for EMRTS. The term 'physician' is interchangeable with 'doctor.'
2. The best available evidence is currently level 2 and 3. Nevertheless we can only act on the basis of the best available evidence at the time of decision making.
3. Only one paper (a recent systematic review) addressed the question of critical care paramedic (CCP) vs. physician led care. Whilst acknowledging the positive role of CCP's, there is currently a paucity of evidence supporting CCP led care. In this review 3 out of 5 papers showed a benefit of physician over CCP led care. **In the absence of available evidence it is difficult to support a CCP led model (supported remotely by physicians).**
4. 3 further systematic reviews point to improved survival (especially in major trauma) with critical care physician led care over standard paramedic care. There is also data to support an improvement in survival from cardiac arrest with critical care physician led care, although this appears to be less well defined. This will be an important area to study, as EMRTS will have a significant role in managing medical emergencies.
5. A Cochrane review points to lower survival for major trauma patients by paramedic trained staff. However it does not address the role of paramedics with extended skills.
6. 6 additional papers support the physician led clinical platform for improving survival in major trauma, despite the evidence being level 2 and 3. Traumatic brain injured patients appear to benefit the most.
7. 2 UK and 1 Australian papers support safe and effective drug assisted intubation (Rapid Sequence Induction) by the doctor/paramedic delivered model.
8. 4 papers demonstrated that critical care physician led pre-hospital care is cost effective with significant wide economic benefits.
9. 1 paper shows the trend that all UK based HEMS moving to doctor/paramedic delivered care. Additional paper showing need for central coordination hub manned by paramedics. This will also enable coordination of the interception model for the car response as outlined in a case review.

## Appendix B Clinical service model and demand analysis

### Introduction

It has been clear from the work conducted so far that some refinement of the clinical service model against the predicted demand on the service is required as part of development of the business case. As the business case has been asked to cover a broad range of pre-hospital and retrieval activities there has been further engagement with existing services inc. the critical care network, Wales neonatal network, paediatric retrieval and maternity services, Welsh Air ambulance Charity, Welsh ambulance Service and University Hospital North Staffordshire Major Trauma Centre Major (North Wales). This has been to determine the level of support required by these stakeholders. Data on predicted demand has been provided by these organisations as well as Trauma Audit Research Network (TARN), Cardiff Neuro-Surgical Department and the South Wales collaborative and are summarised within this document.

Based on this demand analysis and on clinical grounds, the clinical leads have provided a series of recommendations for clinical service provision.

Project board members and stakeholders were asked to:

1. Examine the recommendations and demand analysis provided below inc. assumptions made.
2. Ensure that other individuals within their organisations were aware of the recommendations.
3. Validate the analysis of data provided by their organisations (as appropriate).
4. Provide confirmation that they agree with the recommendations made.
5. Provide suggestions if these require amending.

Based on feedback from the project board members and stakeholders the clinical service model has been agreed and this represents the final version of the document.

### Assumptions

The recommendations provided are based on the following assumptions:

1. The clinical service model of the EMRTS is designed to support and not replace existing pre-hospital and retrieval services in Wales.
2. The service should be equitable and available for all Welsh residents whether in North or South Wales.
3. The pre-hospital and retrieval aspects of the service are equally important.
4. That each base will run a pre-hospital trained critical care doctor (mainly consultant level) AND critical care paramedic (CCP) team for all taskings. The workforce model has already been agreed.
5. The level of activity described is once all bases are fully operational 24/7 on the critical care model. Benefits for existing services would only be during the operational hours of the EMRTS. Coverage will depend upon the agreed operational model and phasing.
6. An acknowledgement that 45-50 flying days per year (12%) can be lost due to adverse weather conditions (Nutbeam T, *EMJ* 2011). Under these circumstances EMRTS could respond by road and transfer times would be longer. The road transfer would be carried out by an EMRTS vehicle in most cases.

### The EMRTS mission statement:

To provide advanced decision making & critical care for life or limb threatening emergencies of all humans that require transfer for time critical management at an appropriate facility.

### Summary of recommendations for clinical service model

#### Pre-hospital critical care

1. Pre-hospital critical care for all age groups (i.e. any intervention/decision that is carried outside standard paramedic practice). Approximately 800 patient contacts per base per year (based on a 12hr day shift).

#### Time critical adult retrieval

1. Based on the data the EMRTS would support existing structures in place and undertake time critical, life or limb threatening adult transfers from peripheral centres (inc. Emergency Departments, Minor Injury Units – MIU's and Surgical Units) requiring specialist intervention at the receiving hospital. This is currently 150-160 patients per year from ED's across Wales.
2. The EMRTS will undertake inter-ICU transfers if time critical and life or limb threatening (e.g. a neurosurgical patient transferred to ICU and is then accepted for neurosurgery).
3. The EMRTS will not undertake non-time critical secondary transfers and repatriations. The service will not replace existing structures in place to transfer these patients.

#### Neonatal Retrieval

1. The EMRTS will provide an enhancement of pre-hospital critical care (both for neonates born at home and those delivered in standalone midwifery led units - MLUs). Currently this is provided by a 999 response. This would ensure movement of these neonates directly to neonatal units using either an air or road asset. Estimated numbers are 10 per 1000 MLU/home deliveries who need time critical transfer, plus 20 per 1000 less urgent neonatal transfers. This is difficult to quantify further until reconfiguration plans are fully realised across Wales, but likely to be approximately 60 patients per year.
2. For babies already in neonatal units, needing time critical transfer where the journey time by road is equal to or exceeding 1hr from base to referral unit, the helicopter utilised by the EMRTS could be used to rapidly transfer the neonatal team to the referring unit. The neonatal team would then stabilise the neonate and could transfer to the receiving unit using their own existing road asset mobilised at the same time as the helicopter. Thus EMRTS would be only providing the transport platform; neonatal teams would continue to provide the clinical care. There are currently 50-60 patients per year which fall into this category (during daylight hours).

## Paediatric Retrieval

1. The EMRTS will provide an enhancement of pre-hospital paediatric critical care. This would ensure movement of appropriate paediatric cases directly to specialist centres (by air or road asset). This equates to approximately 10.4% of the current PICU retrieval workload in South Wales (12 cases per year).
2. The EMRTS could assist with two areas of paediatric retrieval:

Time critical transfers for specialised intervention currently undertaken by the referring hospital (the EMRTS providing the air or road asset and clinical care).

Back up option in the event that the existing paediatric retrieval service is not available (due to factors such as PICU at full capacity or team committed on another retrieval), weather or technical problems with vehicles. The EMRTS could act as an independent team or provide the air asset support to the paediatric retrieval service. This will build resilience into the existing system.

## Maternity

1. The EMRTS would support midwife units by stabilising women and transfer them to a consultant led delivery unit. The mode of transport (air or road) will be determined on a case by case basis. Numbers are likely to be small.
2. This does not include delivery related problems (inc. pain relief and failure to progress) unless classified as time critical and life threatening to mother or foetus. The conditions covered will be clearly defined in a standard operating procedure.

## Overall activity

### 3-4 patients per 12hr shift requiring critical care management

#### Role of the 'top cover' EMRTS consultant

1. Remote senior support for registrars (inc. pre-hospital emergency medicine trainees) and new consultants working for EMRTS. Difficult to quantify number of calls at this stage.
2. Retrieval. To facilitate a remote conference call between referring and receiving unit to appropriately triage the correct resource to the tasking. This to occur for neonatal, paediatric and adult retrieval. Based on current data 220 calls per year.
3. Remote advice for peripheral unit (e.g. Minor Injuries Unit) on immediate management of the patient whilst appropriate resource is being deployed. Difficult to quantify number of calls at this stage.
4. Medical advisor. Role at major incidents or mass casualty events. This would be approximately 6 times a year for the medical advisor role (WAST source).

## EMRTS demand analysis and recommendations for clinical service model

### 1. Pre-hospital critical care

Current annual activity of Wales Air Ambulance (existing 3 helicopters, approx 12hr dayshifts per base):

2250 mobilisations in 2013 (WAST air support PDSA, source: health informatics).

750 mobilisations per helicopter in 2013.

(Mobilisations are aircraft launches).

962 Wales Air Ambulance conveyances in 2013 (321 per helicopter) in 2013.

Equates to 0.88 conveyances per base per day in 2013. This is assuming that the activity of each base is similar.

(Conveyances are patients actually transferred by air).

Limitations of data:

A large number of aborted missions are due to lack of intelligent tasking.

Current aborted missions (mobilisations which do not convey the patient and stand downs where team not required) – approx 58% for 2013.

Stand down rates need to be no more than 20% (Published National average).

Current taskings may not be clinically appropriate.

Difficult to determine increase in the level of pre-hospital activity once the EMRTS is established and tasking improves.

Predicted demand for pre-hospital care under the EMRTS:

Evidence points to approx 800 patient clinical contacts per year per base for pre-hospital critical care under the EMRTS (2.2 patient clinical contacts per base per day). This is based on a comparison with similar services elsewhere.

Within urban pre-hospital care systems approximately 60% of taskings are responded to by road and 40% by air. Given the rural geography of Wales the proportion of response by air is likely to be much higher.

Composition of pre-hospital critical care:

1. Annual major trauma cases – based on West Midlands working rate of 185 per million population and including transient population.

Total number of trauma cases initially classified as major trauma but Injury Severity Score (ISS>9) – 1,270.

Health Board	Predicted number/% for ISS 9-15	Predicted number/% for ISS>15
Cardiff & The Vale	105 (17%)	63 (17%)
Aneurin Bevan	113 (18%)	113 (18%)
ABMU	108 (17%)	108 (17%)
Cwm Taf	58(9%)	58 (9%)
Powys	14 (2%)	14 (2%)
Hywel Dda	82 (13%)	82 (13%)
BCHU	154 (24%)	154 (24%)
Total	634	634

The demand on the EMRTS for major trauma is described further in the Appendix on clinical flows analysis. Based on 24hr availability the EMRTS is likely to attend 618 cases in South Wales and 270 cases North Wales initially classified as major trauma (ISS>9). Half of the major trauma cases will have a severe head injury. If the model is only operational 12hrs per day then activity will be less.

1. Cardiac – Information obtained from WAST indicates that there are approx. 1000 cardiac arrests per year (under age of 60yrs) attended by WAST. It is unclear from this data which group would benefit from pre-hospital critical care input at the present time. Further work has been conducted in the Appendix on clinical flows analysis.

## Recommendations

1. On the basis of the demand analysis it is recommended that pre-hospital critical care for all age groups is an essential part of the EMRTS.

## 2. Time critical adult secondary transfers

Currently hospitals provide their own resource to transfer these patients. Governance and data collection is organised by the critical care network.

Data from critical care network for Level 3 transfers out from Emergency Departments (ED's):

792 transfers in 5 years (approx 150-160 per year) – 66 (42%) defined as time critical. It is this group that the EMRTS will benefit

(Level 3 transfers defined as patients that require advanced respiratory support alone or basic respiratory support together with support of at least two organ systems. This level includes all complex patients requiring support for multi-organ failure).

Data also indicates that a large proportion of these transfers occur between 7pm and 12am (although data on timings is only available for 36% of cases).

Unclear how many patients will self present in Minor Injury Units or Surgical Units that will benefit from transfer as reconfiguration proceeds although some data on this pending on the former.

## Assumptions

Data may not be accurate due to lack of completion of critical care transfer forms for each transfer. Difficult to predict the impact of pre-hospital critical care and reconfiguration on these numbers. However evidence points to a 30-50% reduction in secondary transfers with an adequate pre-hospital response (Hesselfeldt R, *Acta Anaesthesiol Scand*, 2013).

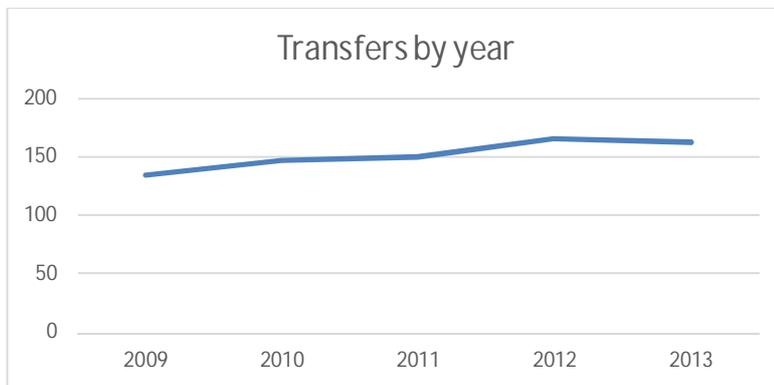
### Recommendations

1. Based on the data EMRTS would support existing structures in place and undertake time critical, life or limb threatening adult transfers from peripheral centres (inc. Emergency Departments, Minor Injury Units and Surgical Units) requiring specialist intervention at the receiving hospital.
2. The EMRTS will undertake inter-ICU transfers if time critical and life or limb threatening (e.g. a neurosurgical patient transferred to ICU and is then accepted for neurosurgery).
3. EMRTS will not undertake non-time critical secondary transfers and repatriations. The service will not replace existing structures in place to transfer these patients.

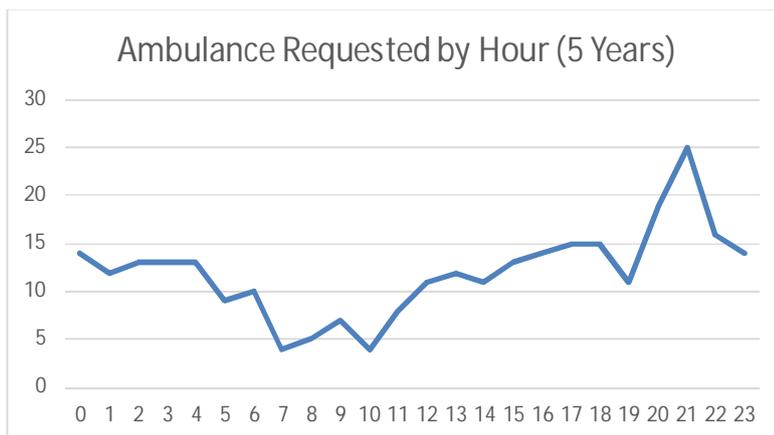
### Summary of Welsh Critical Network Tertiary Transfers

Data from the network covering a period of 5 years (3/1/2009 – 4/3/2014) indicates that 792 tertiary transfers took place from Emergency Departments across Wales.

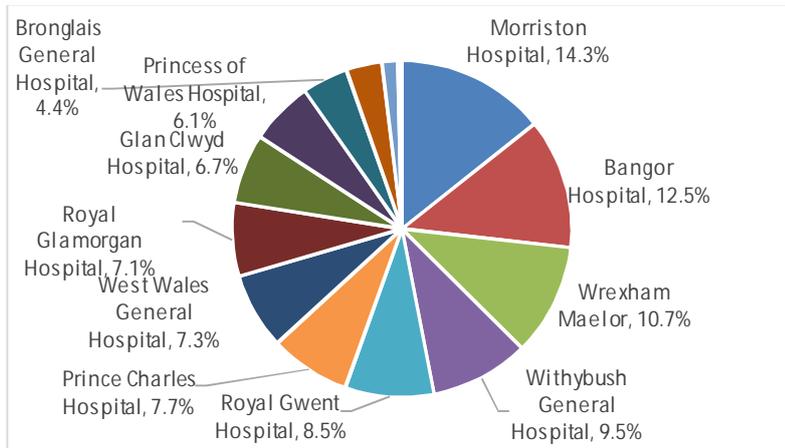
Transfers by year:



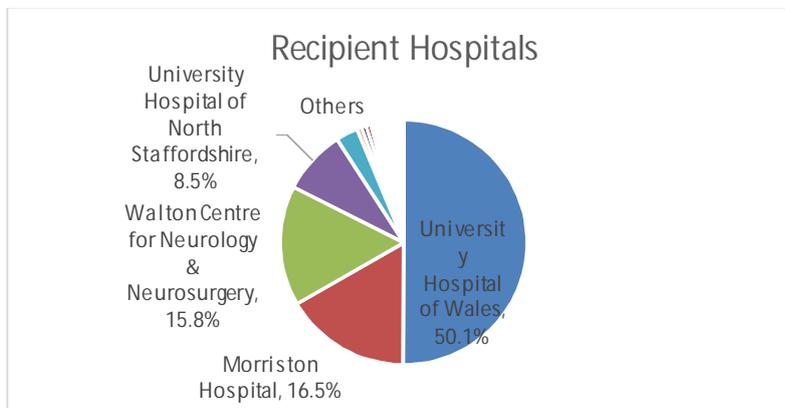
Limited data for times requested available, so data based on 288 records (36%):



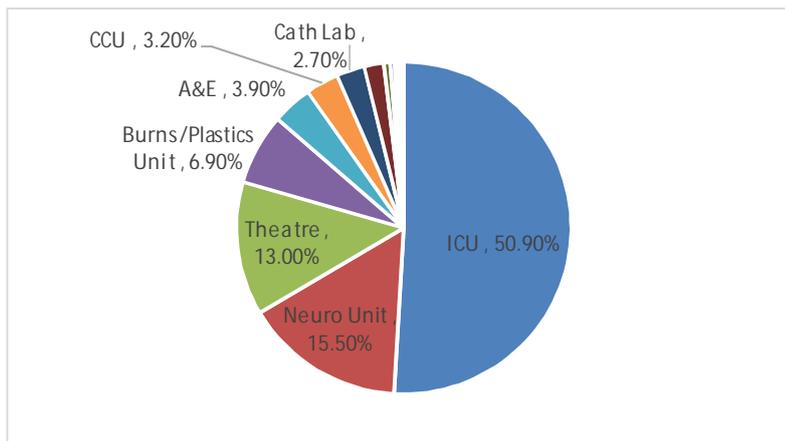
Transferring hospitals:



Receiving hospitals:



Receiving unit:



### 3. Neonatal Retrieval

In South Wales neonatal transfers are provided by CHANTS (Cymru Inter Hospital Acute Neonatal Transfer Service). The service operates twelve hours a day (8am-8pm) and is run from each of the three NICUs in South Wales are Cardiff, Newport and Swansea in turn. Each day there is a neonatal transport nurse, consultant, ambulance and driver dedicated to the service. Out of hours, there is no dedicated ambulance and time critical transfers are performed by the NICUs depending on medical/nursing and cot availability.

The service is a 12hr day shift only with no dedicated overnight cover. Each main NICU provides local *ad hoc* support overnight but this is subject to availability of staff and uses an ambulance from WAST (not a dedicated vehicle).

Currently there are 10 neonatal units (3 of which are NICU's at Cardiff, Newport and Swansea). With reconfiguration of acute service this is likely to reduce to 6 neonatal units (Cardiff, Newport, Swansea, Merthyr Tydfil, POW and West Wales). There are special care baby units (SCBU's), local neonatal units (LNU's) and intensive care units (NICU's).

In North Wales there are currently three neonatal units (Wrexham, Glan Clwyd and Bangor). Babies under 27 weeks gestation are planned to deliver at Arrowe Park (Wirral). Acute neonatal transport is provided by Cheshire and Mersey neonatal transport service (CMNTS), supplemented by an *ad hoc* service from Arrowe Park if CMNTS is already committed. Local units in North Wales provide some transport (e.g. from Bangor to Glan Clwyd and also back transfers). There is no access to an air asset. The ambulance component is a vehicle provided by the WAST.

A sub regional neonatal intensive care unit (SURNIC) is planned at either Glan Clwyd or Wrexham. There has been a review by the RCPCH to determine the site. The decision has not yet been announced.

Data provided by CHANTS (South Wales)

Total number of transfers:

	2011	2012	2013
South Wales	495	531	557

**Group of patients to benefit from EMRTS defined as time critical (specific clinical groups) and journey time by road equal to or exceeding 1hr from base to referral unit:**

	2011	2012	2013
South Wales	34	36	53

This approximates to one per week presently.

Numbers that would benefit from overnight transfer are approximately 20-30 patients per year.

Note: all units including MLU's need to be able to resuscitate a baby. Special care units and local neonatal units are also required to provide ventilation for up to 24hrs when necessary.

Note: all units including MLU's need to be able to resuscitate a baby. Special care units and local neonatal units are also required to provide ventilation for up to 24hrs when necessary.

### Recommendations

1. EMRTS will provide an enhancement of pre-hospital critical care (both for neonates born at home and those delivered in stand alone midwifery led units - MLUs). Currently this is provided by a 999 response. This would ensure movement of these neonates directly to neonatal units using either an air or road asset. Estimated numbers are 10 per 1000 MLU/home deliveries who need time critical transfer, plus 20 per 1000 less urgent neonatal transfers. This is difficult to quantify further until reconfiguration plans are fully realised across Wales, but likely to be approximately 60 patients per year.
2. For babies already in neonatal units, needing time critical transfer where the journey time by road is equal to or exceeding 1hr from base to referral unit, the helicopter utilised by the EMRTS could be used to rapidly transfer the neonatal team to the referring unit. The neonatal team would then stabilise the neonate and could transfer to the receiving unit using their own existing road asset mobilised at the same time as the helicopter. Thus EMRTS would be only providing the transport platform; neonatal teams would continue to provide the clinical care. There are currently 50-60 patients per year which fall into this category (during daylight hours).
3. The ability of EMRTS to deliver the above on a 24hr basis is dependent on the agreed operational model and phasing. It is one of the drivers for creating at least one 24hr base early on in the development of the service including the provision of night flying capability. Alternatively or as an interim overnight neonatal services could use HMS coastguard for time critical retrievals. There would be a cost attached to any retrieval work conducted using this approach. There are likely to be few in number, approximately 20-30 patients per year.

As the EMRTS is focused on time critical cases, it will not be involved in repatriation and movement of neonates to solely create cot capacity.

### Supporting structures required

This will be a unique opportunity for the EMRTS personnel to develop their skills in neonatal resuscitation with the provision of remote neonatal consultant support when managing cases from the pre-hospital environment and midwifery led units (neonatal 'top' cover), extended level of training beyond neonatal life support, standard operating procedures for likely neonatal scenarios and access to training and practice in neonatal stabilisation.

As a result of service redesign in some parts of Wales, there is likely to be an increase in the number of Midwifery Led Units (MLU). Neonatal transfer services in Wales do not cover standalone MLUs. The British Association of Perinatal Medicine, Neonatal support for standalone midwifery led units- Framework for Practice (2011) advises that ' the fastest way for a mother or baby to travel to the nearest appropriate hospital maybe by 999 ambulance, accompanied by the midwife who leads on and delivers any required newborn resuscitation and stabilisation procedures, whilst supported by the ambulance personnel'. Given the increased number of MLUs and distances in Wales, a need has been identified to provide enhanced stabilisation and transfer, for both mother and baby, to consultant led units. The longer journey times will be justified by the provision of an enhanced level of care by the EMRTS above standard midwife or paramedic practice.

## 4. Paediatric Retrieval

In South Wales this is currently run by paediatric retrieval service provided by PICU, Cardiff. They are looking to devolve this to another service. Existing service is consultant paediatric intensivist delivered.

Specialist transfer for paediatric patients requiring critical care is provided by North West and North Wales Paediatric Transfer Service (NWTS). The team is run as a joint project between Alder Hey Children's Hospital and Royal Manchester Children's Hospital. Their role is to provide stabilisation of sick children at the district general hospital within North Wales prior to transfer to an appropriate tertiary referral setting wherever usually in Manchester or Liverpool. The team is established, effective and experienced with access to dedicated paediatric road and air transfer assets.

Data provided by PICU retrieval (South Wales):

581 retrievals in 5yrs. This equates to approximately 116 per year (minimal change year on year).

10% level 3 and 90% level 2. All cases are intubated.

Time critical transfers currently carried out by referring hospital (e.g. a child requiring immediate neurosurgery). These are usually rare, but difficult to quantify.

Paediatric patients that would have triggered a pre-hospital response if EMRTS was in place assuming that these occurred within operational hours of the service. These patients are currently transferred by PICU retrieval from referring hospital:

Year	Number and % of total cases
2009	17/132 (13%)
2010	11/111 (10%)
2011	11/103 (11%)
2012	14/118 (12%)
2013	7/112 (6%)
Average %	10.4%

## Recommendations

1. EMRTS will provide an enhancement of pre-hospital paediatric critical care. This would ensure movement of appropriate paediatric cases directly to specialist centres (by air or road asset). This is equates to approximately 10.4% of the current PICU retrieval workload in South Wales (12 cases per year).
2. EMRTS could assist with two areas of paediatric retrieval:

Time critical transfers for specialised intervention currently undertaken by the referring hospital (EMRTS providing the air or road asset and clinical care).

Back up option in the event that the existing paediatric retrieval service is not available (due to factors such as PICU at full capacity or team committed on another retrieval), weather or technical problems with vehicles. EMRTS could act as an independent team or provide the air asset support to the paediatric retrieval service. This will build resilience into the existing system. This would occur after discussion with PICU retrieval.

Due to demand and workforce composition it will not be possible for the EMRTS to take over the existing PICU retrieval service in South Wales. There is also a clear clinical distinction between adult and paediatric retrieval services in the UK.

However on an all Wales basis it will compliment rather than change the provision of care. If planned and executed correctly critically ill or injured children will benefit from a flexible superior service which can cope with all situations in order to get the child to the correct place to deliver care in a safe, rapid and effective way.

#### Supporting structures required

It would be imperative that the existing paediatric retrieval service provides clinical governance support to the EMRTS in the clinical work described above.

### 5. Maternity Services

Service reconfiguration is likely to leave the increased number of standalone midwifery led units. Again it is difficult to predict the exact number of delivered in these units. The estimated number of maternal emergencies (e.g. eclampsia, intrapartum/postpartum haemorrhage) is 1 in 500 deliveries annually.

On this assumption the estimated annual number of true maternal emergencies will be in order of 10 cases per year across Wales.

#### Recommendations

1. The EMRTS would support midwife units by stabilising women and transfer them to a consultant led delivery unit. The mode of transport (air or road) will be determined on a case by case basis.

This does not include delivery related problems (inc. pain relief and failure to progress) unless classified as time critical and life threatening to mother or foetus. This additional group has not been quantified. The conditions covered will be clearly defined in a standard operating procedure to avoid mission creep and ensure clarity on what the EMRTS will undertake. This group would include any compromise to airway, breathing or circulation and conscious level. Specific conditions would include haemorrhage, eclampsia and pre-eclampsia, non-haemorrhagic shock (amniotic fluid embolus, massive PE, sepsis).

## **6. Key differences between South and North Wales Model**

Following a discussion with clinical colleagues in North Wales and the North Wales Critical Care Network on 30<sup>th</sup> May 2014 the following recommendations for South Wales in most respects and this is indicated below where relevant. Please see clinical flows for further details and quantification.

Pre-hospital critical care

Same as South Wales. Clinical flows to delineate differences especially major trauma.

Time-critical adult retrieval

As per South Wales

Neonatal Retrieval

Retrieval from midwifery-led units. Reconfiguration of maternity services in North Wales has not yet proceeded at the same pace as South Wales. In addition, there is the possibility that existing paediatric and neonatal transfer services will upscale their activities in order to meet demand in this area. It is thus envisaged that (North) EMRTS will not be involved in neonatal retrieval at the outset. This will be reviewed on an ongoing basis should the above assumptions turn out to be false, the priority of course being to ensure safety and equity of care for all patients in Wales. However EMRTS would support the movement of time-critical cases where road times to the referring unit exceed 60mins. In this case the helicopter used by EMRTS would be able to transfer neonatal teams to referring unit as appropriate.

Paediatric retrieval

Pre-hospital care as per South Wales.

Time-critical transfers:

- Where existing paediatric transfer service cannot respond, and where use of EMRTS will result in significant time-savings, then EMRTS will undertake the transfer. This will generally be at the request of the paediatric transfer service, in consultation with the referring clinician.
- PICU retrievals: currently undertaken by North Wales neonatal transfer service. EMRTS can provide support with aircraft and logistics as required.

As per South Wales, EMRTS in North Wales would not undertake inter-PICU retrievals or repatriations.

Maternity

As per South Wales and being clear on the scope of practice.

## **8. Role of the “top cover” EMRTS Consultant**

1. Remote senior support for registrars (inc. pre-hospital emergency medicine trainees) and new consultants working for EMRTS. Difficult to quantify number of calls at this stage.
2. For retrieval facilitate a remote conference call between referring and receiving unit to appropriately triage the correct resource to the tasking. This to occur for neonatal, paediatric and adult retrieval. Based on current data 220 calls per year.
3. Remote advice for peripheral unit (e.g. MUI) on immediate management of the patient whilst appropriate resource is being deployed. Difficult to quantify number of calls at this stage.
4. Provide a medical advisor role at major incidents or mass casualty events. This would be approximately 6 times a year for the medical advisor role (WAST source). Discussions are pending on this area. See below.

## Data sources

Welsh Ambulance Service dataset

Welsh Critical Care Network

Wales Neonatal Network

PICU retrieval

Wales maternity services

Peter Oakley Trauma Lead UHNS MTC

Trauma Audit Research Network (TARN)

South Wales Collaborative

Cardiff Neuro-Surgical Unit

Welsh Air Ambulance Charity.

## Appendix C Operational model analysis

### Summary

- Following meetings undertaken by key stakeholders it was decided that an appraisal of 6 options for the operational model would be conducted.
- This includes the do nothing approach, the option presented to the CE's in December 2014 and four further options for consideration.
- An options appraisal has been internally carried out against the benefits and risks criteria developed in the EMRTS workshops. This was validated by the project board.
- The analysis includes an evaluation of data on operational activity and isochrone mapping for each base to determine geographical/population coverage.
- The results presented here are based on the analysis of data as well consultation with multiple stakeholders and as a result of discussions at the project board meeting on 2<sup>nd</sup> June 2014.
- The project board had an opportunity to feedback on the preferred operational model. On the basis of the qualitative review only the clinicians on the project board chose option 4 in terms of operational activity and coverage.
- However the final decision has been based on the economic appraisal undertaken.

### Background

Following meetings of key stakeholders, a decision was made to conduct an options appraisal of the operational model for the EMRTS. The group concluded that six options would be considered: a do nothing approach, the original option presented to the Chief Executives in December 2013 and a further four options recently developed by the clinical leads for the business case. The recent options have subsequently modified following feedback from the project board. It has also been necessary to include the preferred option from version 1 of the operational model presented to Welsh Government in the current analysis.

Following discussions with Welsh Government it is likely that a business programme will be need to developed with sign off of individual business justification cases for each phase through Gateway reviews at appropriate points. This has led to a modification of the options presented here.

The rationale for assessing the operational model further is summarised below:

- The requirement for 24/7 deliverability to support the reconfiguration plans of acute services across South & West Wales (in particular the South Wales Collaborative and Hywel Dda).
- Following evidence collated from existing retrieval services (e.g. Emergency Medical Retrieval Service Scotland) that this service could be delivered with a fewer number of bases.
- After evaluation of data available on demand analysis to develop a more targeted approach to the operational model.
- The opportunity to explore night flying capability (inc. night HEMS) as part of the business case.
- Potential to further reduce revenue costs of the service, whilst maintaining operational capability.

During the development of the initial proposal a phased approach to the introduction of the operational model was adopted. This received strong support from key stakeholders for the following reasons:

- Recruitment – allow the workforce to develop with time.
- To justify the expansion of the service based on the level of activity and outcomes produced.
- To ensure that the service expands at a manageable rate.
- An opportunity to reduce initial revenue costs.

Consequently all models will be considered using a phased approach to service delivery.

This appendix will describe the options with information presented to support the coverage of the operational model and the deliverability of the agreed clinical service model.

The preferred options based on this analysis and extensive consultation with stakeholders will be subject to financial modelling to determine which option offers the best value for money and affordability.

## 1. Available options (timings for phases will be defined in the implementation plan)

**Option 1 – Do nothing**

**Option 2 – Do minimal (new option for consideration)**

<p><b>Phase 1</b></p> <p>Swansea air and road service (operational between 7am-7pm)</p>	<p><b>Phase 2</b></p> <p>Welshpool air and road service (operational between 9am-9pm)</p>
---	---

**Options 2A (new option for consideration agreed by project board 19<sup>th</sup> June 2014)**

<p><b>Phase 1</b></p> <p>Swansea air and road service (operational between 8am-8pm)</p>	<p><b>Phase 2</b></p> <p>Welshpool air and road service (operational between 9am-9pm)</p>
---	---

The above phases will include:

Swansea and Welshpool phases to occur simulataneosly in time

Designated clinical and deputy leads for the Caernarfon base occurring at the same time as part of Welshpool development

After 12months of introduction of phase 1 and 2 a formal Gateway review will be conducted to strongly consider the need for further phased expansion to include the Caernarfon base and 24/7 cover in Swansea

with reference to the investment objectives incl. equity

**Option 3 (new option for consideration)**

<p><b>Phase 1A</b></p> <p>Swansea air and road service (operational between 7am-7pm)</p> <p>Swansea road service (operational between 7pm-7am)</p> <p><b>Phase 1B</b></p> <p>Swansea air and road service (operational between 7am-7pm)</p> <p>Swansea air and road service (operational between 7pm-7am) – night flying capability between hospital landing sites (HLS) only</p> <p><b>Phase 1C</b></p> <p>Swansea air and road service (operational between 7am-7pm)</p> <p>Swansea air and road service (operational between 7pm-7am) – night HEMS capability from non-hospital landing sites</p>	<p><b>Phase 2</b></p> <p>Welshpool air and road service (operational between 9am-9pm)</p>
--	---

**Options 4 (new option for consideration)**

<b>Phase 1</b>	<b>Phase 2</b>
<p>Swansea air and road service (operational between 7am-7pm)</p> <p>Swansea road service (operational between 7pm-7am)</p> <p>Welshpool air and road service (operational between 9am-9pm)</p> <p>Designated clinical lead for Caernarfon, but no additional investment at this stage</p>	<p>This includes a number of enhancements to phase 1 which include:</p> <p>Caernarfon air and road service (operational between 7am-7pm)</p> <p>Swansea air and road service (operational between 7pm-7am) – night flying capability between hospital landing sites (HLS) only</p> <p>Swansea air and road service (operational between 7pm-7am) – night HEMS capability from non-hospital landing sites</p> <p>Establishment of these elements and the order in which they develop will depend upon evaluation of the following factors:</p> <p>Additional demand and clinical benefit The value for money Affordability of the financial model by stakeholders Establishment of workforce in North Wales</p>

**Option 5 – do maximal (original option presented to the Chief Executives in December 2013):**

<b>Phase 1</b>	<b>Phase 2</b>	<b>Phase 3</b>
<p>Swansea air and road service (operational between 7am-7pm)</p> <p>Cwmbran road service (operational between 3pm-3am)</p>	<p>Welshpool air and road service (operational between 9am-9pm)</p>	<p>Caernarfon air and road service (operational between 7am-7pm)</p> <p>The option of expanding the South Wales service to 24/7 by extension of the Swansea service to 24/7 (road only overnight) and Cwmbran to remain 3pm-3am OR move Cwmbran road service to 7pm-7am</p>

For options 4 a designated clinical lead will be established at Caernarfon when introducing the Welshpool service to 'bridge the gap' until a full service is established. The purpose of this will be to ensure equity of access for the North West Wales population, support paramedic development and determine the requirements for expansion based on local population demand. This will also support the alignment of clinical governance arrangements and promote recruitment of medical personal in North West Wales.

The above options are based on the following assumptions:

1. That each base will run a pre-hospital trained critical care doctor (mainly consultant level) AND critical care paramedic (CCP) team for all taskings. The workforce model has already been agreed.
2. Each air base will have a road asset attached to it for either overnight provision (as described) or when the aircraft is not operational or use not appropriate (e.g. local tasking).
3. The central coordination hub will be located in Cwmbran (as described in the initial case). The workforce arrangements for this are under discussion at present.

4. For Options 2 to 5, it will be essential that the establishment of the Swansea and Welshpool services occur closely for the following reasons:
- Provision of an equitable clinical service provision for North and South Wales.
  - Provide cross-cover between air assets during periods of highest activity (see demand analysis).
  - To utilise the workforce being provided by University Hospital of North Staffordshire (Stoke) to establish the Welshpool service.
- If there is any significant delay in the introduction of the Welshpool service, the Swansea service will need to be altered such that the late service in Swansea commences at 3pm, thus providing 2 teams available for simultaneous call during periods of highest activity (i.e. 3pm-7pm). Thus the South Wales service would initially only be available for 20hrs per day, extending to 24hrs per day once Welshpool is established.
5. The suggested timescales for introduction of each phase will be described in the economic case although these will be subject to capital/revenue costs and the availability of workforce.

## 2. Options appraisal against agreed benefits and risks

A benefits and risks workshop was conducted on the 2<sup>nd</sup> April 2014 involving several stakeholders. A list of key benefits and risks is attached below. At a subsequent workshop attendees were asked to rank the benefits criteria.

Both benefits and risk criteria have been weighted below and scored against each option for the operational model inc. a do nothing approach. The weighting for each criteria has been multiplied by each score to arrive at an overall score (in brackets). Totals for each option are then provided.

The weighting and scoring has been conducted internally and it was recommended that this is validated by the project board as agreed at the project board meeting on 2<sup>nd</sup> June 2014, in order for stakeholders to have an opportunity to provide objective feedback.

### 2.1 Benefits scoring and ranking for each option

Key Benefit	Weighting (%)	Option 2	Option 2A	Option 3	Option 4	Option 5
.Reduce health inequality	20	2	2.5	3	4	5
.Improve quality of clinical services	25	3	3.5	4	5	5
.Increased ability to train and educate staff	5	2	2	3	4	4
.Increased ability to undertake clinical research	5	2	2	3	4	3
.Improvement in recruitment and retention	10	2	2.5	3	4	4
.Vertical integration with community & primary care	5	2	2	3	4	5
.Alignment with stakeholder / commissioner priorities	15	2	2	3	4	4
.Technical deliverability	15	3	3	3	2	1
Total Score		<b>18</b>	<b>19.5</b>	<b>25</b>	<b>31</b>	<b>31</b>
Weighted Score		<b>240</b>	<b>267.5</b>	<b>325</b>	<b>395</b>	<b>385</b>
Rank		<b>5</b>	<b>4</b>	<b>3</b>	<b>1</b>	<b>2</b>

Range: 0 – no benefit & 5 – largest benefit

## 2.2 Risks scoring and ranking for each options

Key risks	Weighting (%)	Option 2 (Do Minimum)	Option 2A	Option 3	Option 4	Option 5
Clinical	15	3	2.5	3	1	2
Operational	20	1	1.5	2	2	4
Technological	5	2	2	3	3	4
Financial	20	2	2	3	4	4
Stakeholder	30	2	2	2	3	3
Reputation	5	3	3	3	2	2
Project	5	2	2	2	3	4
<b>Total Score</b>		<b>15</b>	<b>15</b>	<b>18</b>	<b>18</b>	<b>23</b>
<b>Weighted Score</b>		<b>200.0</b>	<b>202.5</b>	<b>245.0</b>	<b>265.0</b>	<b>330.0</b>
<b>Rank</b>		<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>

Range: 0 – no risk & 5 – highest risk

## 2.3 Summary of recommendations

In terms of the options appraisal Options 4 appears to be most favourable as it marginally provides the largest benefit but carries a lower risk than option 5.

## 3. Data analysis to justify a change in the operational model

### 3.1 Coverage by time of the day demonstrating increased periods of activity

#### Pre-hospital care

- Major trauma (WAST dataset, 12mth period from April 2013-April 2014, including incidents coded as RTC and fall from a significant height):

Lowest period of activity (all Wales) – 1am-6am

Peak times of activity (all Wales) – 3pm-6pm

Peak times of activity (South Wales) – 3pm-6pm

Peak times of activity (North Wales) – 12pm-5pm

70% of calls between 7am-7pm

- Major trauma (North Wales, 12mth transfer data to UHNS Major Trauma Centre):  
30 transfers from North Wales to UHNS between 12am-8am last year.

- Cardiac arrest (WAST dataset, 12mth period from April 2013-April 2014, including incidents coded as cardiac arrest and age <60yrs):

Lowest period of activity (all Wales) – 12am-6am

Constant levels of activity seen from 6am-12am

60% of calls between 7am-7pm

- Peaks of activity are similar across all Health Boards

#### Time critical adult retrieval (two sources of data)

- ED critical care transfers (Critical care network dataset on ambulance requests, 5yr period, data for timings only available for 36% of cases):

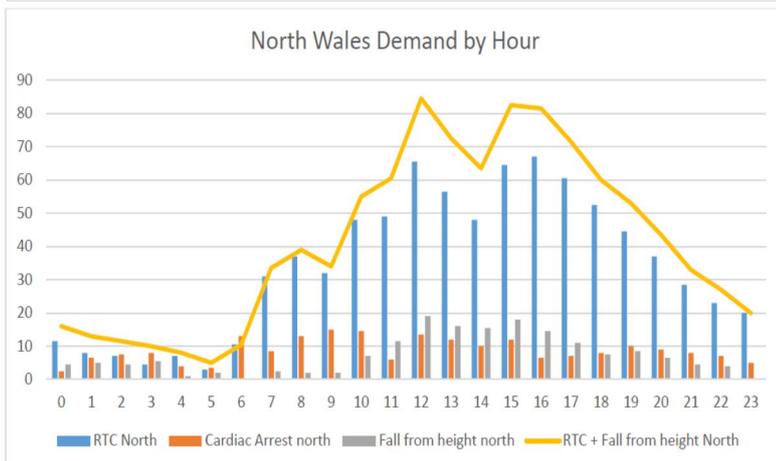
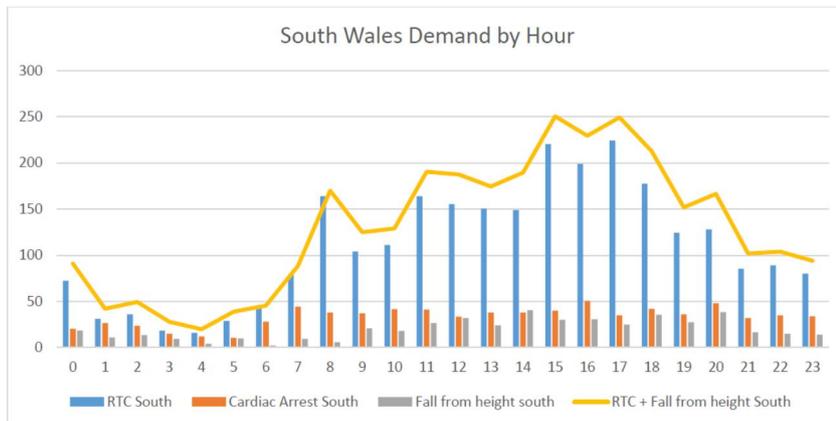
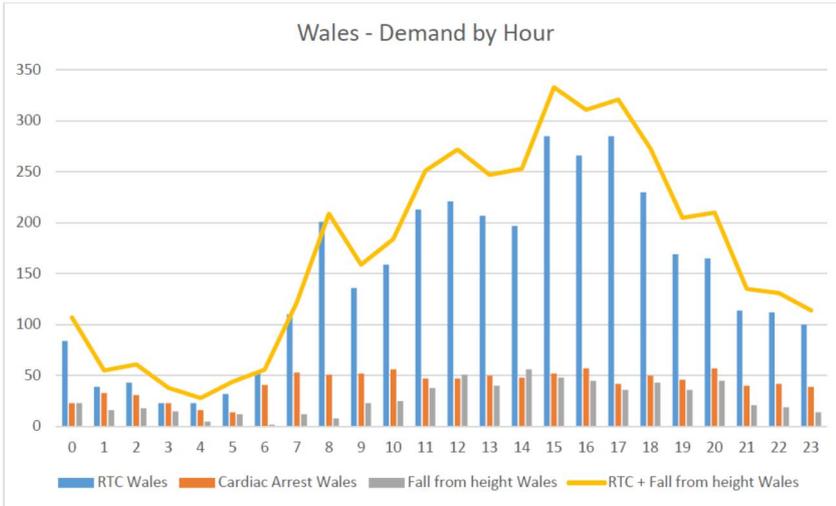
Peak time of activity (all Wales) – 9pm

- ED critical care transfers (WAST dataset, 12mth period, category A transfer requests):

Peak times of activity (all Wales) – 12pm-9pm

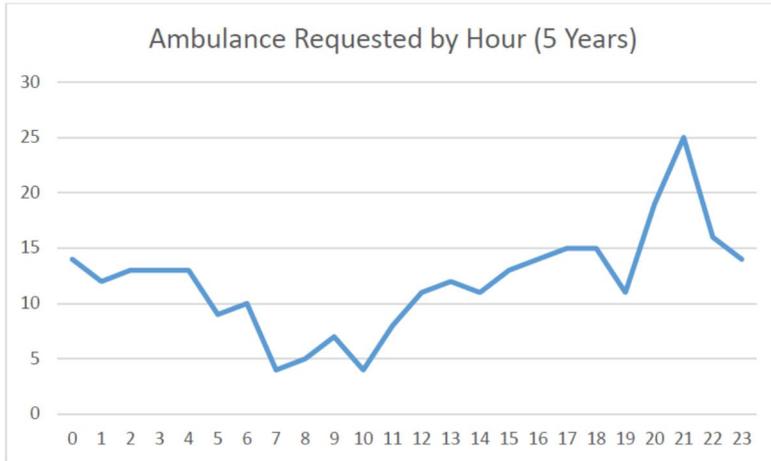
- From both sources of data, the lowest period of activity appears to be between 12am-6am.

**Demand by time of the day for pre-hospital activity (WAST dataset)**

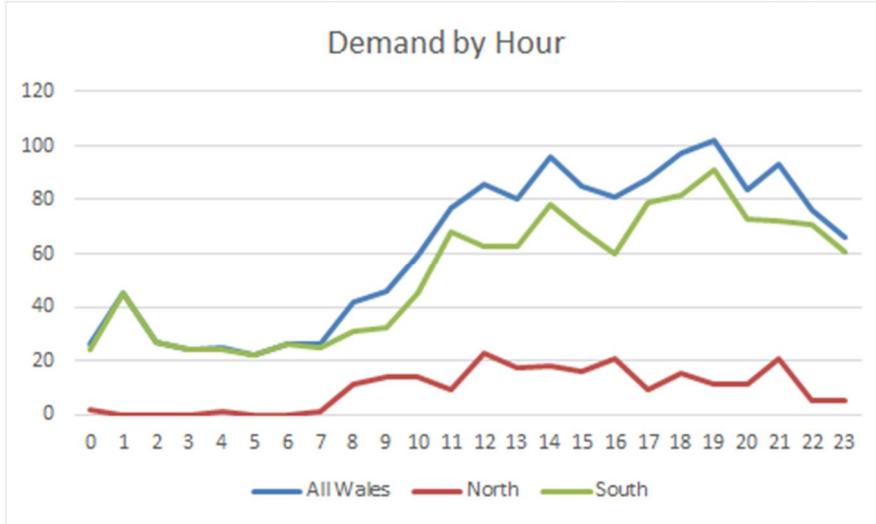


**Critical care transfers for Emergency Departments (critical care network dataset)**

Limited data for times requested available, so data based on 288 records (36%)



**ED critical care transfers (WAST dataset, 12mth period, category A transfer requests)**



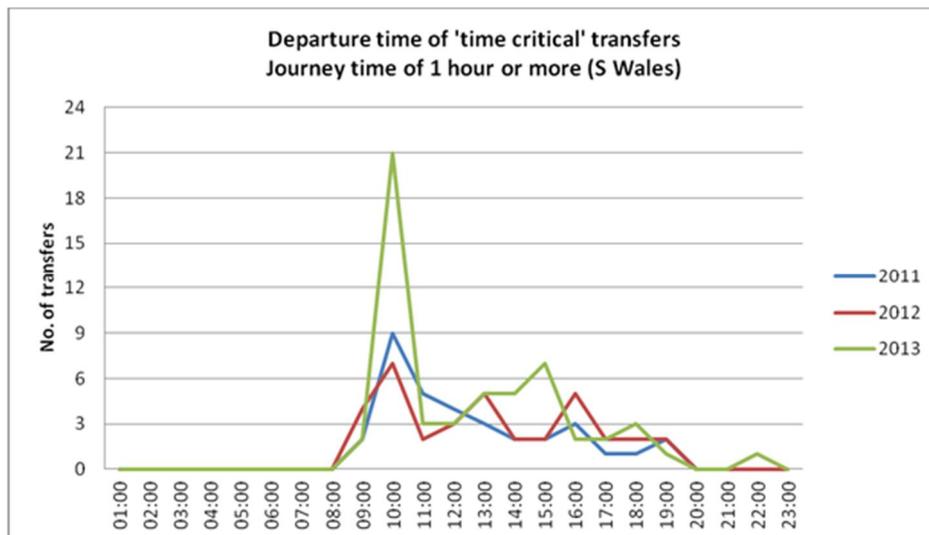
**Current annual transfers to UHNS (Major Trauma Centre) from North Wales From BCUHB**

Arriving 0800hrs-1800hrs 35; 1800hrs-0000hrs 51; 0000hrs-0800hrs 30  
 ISS > 15 85; ISS 9-15 20; ISS <9 11

**From WAST directly**

Arriving 0800hrs-1800hrs 11; 1800hrs-0000hrs 3; 0000hrs-0800hrs 0  
 ISS > 15 11; ISS 9-15 3; ISS <9 0

**Potential operational demand on the EMRTS to convey CHANTS (Cymru Inter Hospital Acute Neonatal Transport Service) to time critical taskings where referring hospital greater than 1hr by road**



There are several conclusions that can be drawn from this to support the updated operational model:

1. Peak activity is between 3pm-6pm for pre-hospital taskings and 12pm-9pm for adult retrieval. Peak demand in requirement to transfer CHANTS to referring hospital is 10am. This supports the operational hours of the service and strongly reinforces the introduction of Swansea base in parallel with the Welshpool base for options 2 to 5. This will provide the depth of resilience for simultaneous calls (cross-cover) and supports the clinical service model that has been developed. This also supports the view that retrieval taskings are considerably longer than pre-hospital taskings (key performance indicator for time on scene for pre-hospital taskings – 30mins & at hospital for retrieval – 60mins).
2. Current evidence suggests that there is no requirement for an overnight service in North Wales. This is based on demand analysis and projected availability of workforce.
3. The introduction of a Caernarfon base (as part of options 4 and 5) will also support the hyperacute transfers occurring from Bangor (second highest number in Wales) as defined by the EMRTS clinical service model for North Wales.

### 3.2 Coverage by response times from bases

The data attached outlines the isochrones for air and road response from current and potential bases across Wales.

Air isochrones - utilising Google Earth Pro including an activation time of 6mins and cruise speed 158mph (137kn).

Road isochrones - utilising Microsoft Map Point, using normal speed drive time zones at speed limit (automatic function of the software), increased by 50% to account for higher speed (e.g. for night driving, no traffic, good weather conditions and as such represents a maximum).

There are a number of conclusions that can be drawn from this to support the updated operational model:

1. The majority of Wales can be covered within 30mins by air (inc. 6mins activation time) from Swansea and Welshpool bases. There is an overlap between these two bases providing resilience for cross covering simultaneous calls. This emphasises the importance of the early introduction of the Welshpool base (see Figures 12 and 14).
2. From the Swansea base, all of South Wales is covered within a 30min by air. This will provide additional support for taskings in Hywel Dda and Powys once overnight coverage is provided by the Swansea base as part of option 3 and 4.

3. Although excellent coverage can be provided by utilising the Swansea and Welshpool bases only, weather and geographical factors will frequently restrict access to North West Wales from Welshpool. This will limit the isochrone modelling for Welshpool. As such Caernarfon has been included as part of the phasing for options 4 and 5.
4. A significant part of North Wales can also be covered within 45mins by air from Swansea thus providing additional resilience once the phasing of option 3 and 4 is fully realised.
5. In South Wales, forward location of the road asset at Morrision Hospital provides the greatest coverage (of both urban and rural populations) compared to Cwmbran, Bridgend or Cardiff. This optimal location offers the best opportunity to rendezvous with paramedic crews on the periphery of the isochrones within an acceptable time frame (model of interception). This will be particularly beneficial when responding to taskings in Hywel Dda and Powys.

Options 2, 3 and 4 do not include a road service in Cwmbran. In the development of the EMRTS the establishment of a single South Wales base would be preferable in terms of control of governance, logistics and cost. However in the event of the aircraft not being available or overnight (for options 3 and 4), coverage of SE Wales could be provided by the following:

*Forward location of the car on the M4 corridor.*

Interception with Welsh Ambulance Service crews through rendezvous points.

Cross-cover by Welshpool during operational hours.

6. There is reasonable coverage (using the 30min isochrones) by road from Welshpool, allowing timely access to taskings within Powys.

### 3.3 Overall summary of data analysis

The conclusions derived from the data provided by WAST, critical care network and UHNS (Stoke) point towards option 4 being the favoured operational model based on activity level and geographical coverage. In particular it supports the parallel implementation of the Swansea and Welshpool bases.

### 3.4 Road and air Isochrones for bases

#### Road Travel, emergency driving 20 & 30 Minutes

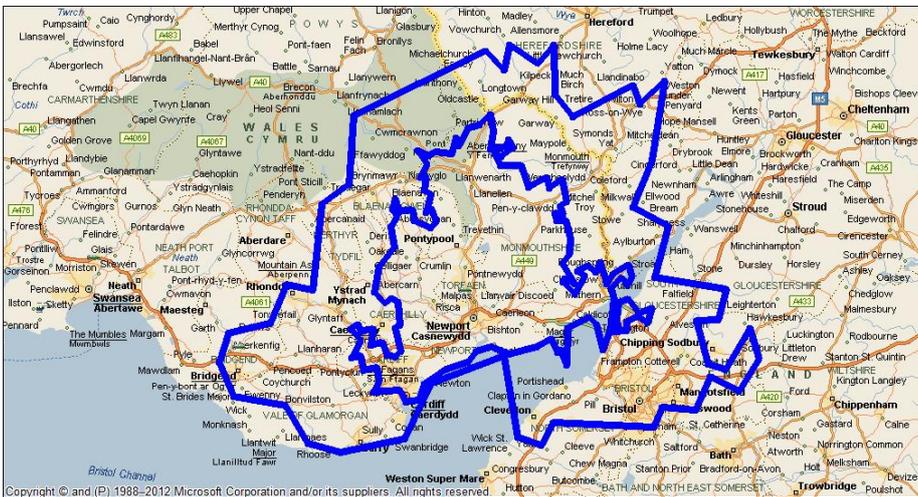


Swansea Airport

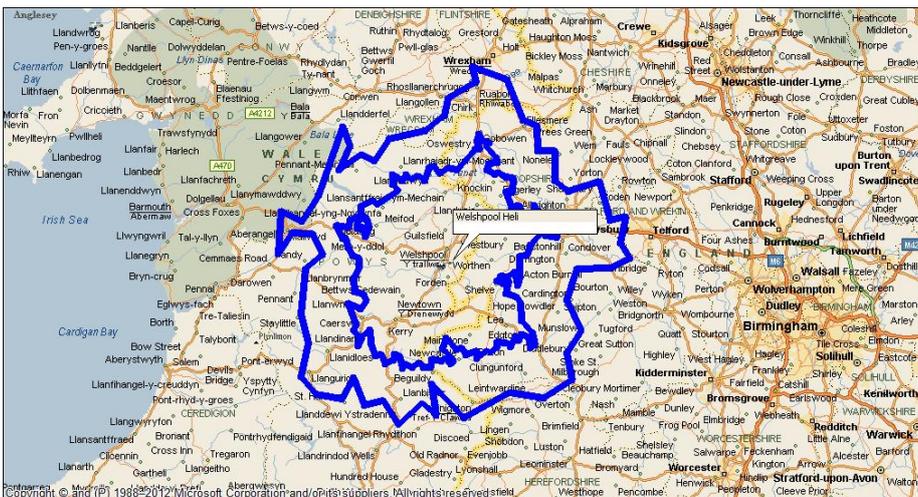


Copyright © and (P) 1988-2012 Microsoft Corporation and/or its suppliers. All rights reserved.

Morrison Hospital (forward location of the Swansea car)



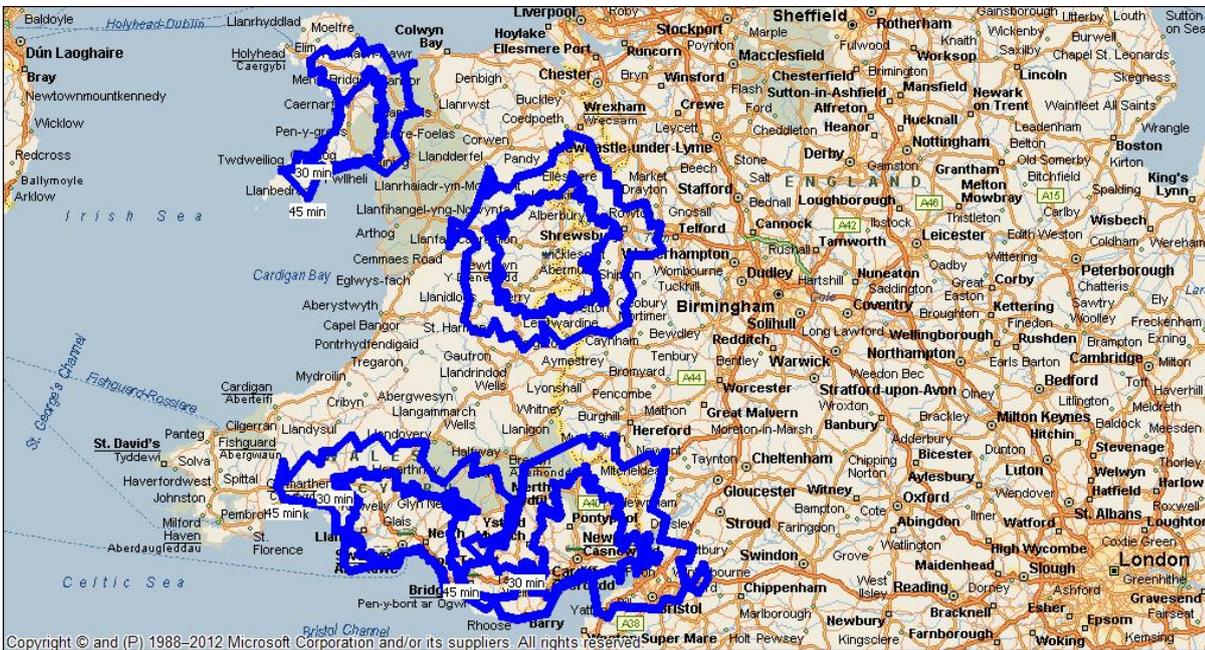
Cwmbran



Welshpool Airport

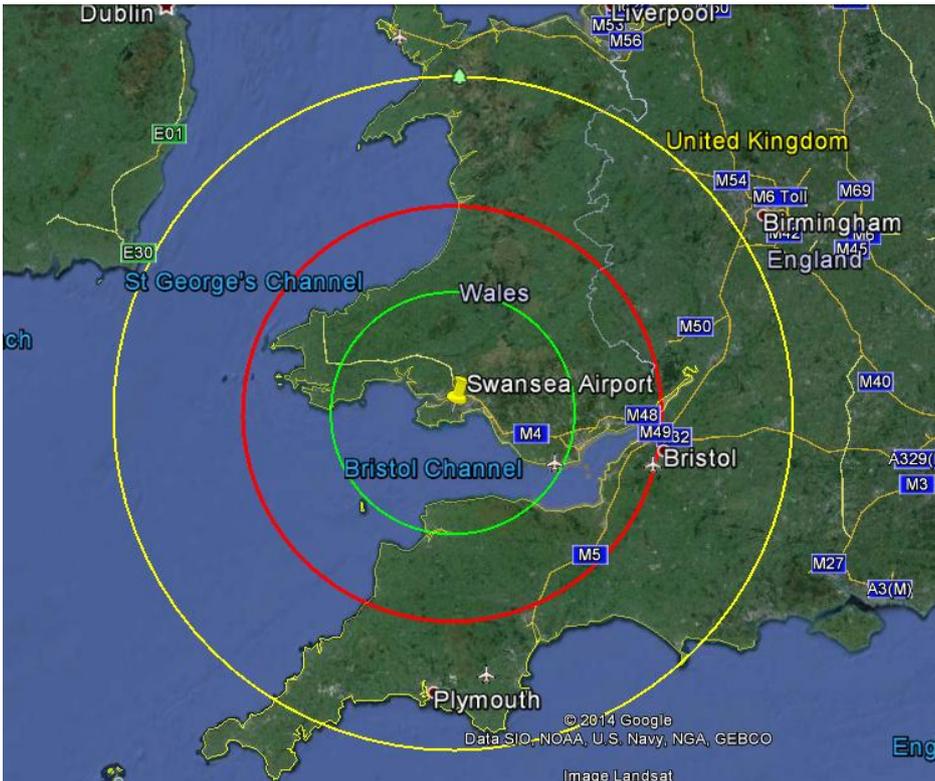


Caernarfon Airport

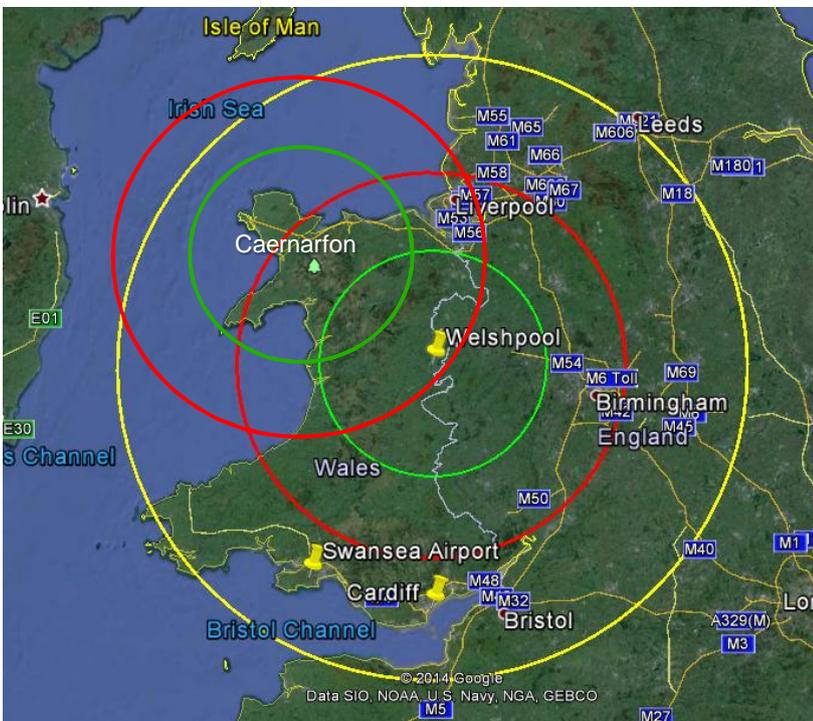


Overview including Caernarfon airport, Welshpool airport, Morrision Hospital and Cwmbran

**Air Travel**



1, 20, 30 and 45 minute from call flight distance from Swansea base



20, 30, 45 Minute from call Flight Distance from Welshpool base  
20 & 30 Minute from call Flight Distance from Caernarfon base

**4. Table to illustrate timings, geographical coverage and population coverage of clinical service model for each option**

**Option 2 and Option 2A (new option for consideration)**

	<b>Total operational hours (air and road)</b>	<b>Approx. % geographical coverage of Wales (30mins by air, 30mins by road)</b>	<b>Approx. % population coverage of Wales (30mins by air, 30mins by road)</b>
<b>Phase 1</b>	12hrs in South Wales	Air – 50% Road – 15%	Air – 69% Road – 42%
<b>Phase 2</b>	12hrs in South and North Wales	Air (Swansea and Welshpool) – 98% (12hrs) Road (Swansea and Welshpool) – 35%	Air (Swansea and Welshpool) – 95% (12hrs) Road (Swansea and Welshpool) – 46%

**NOTE: For Swansea road cover assume forward response from Morriston Hospital**

**Option 3 (new option for consideration)**

	<b>Total operational hours (air and road)</b>	<b>Approx. % geographical coverage of Wales (30mins by air, 30mins by road)</b>	<b>Approx. % population coverage of Wales (30mins by air, 30mins by road)</b>
<b>Phase 1A</b>	24hrs in South Wales	Air – 50% (12hrs) Road – 15%	Air – 69% (12hrs) Road – 42%
<b>Phase 1B</b>	24hrs in South Wales	Air – 50% (24hrs) Road – 15%	Air – 69% (24hrs) Road – 42%
<b>Phase 1C</b>	24hrs in South Wales	Air – 50% (24hrs) Road – 15%	Air – 69% (24hrs) Road – 42%
<b>Phase 2A</b>	24hrs in South Wales  12hrs in North Wales	Air (Swansea and Welshpool) -98% Road (Swansea and Welshpool) – 35%	Air (Swansea and Welshpool) – 95% Road (Swansea and Welshpool) 46%

**Option 4 – (new option for consideration)**

	<b>Total operational hours (air and road)</b>	<b>Approx. % geographical coverage of Wales (30mins by air, 30mins by road)</b>	<b>Approx. % population coverage of Wales (30mins by air, 30mins by road)</b>
<b>Phase 1</b>	24hrs in South Wales 12hrs in North Wales	Air – 98% (12hrs) Road – 35% (12hrs) and 15% (24hrs)	Air - 95% (12hrs) Road – 46% (12hrs) and 42% (24hrs)
<b>Phase 2</b>	24hrs in South Wales 12hrs in Welshpool & Caernarfon	Air (Swansea, Welshpool and Caernarfon) – 100% (12hrs) Air (Swansea) – 50% (24hrs) Road (Swansea, Welshpool, and Caernarfon) – 55%	Air (Swansea, Welshpool and Caernarfon) – 100% (12hrs) Air (Swansea) – 69% (24hrs) Road (Swansea, Welshpool, and Caernarfon) – 60%

**NOTE: For Swansea road cover assume forward response from Morriston Hospital**

**Option 5 – original option presented to the Chief Executives in December 2013:**

	<b>Total operational hours (air and road)</b>	<b>Approx. % geographical coverage of Wales (30mins by air, 30mins by road)</b>	<b>Approx. % population coverage of Wales (30mins by air, 30mins by road)</b>
<b>Phase 1</b>	20hrs in South Wales	Air – 50% Road (Swansea and Cwmbran) – 30%	Air – 69% Road (Swansea and Cwmbran) – 55%
<b>Phase 2</b>	20hrs in South Wales 12hrs in North Wales	Air (Swansea and Welshpool) – 98% Road (Swansea, Cwmbran and Welshpool) – 55%	Air (Swansea and Welshpool) – 95% Road (Swansea, Cwmbran and Welshpool) – 59%
<b>Phase 3</b>	Potentially 24hrs in South Wales 12hrs in North Wales	Air (Swansea, Welshpool and Caernarfon) – 100% Road (Swansea, Welshpool, Cwmbran and Caernarfon) – 70%	Air (Swansea, Welshpool and Caernarfon) – 100% Road (Swansea, Welshpool, Cwmbran and Caernarfon) – 67%

**NOTE: For Swansea road cover assume forward response from Morriston Hospital**

The above data on coverage for the options described is based on estimates using information provided from public health Wales for population modelling and square mile estimations for the geographical coverage.

The data is limited by the fact that population does not necessarily parallel demand (e.g. wide distribution of major trauma across rural and urban Wales).

### 5.1 Summary of recommendations

Based on the coverage of Wales by geography and population it can be recommended that option 4 is the favoured operational model. This will not be subject to financial assessment.

- 3 bases (Swansea, Welshpool and Caernarfon) – cover 100% of the population of Wales within 30mins by air.
- For South Wales the provision of an overnight road service will cover 42% of the population inc. part of Hywel Dda.
- For South Wales moving from phase 1 to 2 provides cover of 69% of the population of Wales on a 24hr basis by air.
- Although the addition of Caernarfon only increases coverage of population by 5% accessibility of North West Wales can be limited by geography and bad weather. There is also fluctuations in population due to tourist activity. This may help justify the later phasing of the Caernarfon base.

### Data sources

Welsh Ambulance Service dataset  
 Welsh Critical Care Network  
 Wales Neonatal Network  
 Peter Oakley Trauma Lead UHNS MTC  
 David Rawlinson – ABMU

## Appendix D Clinical flows

### D1 – Summary of clinical flows analysis

The Project Board has been asked to identify the major changes in clinical flows between Health Boards as a direct impact of the introduction of the EMRTS. This is necessary in order to quantify any changes in the commissioning arrangements which may result. This has been done following consultation with colleagues from the South Wales Collaborative, Critical Care Network (Sue O’Keeffe), Welsh Ambulance Service, Trauma Audit Research Network (TARN) and Dr Peter Oakley (Project Board member and Clinical Lead for Major Trauma, University Hospital North Staffordshire, UHNS).

In order to evaluate these flows a number of high level assumptions have been made:

1. Any clinical flows outside the impact of the EMRTS have not been quantified inc. any additional flows related to the establishment of the South Wales and Powys Trauma Network.
2. The major change in flow is due to the pre-hospital response thereby taking the patients directly to the most appropriate centre and avoiding a secondary transfer later. The major changes to flow are in relation to major trauma which includes head injured patients. Many of these flows have already started (e.g. Wales Air Ambulances already conveying patients to the appropriate centre).
3. Although the clinical flow pathways will apply to the vast majority of cases, individual decision making will lie with the treating clinician and ‘top cover’ consultant.
4. Data has been collected using population based estimates and actual data sources. Details of the assumptions made here are given in the following accompanying documents:
  - ▶ Detail of clinical flows for the EMRTS – Appendix D2
  - ▶ South Wales Collaborative Clinical Flows for Trauma – Appendix D3
 These assumptions must be read in conjunction with the summaries provided. They have been discussed with a wide range of stakeholders involved in this process to cross check for validity.
5. In South Wales the clinical flows will be aligned with the South Wales and Powys Trauma Network once this is established.

South Wales (annual data) – figures formatted to the nearest whole number

- Major trauma (Injury Severity Score >15) – 50% predicted to be severe head injuries.

Breakdown of flows for UHW and Morriston Hospital – major trauma

	UHW	Morriston Hospital
Population based modelling	242	106
Current activity (TARN) Average 2009-2013	194	118
Predicted increase or decrease in UHW and Morriston Hospital	+48	-13

**Breakdown by HB (using current TARN data transfers in as a proxy) – major trauma**

	To UHW	From Morriston Hospital
ABMU	-6	5
Aneurin Bevan	-17	1
Cardiff & Vale		
Cwm Taf	-16	1
Hywel Dda	-9	6
Total modelled impact on UHW and Morriston Hospital	-48	+13

- Moderate trauma (Injury Severity Score 9-15) – 35% predicted to be moderate head injuries

Breakdown of flows for UHW and Morriston Hospital – moderate trauma

	UHW	Morriston Hospital
Population based modelling	164	106
Current activity (TARN) Average 2009-2013	149	180
Predicted increase or decrease in UHW and Morriston Hospital	16	-74

Breakdown by HB (using Royal Glam Hospital and current TARN data transfers out as a proxy) – moderate trauma

	To UHW	From Morriston
ABMU	12	31
Aneurin Bevan	0	4
Cardiff & Vale		
Cwm Taf	-28	6
Hywel Dda	0	34
Total modelled impact on UHW and Morriston Hospital	-16	+74

- Summary of expected Health Board impact of major and moderate trauma flows

	ISS 9-15 (moderate trauma)	ISS >15 (major trauma)	Total ISS >9
ABMU	-31	-14	-45
Aneurin Bevan	4	-17	-13
Cardiff & Vale	16	48	64
Cwm Taf	-22	-15	-37
Hywel Dda	34	-3	31

- For complex trauma (e.g. open fractures) - no change in flow until SW and Powys Trauma Network agreement.
- Single system trauma patients – no change in flow as no indication for direct transfer to MTC unless over triaged.
- Spinal cord injury with paralysis – transferred directly to UHW but included in the major trauma section.
- Major Burns – transferred directly to Morriston Hospital so no major change in clinical flow.
- Non-traumatic brain injuries – transferred direct to UHW on a selective basis. This required further discussion with neurosciences at UHW. Please see detail for approach to this group.
- Myocardial Infarction – no change in flow.
- Out of hospital cardiac arrests with return of spontaneous circulation and suspected cardiac cause – based on data from WAST source but difficult to quantify current drift

	To UHW	To Morriston
ABUHB	-24	0
CTUHB	-16	0
ABMU (Morriston Hospital)	0	15
ABMU HB (POW)	-8	0
HDUHB	0	-18
PtHB	-2	-2
C&V UHB	26	0
Total additional impact on cardiac centre	50	20

- Strokes, neonates and maternity – no change in flow.
- Paediatrics as outlined above.

North Wales (annual data) - figures formatted to the nearest whole number

- Patients identified at the scene as major trauma

Currently no patients transferred directly to UHNS.

Under the EMRTS 120 patients will be transferred to UHNS directly from scene (60 major, 50 moderate and 10 minor once differentiated). From this data over triage and 'same day' repatriation will be minimal.

Of these 20 more major cases and 40 more moderate cases will be treated in UHNS compared to current numbers.

Approx 50% of the major trauma patients will have a severe head injury. Approx 35% of moderate trauma patients will have a moderate head injury.

Three changes:

- ▶ Commissioning arrangements for direct transfer as opposed to secondary transfer will need to be agreed between BCUHB and UHNS.
  - ▶ Small increase in total major trauma cases directly transferred to UHNS as most are already being transferred. These will need to be commissioned.
  - ▶ Savings for BCUHB in secondary transfers and local ED admissions.
- 
- For complex trauma (e.g. open fractures), single system injuries and spinal injury with paralysis – no change in clinical flow.
  - Major Burns - no change in clinical flow at present for the EMRTS (BCUHB will need to commission direct burns transfers to Whiston and Alderhey Hospital).
  - Non- traumatic brain injuries – no change in clinical flow at present for the EMRTS (BCUHB will need to commission direct transfers to the Walton Centre).
  - Strokes, paediatrics, neonates and maternity – no change in flow.
  - Myocardial infarction – no change in flow (although will be taken direct to YGC once open for primary PCI).

Out of hospital cardiac arrest – 28 patients to YGH directly with return of spontaneous circulation only (once YGC open for primary PCI).

## D2 – Details of clinical flows for the EMRTS

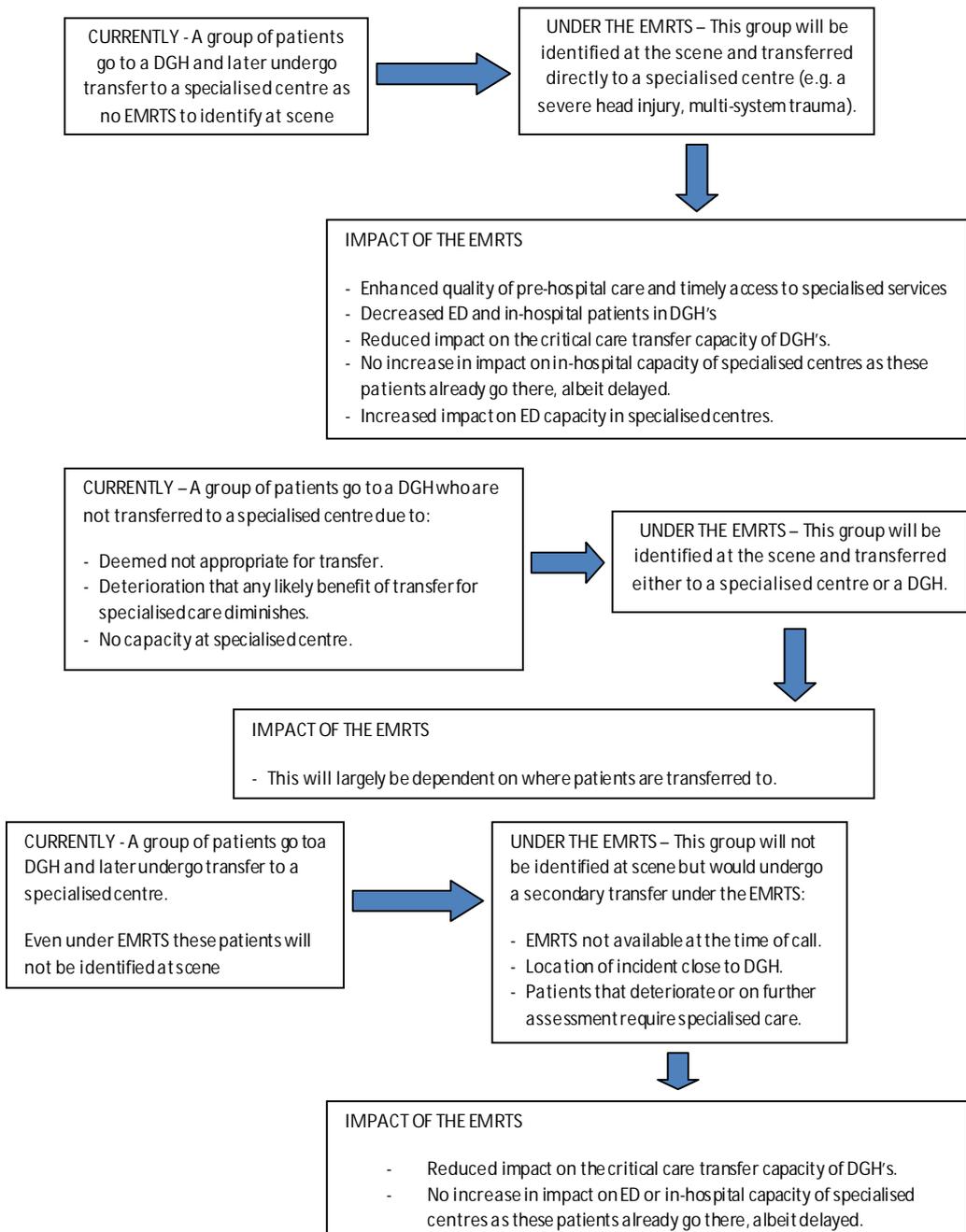
### Background and Assumptions

As part of the engagement process with Health Boards, the project board have been asked to provide a description of the clinical flows that are likely to be implemented as part of the introduction of the EMRTS. In addition information is provided to quantify the following:

1. For net-exporting Health Boards, the reduction in patient number by type.
2. For net-importing Health Boards, the increase in patient numbers by type.

Before proceeding it is essential that the following points are considered:

#### 1. Effect of clinical flows:



1. Therefore quantification will be concerned with additionality (i.e. determine the net deficit or gain of patients over and above what is currently occurring). Where clinical flows are unlikely to change (due to established processes) this is clearly stated and not quantified.
2. The EMRTS will transfer patients to the most appropriate centre. This does not necessarily mean that all patients will be taken to a specialised centre. The presence of senior treating clinicians will ensure that over triage to specialised centres is minimal and patients are transferred to their local DGH where appropriate.
3. Many of these clinical flows are already occurring via the existing arrangements with the Wales Air Ambulances and Pre-Hospital Emergency Medicine trainees.
4. The project board acknowledges the requirement to repatriate patients within a defined time period from a specialised centre to their local hospital. In the interim the introduction of a 'skeleton' service as part of the implementation plan will have limited impact on capacity whilst systems develop to support a more comprehensive service (e.g. the South Wales & Powys Trauma Network).
5. Although the clinical flow pathways will apply to the vast majority of cases, individual decision making will lie with the treating clinician (in some cases supported by a 'top cover' consultant). This approach has been shown to be more sensitive than rigid pre-hospital triage tools. Clearly decision making on the disposition of patients in the pre-hospital environment is challenging and complex, often being dependent on multiple factors (e.g. co-morbidity, logistics of transfer, weather etc). Therefore the following clinical flow pathways are only stated as a guide.
6. Existing data on the transfer of critically ill and injured patients is limited and as such some high level assumptions are made when quantifying the clinical flows under the EMRTS. Only two Health Boards in South Wales currently contribute to the Trauma Audit & Research Network (TARN). Therefore the quantification provided is for indicative purposes only. These will be tested against receiving hospitals to check for accuracy.
7. The flow of trauma patients will be decided by the development of the South Wales and Powys Trauma Network. Once established the EMRTS will support the agreed pre-hospital triage tool that is developed inc. which patients are appropriate for major trauma centres and trauma units.

#### Clinical flows – South Wales

The following assumptions are solely applicable to the major/moderate trauma workload as it is in these areas that clinical flows are likely to change the most. These have been used for the population modelling analysis:

- Resident and visitor population has been considered.
- Incidence of major trauma is 185 per million per year.
- Additionally incidence of moderate trauma is 185 per million per year.
- 15% of major trauma will not be 'suspectable' (e.g. elderly collapse or fall).
- Only 50% of 'suspectable' major trauma cases will be reachable by EMRTS (due to time of the day, close to trauma units, competing taskings, low mechanisms of injury).
- Approx. 67% of major trauma cases taken to a trauma unit (TU) will undergo secondary transfer to the major trauma centre (MTC).
- 15% of moderate trauma cases taken to a TU will undergo secondary transfer to the MTC).

Table showing clinical flows against clinical condition

Clinical condition	Referring hospital	Receiving hospital
Patients identified as major/moderate trauma at scene (inc. head injuries)	See clinical flow modelling in South Wales Collaborative document	See clinical flow modelling in South Wales Collaborative document
Complex trauma (open fractures and isolated pelvic injuries)	No change in flow until South Wales and Powys Trauma Network agreement	No change in flow until South Wales and Powys Trauma Network agreement
Single system trauma patients non-life threatening	No change in flow as no indication for direct transfer to MTC	No change in flow as no indication for direct transfer to MTC
Spinal injury with paralysis	Taken to UHW but included in major trauma flow analysis	Taken to UHW but included in major trauma flow analysis
Major burns	Major burns to be transferred directly to Morriston Hospital unless instructed by Burns Centre to convey elsewhere due to capacity issues. Paediatric major burns to Bristol Children Hospital.  No major change in flows.	No major change in flows.
Myocardial Infarction	No change in flow	No change in flow
Out of hospital cardiac arrests with return of spontaneous circulation and suspected cardiac cause	To UHW: ABUHB - 24 ABMUHB - 8 CTUHB - 16 HDUHB 0 PtHB - 2 (26 direct to UHW from C&V)  To Morriston HDUHB - 18 PtHB - 2 (15 direct to Morriston Hospital from ABMU)	76 direct to UHW (inc. 26 from C&V HB) – 50 additional patients from outside C&V  35 direct to Morriston Hospital (inc. 15 from ABMU HB) – 20 additional patients from outside Morriston Hospital  Therefore likely to minimal change in flows, no data presently available on current activity as unclear what drift is already occurring between HB's but likely to minimal at present
Non-traumatic brain injury (low GCS/requiring intubation)	No change in flow yet but will need further discussion as highlighted below	No change in flow yet but will need further discussion as highlighted below
Stroke	No change in flows	No change in flows
Neonates	No change in flows	Taken to nearest NICU (Singleton, UHW and RGH) or SCBU's or LU's. Most will be moved to a NICU. No change in clinical flow. Each case

		(attended at home or midwifery led unit) will be discussed with neonatal intensivist on call and decision on movement based on clinical condition and cot capacity
Paediatrics	Incorporated in the above	Incorporated in the above
Maternity	No change in flows	No change in flows

#### Notes on South Wales flows

Myocardial Infarction (for PCI) – no change in clinical flows as patients will be transferred to UHW, Morriston Hospital or Worcester. There are already agreed pathways in place by the Welsh Ambulance Service and Wales Cardiac Network for this.

Out of hospital cardiac arrest with return of spontaneous circulation (ROSC) where suspected cause non-cardiac – no change in clinical flow as patients will be transferred to nearest acute hospital with an intensive care unit.

Cardiac arrests with ROSC where suspected cause is cardiac - patients will be taken directly to UHW or Morriston Hospital. Again senior decision making will ensure over triage is minimised.

Data below has been provided by Welsh Ambulance Service and is based on patients under 60yrs coded as cardiac arrest over a 12mth period. Data on over 60yrs was not easy to delineate. This does not indicate that the EMRTS will exclude >60yrs, therefore the modelling may need up scaling later.

It is assumed that the EMRTS will achieve a ROSC in approximately 30% of cases and that 90% of cases will be suspected to be cardiac in origin pre-hospital. Like major trauma it is likely that only 50% will be reachable by EMRTS due to the factors given above. These assumptions are not robust but are necessary due to the lack of data to support more accurate assumptions. They have been discussed with clinicians on the project board. A similar clinical flow to major trauma has been used here.

It is unlikely that EMRTS will transfer many patients to hospital in established cardiac arrest. Most cases will only be conveyed if ROSC is established.

Estimated annual numbers	ABUH B	ABMU HB	C&VU HB	CTU HB	HDU HB	PtHB	Total Wales	S.
Total number of cardiac arrests in under 60yrs	179	176	195	116	119	30	815	
Total number reachable by EMRTS (50%)	90	88	98	58	65	15	414	
Total number achieving ROSC and suspected cardiac in origin	24	23	26	16	18	4	111	
Expected direct disposition to UHW or Morriston Hospital of cardiac arrests with ROSC suspected to be cardiac in origin								
UHW	24	8	26	16		2	76	
Morriston Hospital		15			18	2	35	

### Non-traumatic brain injury

This includes the following patients groups:

- GCS of 8 or less AND/OR a motor score of 4 or less AND/OR
- Requiring intubation at scene
- Clinical discretion of the treating clinician

These patients should be transferred from scene directly to UHW. All other patients will be taken to the nearest acute hospital. Clearly senior clinical decision making will ensure that only patients that are likely to benefit from neurosurgery or neuro-critical care will be transferred directly to UHW. This will also be based on an assessment of clinical status (e.g. co morbidity).

This includes adults, paediatrics and neonates.

This flow is difficult to quantify. Patients who are already transferred to UHW by secondary transfer will not impact on capacity. Which additional patients will be transferred to UHW directly by the EMRTS that are not currently transferred is unclear at the present time. The project board will seek advice from Neurosciences at UHW for advice on this matter. A process of CT imaging at the nearest acute hospital followed by a 'hyper acute' transfer (if agreed) may be appropriate in selected cases AND/OR direct discussion with neurosurgical registrar directly from scene.

Data sources and analysis:

South Wales Collaborative – see Appendix D3

Peter Oakley – Clinical Lead for Major Trauma, UHNS

WAST dataset

Clinical flows – North Wales

The following assumptions are solely applicable to the major/moderate trauma workload as it is in these areas that clinical flows are likely to change the most. These have been used for the population modelling analysis:

- Resident population 700,000 and visitor population 100,000-130,000.
- Incidence of major trauma is 185 per million per year.
- Additionally incidence of moderate trauma is 185 per million per year.
- 15% of major trauma will not be 'suspectable' (e.g. elderly collapse or fall).
- Only 50% of 'suspectable' major trauma cases will be reachable by EMRTS (due to time of the day, close to trauma units, competing taskings, low mechanisms of injury).
- Approx. 67% of major trauma cases taken to a trauma unit (TU) will undergo secondary transfer to the major trauma centre (MTC).
- 15% of moderate trauma cases taken to a TU will undergo secondary transfer to the MTC).

Table showing clinical flows against clinical condition

Clinical condition	Referring hospital	Receiving hospital
Patients identified as major trauma at scene (inc. severe head injuries)	Population modelling: 120 patients not being brought TU Trauma unit experience of	Population modelling: 120 patients direct transfers to UHNS (60 major, 50 moderate, 10 minor) Approx 30 secondary major

	<p>receiving major trauma will fall by 45 (40%).</p> <p>The need for secondary transfers will fall by 40/35%</p> <p>Currently no patients undergoing direct transfer from BCUHB to UHNS</p>	<p>trauma transfers to UHNS by EMRTS on top of that</p> <p>Existing TARN and Critical Care Network data (1year) for comparative purposes:</p> <p>Currently 113 patients who have undergone secondary transfers to UHNS (72% major trauma, 28% moderate trauma)</p> <p>Commissioning arrangements will need change in order to facilitate transfer of 120 patients per year direct from scene. Of these there will be an increase of 20 and 40 cases of major and moderate trauma respectively transferred to UHNS by the EMRTS.</p> <p>BCUHB to UHNS (currently 113 per year by secondary transfer).</p>
Complex trauma (open fractures and isolated pelvic injuries)	No change in flow (EMRTS available for hyper-acute transfers)	No change in flow (EMRTS available for hyper-acute transfers)
Single system trauma patients non-life threatening	No change in flow as no indication for direct transfer to MTC unless over triaged as covered above	No change in flow as no indication for direct transfer to MTC unless over triaged as covered above
Spinal injury with paralysis	No change in flow unless under the category of major trauma and EMRTS available for hyper-acute transfers)	No change in flow unless under the category of major trauma and EMRTS available for hyper-acute transfers)
Major burns	No change in flow at present	No change in flow at present (BCUHB will need to commission direct burns transfers to Whiston and Alderhey Hospital)
Myocardial Infarction	No change in flow	No change in flow PCI opening June 2014 at YGH, therefore will be commissioned for confirmed Myocardial Infarction
Out of hospital cardiac arrests	Estimated 9 from North West Wales, 9 from YGH area and 9 from North East Wales	Under EMRTS approx 28 per year to YGH based on data from WAST and modelling done in South Wales (baseline unknown at time of writing as service not established yet)

Non-traumatic brain injury (low GCS/requiring intubation)	No change in flow yet	No change in flow yet (BCUHB will need to commission direct transfers to the Walton Centre)
Stroke	No change in flows	No change in flows
Neonates	No change in flows	No change in flows (Neonatal data requested to check number going to direct from scene to neonatal unit)
Paediatrics	No change in flows	No change in flows (Paediatric data requested to check number going to direct from scene to Alderhey)
Maternity	No change in flows	No change in flows

## Clinical flow pathways for EMRTS – Pre-hospital care (North Wales)

Sue O’Keefe – North Wales Critical Care Network Manager

Although the clinical flow pathways will apply to the vast majority of cases, individual decision making will lie with the treating clinician (in some case supported by a ‘top cover’ consultant). Clearly decision making on the disposition of patients in the pre-hospital environment is challenging and complex, often being dependent on multiple factors (e.g. co-morbidity, logistics of transfer, weather etc). Therefore the following clinical flow pathways are only stated here as a guide.

NOTE: Since October 2012 North Wales has been part of the North West Midlands and North Wales Trauma Network. Betsi Cadwaladr University Health Board (BCUHB) has therefore commissioned the University Hospital North Staffordshire (UHNS) for treatment of their major trauma patients.

### Trauma

1. Isolated neurosurgical trauma (i.e. traumatic brain injuries). This includes the following patient groups:
  - GCS of 8 or less AND/OR a motor score of 4 or less
  - Requiring intubation at scene

These patients will be transferred from scene directly to UHNS.

All other patients will be taken to the nearest acute hospital.

This includes adults (*see section 2 – for patients with GCS of 8 or less but with no history of trauma*).

Paediatrics and neonates will be transferred to Alder Hey hospital.

Critical care network have provided data on patients transferred to UHNS from DGH’s. As these patients are already being admitted to UHNS (and Alder Hey), there should be no impact on UHNS’ inpatient services by moving these patients directly. The impact will be on their ED and supporting services.

2. Multisystem trauma patients (life threatening)

These patients will be transferred from scene directly to UHNS depending on the presence/absence of signs of life threatening haemorrhage (in which case the nearest hospital may be more appropriate depending on flight times).

This includes adults.

Paediatrics and neonates will be transferred to Alder Hey Hospital.

Critical care network have provided data on patients transferred to UHNS from DGH’s. As these patients are already being admitted to UHNS there should be little impact on inpatient services by moving these patients directly. There will however be an impact on ED and the supporting services. There will be a small increase in numbers transferred:

- a. Patients who could have been appropriately managed in Trauma Units (over triage). Triage pathways in North Wales will be robust and specific to minimise this risk.
- b. Patients who would otherwise have died in the Trauma Unit or during secondary transfer, i.e. those who only survived because of primary transfer. While this will have some financial impact, it is the one of the *raisons d'être* of the service.

These numbers are hard to quantify in North Wales but will be small.

1. Complex trauma (open fractures requiring orthoplastic input and patients with significant vascular deficit of limbs).

These patients will be transferred from scene initially to nearest hospital, with EMRTS remaining available for hyper-acute transfer to UHNS should this be required.

Suspected pelvic fractures not satisfying criteria (2): to nearest hospital, with EMRTS remaining available for hyper-acute transfer to UHNS should this be required.

Suspected paediatric pelvic fractures will be transferred to Alder Hey.

As these patients' clinical flows are unchanged (EMRTS merely facilitates transfer), there should be no net effect on services.

2. Single system trauma patients (non life threatening)  
Examples inc. simple pneumothorax, stable abdominal/pelvic fractures, isolated closed limb injury)

These patients will be taken to the nearest acute hospital.

As these patients' clinical flows are unchanged (EMRTS merely facilitates transfer), there should be no net effect on services.

3. Spinal injury with paralysis. These patients will be transferred from scene directly to nearest hospital. This includes all patients.

As these patients' clinical flows are unchanged (EMRTS merely facilitates transfer), there should be no net effect on services.

4. Burns  
Betsi Cadwaladr University Health Board (BCUHB) has therefore commissioned the University Hospital North Staffordshire (UHNS) for treatment of their major trauma.

All major burns: in the absence of other injuries, Whiston hospital.  
Paediatric burns will be transferred to Alder Hey Children's Hospital.

As these patients are already being referred to the above services, there should be little impact on inpatient services by moving these patients directly. BCUHB will need to liaise with Whiston to see if they are willing to accept direct transfers; they are not currently commissioned to do so.

#### Non-Trauma

##### 1. Cardiac

Myocardial Infarction (for PCI) – patients will be taken directly to Glan Clwyd hospital. (Primary Percutaneous Cardiac Intervention (PPCI) Suite opens June 2014)

Cardiac arrests with return of spontaneous circulation – patients will be taken directly to Glan Clwyd Hospital.

It seems there were 185 cardiac arrests in BCU in 2013-14; presumably 1/3 came to YGC anyway. Unclear how many had ROSC; Also unclear how many STEMIs will be referred for PCI.

Assuming the same assumptions as South Wales, 25 cardiac arrests with ROSC where the cause is presumed to be cardiac will be transferred to YGC.

Since BCUHB has centralised services for PPCI in Glan Clwyd, EMRTS will largely be facilitating transfers which should occur anyway.

##### 2. GCS of 8 or less but no history of trauma e.g. suspected SAH/ICH

BCUHB commission the Walton Centre Foundation Trust (WCFT) for all their non-traumatic neurosurgical and neuromedical care.

At the time of writing this 'flows' document BCUHB do not commission WCFT to take patients directly, only as secondary transfers. Until further discussions have taken place (where considered necessary by the BCUHB executive and contracts team) all patients with GCS of 8 or less but no history of trauma, or undetermined origin will continue to be taken to the nearest hospitals.

As these patients' clinical flows are (currently) unchanged (EMRTS merely facilitates transfer), there should be no net effect on services.

##### 3. Stroke

Nearest hospital. No hospital in North Wales is superior to any other for the management of Stroke patients.

No impact on clinical flows.

##### 4. Neonates

- a. Pre-hospital: Taken to nearest hospital with NICU. In most cases this will be Glan Clwyd hospital (Sub Regional Neonatal unit).
- b. Inter-hospital transfer. In all but the most unusual cases, these transfers will be undertaken by the Neonatal Retrieval Service. Involvement of EMRTS on a case-by-case basis.

Since BCUHB will be centralising neonatal care in a Sub-Regional Neonatal Unit in Glan Clwyd, EMRTS will largely be facilitating transfers which should occur anyway. Numbers small due to involvement of neonatal transfer service.

Estimated numbers already requested from neonatal network.

#### 1. Paediatric

As given for points 1-6.

Any intubated paediatric patient will be transferred to Alder Hey.

All other groups to DGHS' acute paediatric unit with HDU (Glan Clwyd Hospital and TBC)

In most cases paediatric inter-hospital transfers will be undertaken by NWTs.

Estimated numbers already requested from neonatal network.

#### 2. Maternity

Nearest consultant led unit

EMRTS facilitates transfer; no impact on clinical flows.

Data source for points 9-11 can be found in the agreed EMRTS clinical service model attached.

### The EMRTS Predictions for Major Trauma in North Wales

Peter Oakley – Clinical Lead for Major Trauma, UHNS

#### Assumptions

- Resident population 700,000
  - Visitor population 100,000 - 130,000 (8 m staying 4 nights and 15 m not staying)
  - The incidence of major trauma is 185 per million per year
  - About 15% of major trauma cases will not be 'suspectable' (e.g. elderly collapse or fall)
  - 90-100% of the population will be within the 45-60 minute isochrone from the MTC
  - Only about half of the 'suspectable' major trauma cases will be reachable by EMERTS (time of day, in conurbations close to TUs, competing EMERTS jobs, relatively low-energy mechanism of injury, 40% of major trauma cases are MVCs, 30% are low-height falls)
  - Of the patients sent in by EMERTS to the MTC, half will turn out to be severe (ISS > 15), 8% will be minor, and the remainder (42%) will be moderately severe – if a standard paramedic triage tool is used, these proportions will be 32%, 19% and 49%
  - More than half of cases attended by EMERTS will be directed to TUs rather than the MTC
  - 67% of major trauma cases taken to a TU will undergo secondary transfer to the MTC
  - 15% of moderate trauma cases taken to a TU will undergo secondary transfer to the MTC
- (These assumptions are not robust, but have been necessary because of the lack of data to support more objective assumptions. They have been discussed with pre-hospital physicians from North Wales and the West Midlands. The findings will be inaccurate if the call-out is very liberal)

#### Findings

- 120 direct transfers to the MTC (60 major, 50 moderate, 10 minor) by EMERTS

- More than 120 other scene attendances by EMERTS directed to TUs
  - 60 major secondary transfers with more than 30 of these transferred by EMERTS
  - 15 moderate secondary transfers a few of which may transferred by EMERTS
  - 20 more major trauma cases will be treated in the MTC (120 total) – this is a relatively small increase in the total number because most major trauma cases are currently being sent to the MTC; the main difference will be that many will get there much sooner
  - 40 more moderate trauma cases will be transferred in total to the MTC (65 total)
  - The TU experience of receiving major/moderate trauma will fall by 45/40 %
  - The TU experience of continuing care of major/moderate trauma will fall by 40/35 %
  - The need for secondary transfers of major/moderate trauma will fall by 40/35 %
  - The total number of non-aborted major trauma EMERTS missions will be more than 270 per year – likely to be about one a day on average. The frequency of calls will vary considerably, highest in the summer when it will be often be several times per day.
  - If EMERTS is called out much more frequently, the service will be less available for non-trauma duties, there will be a higher incidence of 'simultaneous' jobs, and a greater number of moderate cases are likely to be over-triaged to the MTC. This will have a bigger effect on MTC workload, more patients finding themselves far from home with TU-treatable injuries, and a greater impact on TU experience and ongoing workload
  - If EMERTS is call out much less frequently, fewer major cases will be transferred directly, reducing the benefits.
  - If a 'standard triage tool' is used, rather than 'expert clinical judgement', many more moderate and minor cases will be taken to the MTC and a much higher number of missions will be needed to capture as many major patients. The use of rapid CT-scanning in the TUs and 'hyper-acute' secondary transfer by EMERTS to the MTC will reduce under-triage of major patients to the MTC.
- (The predicted numbers transferred and the total mission numbers are highlighted yellow. The numbers have been rounded slightly for clarity)

### D3 - South Wales Collaborative clinical flows for trauma

#### South Wales Health Collaborative

Updated high level modelling of expected major and moderate trauma activity and demand, and comparison to current 5 year average actual activity in UHW & Morriston hospitals

#### Purpose

The purpose of this brief paper is to update on work previously undertaken on some high level, "top down", population incidence based modelling, to estimate the annual expected activity and demand levels for major and moderately severe trauma activity (ISS >9) across South Wales and South Powys, current projected hospital disposition of this activity using the current service provision and how this compares to the current activity levels (based on a 5 year average) for the current two centres. It also estimates the impact on other hospital sites across South Wales resulting in the change in flows suggested by this modelling and the impact on existing activity. It is intended that this will then be used to further inform some of the initial high level costing as part of the EMRTS business case and the much more detailed activity and patient flow modelling that will subsequently be required, in both the EMRTS and the emerging Major Trauma Network business cases. This builds on that initially undertaken to estimate much of this, which was described in a previous paper, which is included again here as *Annex 1* for ease of reference.

#### Major trauma – ISS >15

The previously modelled levels of potential incidence of this, and hospital disposition, as included and described in Annex 1, has been enhanced by Peter Oakley, Clinical Lead for major trauma in University of North Staffordshire NHS Trust, based in Stoke, who are also now the major trauma centre provider for BCUHB. This also ensures therefore that this modelling work for South Wales is consistent with that previously applied in North Wales.

The previously modelled estimates of major trauma incidence and disposition have therefore been enhanced by the following assumptions and updates to the methodology applied:-

- ▶ Resident and visitor population has been considered.
- ▶ Incidence of major trauma is 185 per million per year.
- ▶ Additionally incidence of moderate trauma is 185 per million per year.
- ▶ 15% of major trauma will not be 'suspectable' (e.g. elderly collapse or fall).
- ▶ Only 50% of 'suspectable' major trauma cases will be reachable by EMRTS (due to time of the day, close to trauma units, competing taskings, low mechanisms of injury).
- ▶ Approx. 67% of major trauma cases taken to a trauma unit (TU) will undergo secondary transfer to the major trauma centre (MTC).
- ▶ 15% of moderate trauma cases taken to a TU will undergo secondary transfer to the MTC.

The updated results of this work, for South Wales and South Powys, is the following estimated levels of Major Trauma (ISS >15) work expected to be served and impacted by the EMRTS service, and where, based on current service provision in South Wales, these are estimated to taken:-

	Cardiff	Swansea	Others
Updated modelling from Peter Oakley:-			
Nos. expected to be via helicopter straight to MTC	156	38	
Nos. expected to be via road straight to MTC	55	47	
Secondary transfer expected to MTC	31	20	
No. expected to stay in TUs			114
Totals expected	242	106	114

This has then been compared to the current activity levels at both UHW and Morriston, for activity currently being undertaken for patients with an ISS > 15, based on TARN data. The actual activity for the calendar years 2009 – 2013 was reviewed and a 5 year average ascertained, for both sites. This was then compared to the modelled values above, as follows:-

ISS > 15	Cardiff	Swansea
Updated modelling from Peter Oakley	242	106
Current activity (per TARN):- Average 2009 - 2013	194	118
Expected increase / (decrease) in MTC	48	-13

The impact on other hospital sites across South Wales was then estimated, based on these modelled differences in expected future activity levels when compared to the current 5 year average of actual activity, and using the current 5 year average transfers in or out of these units as a proxy basis on which to estimate this (also using TARN data). This also assumes that such flows between Cardiff and Swansea centres themselves have already been captured in the updated modelling already undertaken.

The resulting impact of this, for ISS > 15, summarised by Health Board, is as follows:-

Estimate of where increase / decrease in ISS > 15 activity will flow from / to (by Health Board):-  
(using current TARN data transfers in as a proxy):-

	To Cardiff	From Swansea
ABM	-6	5
Aneurin Bevan	-17	1
Cardiff & Vale		
Cwm Taf	-16	1
Hywel Dda	-9	6
Total modelled impact on MTC	-48	13

Moderately severe trauma – ISS 9-15

The previously modelled impact of transfers of moderately severe trauma (ISS 9-15) on the major trauma centres has been reviewed and updated, and then again compared to the current 5 year average reported actual activity via TARN.

The base assumption of an average of 15% of those with a moderately severe trauma needing transfer to a MTC remains, as does the estimated incidence of 185 per million of relevant population. This has been updated, however, for the following:-

- ▶ A recognition that 100% of such activity for the Cardiff & Vale population will flow to UHW;
- ▶ An estimate that 100% of the non Bridgend ABMU activity will flow direct to Morrison;
- ▶ A modelled impact of the changes in Royal Glamorgan Emergency Medicine, as a result of the South Wales Programme (SWP). With no consultant led A&E department at Royal Glam in the future, an estimate and assumption has been made of the relevant element of the Cwm Taf population, and the subsequent expected flow in total to Cardiff;
- ▶ For modelling purposes only, to inform this business case, a transfer rate of 30% has been considered for the Hywel Dda population. This has been informed by the current levels of activity reported, which suggest that a higher transfer rate than 15% is already in place for the population in Hywel Dda.

A summary of this revised modelling of the impact on the two current major trauma sites in South Wales, on the admittances and transfers of moderately severe trauma, is therefore as follows:-

Updated modelling re moderately severe trauma incidence, probability of transfer and likely hospital disposition

HB / LA	Base population	Plus estimated transient	Total applicable population	Estimated incidence (based on 185/m)	%age to / transferred to MTC	Estimated nos to MTC	MTC
Aneurin Bevan	577,000	48,760	625,760	116	15%	17	Cardiff
ABMU - Bridgend	132,000	19,229	151,229	28	15%	4	Cardiff
ABMU - rest	386,000	47,773	433,773	80	100%	80	Swansea
Cardiff & Vale	472,000	97,605	569,605	105	100%	105	Cardiff
Cwm Taf - Ponty & Rhondda (Royal Glam)	166,400	9,971	176,371	33	100%	33	Cardiff
Cwm Taf - Merthyr / Cynon (Prince Charles)	126,600	8,486	135,085	25	15%	4	Cardiff
Hywel Dda	382,000	63,353	445,353	82	30%	25	Swansea
South Powys - 50%	32500	6,440	38,940	7	15%	1	Cardiff
South Powys - 50%	32500	6,440	38,940	7	15%	1	Swansea
<b>Total</b>	<b>2,307,000</b>	<b>308,057</b>	<b>2,615,057</b>	<b>484</b>		<b>270</b>	

Summary MTC:-

Cardiff	164
Swansea	106

Again, this was then compared to the current 5 year average actual activity, as follows:-

ISS 9-15	Cardiff	Swansea
Updated modelling	164	106
Current activity (per TARN):- Average 2009 - 2013	149	180
Expected increase / (decrease) in MTC	16	-74

Whilst the expected levels of such activity in total in Cardiff is broadly at current levels, the impact of the additional flows from Royal Glamorgan, based on the estimated catchment population, needs to be factored in, with an increase up from the previously average assumed 15% to 100% (an increase of 85%). This modelling work does therefore take into account the planned future changes in Emergency Medicine at Royal Glamorgan, and its impact on this cohort of patients, as a result of SWP. This activity would also have been included in the overall Emergency Medicine modelling and patient flows work that was undertaken on each of the shortlisted options for the SWP consultation.

When this is done, and to apply the remaining modelled values compared to current average actual, results in a small expected shift out of Cardiff back to other hospitals. The distribution of this has again been estimated using current transfers as a proxy, although this time using transfers out of UHW, which results in this suggesting all of this would then flow back to Morriston.

The resulting impact on other sites, when again current average transfers within Morriston are used as a proxy basis to do so, are as follows, again summarised by Health Board:-

Estimate of where increase / decrease in ISS 9-15 activity will flow from / to (by Health Board):-  
(using Royal Glam and current TARN data transfers out as a proxy):-

	To Cardiff	From Swansea
ABM	12	31
Aneurin Bevan	0	4
Cardiff & Vale		
Cwm Taf	-28	6
Hywel Dda	0	34
Total modelled impact on MTC	-16	74

For the Hywel Dda population, both in terms of the current service and, in particular, the future model of Emergency Medicine across the main hospital sites in the Hywel Dda area, at this time it is not possible to definitively determine the % transfer rate of any potential future service changes on Hywel Dda hospital sites. For modelling purposes only, however, to inform this business case, a transfer rate of 30% has been considered. This has been informed by the current levels of activity reported which suggest that a much higher transfer rate than 15% is already in place for this population.

Summary LHB impact

Based on the current modelled assumptions above, the summary impact across all sites, when compared to the current reported activity levels, using TARN data, is estimated as follows, summarised by Health Board provider, including the net impacts assumed on the current MTCs:-

Summary expected Health Board impact of major and moderately severe trauma flows

	ISS 9- 15	ISS>15	Total ISS>9
ABM	-31	-14	-45
Aneurin Bevan	4	-17	-13
Cardiff & Vale	16	48	64
Cwm Taf	-22	-15	-37
Hywel Dda	34	-3	31
<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>

*Note: the figures may be subject to rounding which accounts for any discrepancies in totals*

It must also be noted that many of the key assumptions and caveats that were relevant to the initial exercise (and detailed later in this appendix) remain here, including:-

- ▶ In terms of the base population estimates, especially those then used again here to update the ISS 9-15 population incidence based modelling, whilst an attempt has been made to take into account the transient population for each LA and HB area, based on day visitors and estimated overnight stayers, this has then been averaged across the year, and what this estimate of the applicable population does not therefore take into account at this stage is the following:-
  - ▶ The seasonal nature of this, in terms of identifying peaks and troughs in the potential demand for major trauma services;
  - ▶ No assessment has been made at this stage in terms of the transient population “the other way”, i.e. in terms of the number and length of time the permanent population of South Wales is similarly out of the area on day visits outside South Wales, holidays, etc;
  - ▶ No assessment at this stage has been undertaken in terms of changes in “applicable” population based on the working day. It is very likely, for example, that the average population in Cardiff is much higher (and other areas less so) between say, the hours of 8am – 6pm due to the number of people who live outside C&V but who travel to Cardiff to work. Similarly, no assessment at this stage has been made in terms of the evening/ night time population influx to, say, Cardiff and Swansea on a Friday and Saturday night. This will require much more sophisticated population modelling than has been currently undertaken.
- As with the previous exercise, in terms of the EMRTS business case and activity, demand and patient flow modelling, this piece of work only covers those expected cases as described above, i.e. major and moderately severe trauma. It does not cover a range of other services, for which it is expected that the EMRTS service will also need to input, including:-
  - ▶ Cardiac
  - ▶ Stroke
  - ▶ Neonates
  - ▶ Paediatrics
  - ▶ Maternity

None of this activity has been included in this high level modelling, other than that which will also be subject to a major trauma. Separately pieces of work are also being progressed to estimate the impact of these patients on the proposed EMRTS service.

## South Wales Health Collaborative

### High level modelling of expected Major Trauma activity and demand

#### Purpose

The purpose of this brief paper is to describe some high level, “top down”, population incidence based modelling work that has been undertaken to estimate the annual expected activity and demand levels for Major Trauma activity across South Wales and South Powys, and the current projected hospital disposition of this activity, using the current service provision. It is intended that this will then be used to inform much more detailed activity and patient flow modelling, in both the EMRTS and the emerging Major Trauma Network business cases. The methodology for this work has built upon that used in North Wales for their Major Trauma Centre business case, which in turn mirrored similar work undertaken in England.

#### Methodology

This high level piece of modelling has been based on an average expected incidence of both Major Trauma cases (Injury Severity Score - ISS>15) and “moderately severe trauma” (ISS 9-15). In both cases, based on clinical discussion and input, it has been assumed that this will be in the region of 185 per million of applicable average population. The population base that this has been applied to has taken into account, at a high level and using what is readily available, the transient population for South Wales as well as the permanent resident population, by Health Board (HB) area. The individual Health Board split of this population at this stage is important in estimating, based on the current service provision across South Wales, where these patients will then be admitted or transferred (see later).

This “applicable” population has therefore been built up as follows:-

- ▶ The current resident population for each of the Health Board areas has been used, based on that currently contained on the [www.wales.nhs.uk](http://www.wales.nhs.uk) website, and updated by the Public Health Wales Observatory, as follows:-
 

▶ Aneurin Bevan UHB	577,000
▶ ABM UHB	518,000
▶ Cardiff & Vale UHB	472,000
▶ Cwm Taf UHB	293,000
▶ Hywel Dda UHB	382,000
  
- ▶ For Powys tHB, only the South Powys population is relevant to the South Wales service. The resident population for this has therefore been assumed as 65,000, consistent with other planning work used previously by the South Wales Programme / Health Collaborative;

On top of this, an estimate of the transient population, for visitors to each of these areas, has also been undertaken. This has been built up in two steps, as follows:-

- ▶ Contained within the *2012 GB Day Visitor Survey* undertaken by Visit Scotland, Visit Wales and Visit England, and contained on the Welsh Government website, is detail of the day visitors, based on a two year average, to each Local Authority (LA) area within Wales. The applicable LA area for each Health Board has therefore been used to ascertain an annual average day visitor number;
- ▶ Using the same conversion factor as was used in the North Wales work and their Major Trauma Centre business case, and based on the above numbers of day visitors, an estimate was then made on those who stay overnight, with, again based on the North Wales work as a proxy, the average stay being assumed as 4 nights.

Both of these values were then converted into an average annual “applicable” population, for which the average expected incidents of major trauma cases was then assessed. These “applicable” average annual populations were therefore as follows:-

▶ Aneurin Bevan UHB	625,760
▶ ABM UHB	585,002
▶ Cardiff & Vale UHB	569,605
▶ Cwm Taf UHB	311,457
▶ Hywel Dda UHB	445,353
▶ South Powys	77,880
▶ Total “applicable” population for South Wales	2,615,057

The above estimated incidence of major and moderately severe trauma cases was therefore then applied to these applicable population numbers. The results of this are summarised below.

Given the current service provision within South Wales, split between UHW in Cardiff and Morriston in Swansea, this high level modelling has then assumed that 100% of the cases for major trauma (ISS>15) will be taken to, and admitted to one of these two hospitals. Should the emerging Major Trauma Network business case propose and implement a different service model to this (which this high level expected activity and demand modelling will no doubt look to inform), this assumption may need to be reviewed. The North Wales modelling work and business case assumed that 70% of this major trauma activity would need to be treated in its Major Trauma Centre (now located in England) with the remaining numbers being able to be treated more locally.

In line with the North Wales modelling work, what has also been assumed here though is that 15% of those suffering from “moderately severe trauma” (ISS 9-15) will also subsequently need to be transferred and treated in one of the current major trauma centres.

### Current expected hospital disposition

Once the above has been used to estimate the expected number of major trauma cases, and those likely to require transfer to a major trauma centre for moderately severe trauma cases, by Health Board area, the likely hospital disposition of these has also been estimated, between the current service in Cardiff and Swansea, based on the following. As noted above, this is only intended to be a high level estimate of all this at this stage, to inform some more detailed work that will be required for both the all Wales EMRTS and the emerging Major Trauma Network in South Wales business cases.

The current assumptions for Health Board populations and resulting hospital disposition used in this analysis is as follows:-

- ▶ Aneurin Bevan UHB population will all flow to UHW, Cardiff;
- ▶ ABM UHB population will be split between UHW and Morriston, with the Bridgend LA area population flowing to UHW, and the rest of ABM to Morriston. The basis for estimating this split is entirely consistent with the overall high level modelling described above, using a base resident population for Bridgend of 132,000. The detail of this calculation is also provided in *table at the end of this appendix*.
- ▶ Cardiff & Vale UHB population will all flow to UHW in Cardiff. It is accepted that there may be a small proportion of the Western Vale of Glamorgan activity that might likely flow to Morriston as opposed to Cardiff, but these numbers are not expected to be material in reviewing this high level modelled assessment of activity levels;
- ▶ Cwm Taf UHB population will all flow to UHW;
- ▶ Hywel Dda UHB population will all flow to Morriston;
- ▶ The South Powys population will flow to both sites. Given the relatively small numbers for South Powys overall, a 50/50 split of this activity between the two sites is not an unreasonable assumption at this stage.

### Summary output

The summary of all this is provided in the table below:-

	Health Board						Total S Wales
	ABUHB	ABMUHB	C&VUHB	CTUHB	HDUHB	PHB (S Powys) (50/50 split between UHW & Morri)	
Applicable population numbers:-							
Resident population	577,000	518,000	472,000	293,000	382,000	65,000	2,307,000
Plus estimate of transient population:-							
Day visitors (based on 2 year average per 2012 GB tourism survey)	5,680,000	7,805,000	11,370,000	2,150,000	7,380,000	1,500,376	35,885,376
Equivalent population	15,562	21,384	31,151	5,890	20,219	4,111	98,316
Plus estimate of 4 night stayers (used N Wales proportions as a proxy)	3,029,333	4,162,667	6,064,000	1,146,667	3,936,000	800,201	19,138,867
Equivalent population	33,198	45,618	66,455	12,566	43,134	8,769	209,741
<b>Total applicable population</b>	<b>625,760</b>	<b>585,002</b>	<b>569,605</b>	<b>311,457</b>	<b>445,353</b>	<b>77,880</b>	<b>2,615,057</b>
Expected incidence of major trauma to be modelled (ISS > 15) (per million per year)	185	185	185	185	185	185	
Expected incidence of 'moderately severe trauma' ISS 9-15 (per million per year)	185	185	185	185	185	185	
Likelihood of ISS 9-15 being transferred from TU to MTC	15%	15%	15%	15%	15%	15%	
Estimated numbers per year with ISS > 15	116	108	105	58	82	14	484
Estimated numbers per year with ISS 9-15	116	108	105	58	82	14	484
Estimated number of ISS 9-15 being transferred to MTC	17	16	16	9	12	2	73
<b>Estimated total number to MTC</b>	<b>133</b>	<b>124</b>	<b>121</b>	<b>66</b>	<b>95</b>	<b>17</b>	<b>556</b>
Expected MTC disposition (base on current service provision):-							
UHW	133	32	121	66		8	361
Morrison		92			95	8	195

What this high level modelling therefore suggests is the following:-

- ▶ Allowing for the obvious limitations of such a high level, top down, population based piece of work, and the estimated incidence levels of 185 per million of both major and moderately severe trauma, and the applicable population bases as described above, it would be expected that there will be 484 cases of major trauma (ISS>15) a year across South Wales, with a similar number of ISS 9-15, 15%, or 73 of which will also subsequently need transferring to a major trauma centre. This results in an estimated total of 556 major trauma cases per annum;
- ▶ Based on the current service provision for these types of cases in South Wales, it is estimated that 361 of these will flow to UHW in Cardiff, with the remaining 195 going to Morryston Hospital in Swansea.

#### Key assumptions and caveats

Along with the obvious limitations of using such a top down, average incidence population approach to estimating future activity and demand levels, the following additional points need to also be noted when reviewing and using the outputs of this work:-

- ▶ Whilst an attempt has been made to take into account the transient population for each LA and HB area, based on day visitors and estimated overnight stayers, this has then been averaged across the year, and what this estimate of the applicable population does not therefore take into account at this stage is the following:-

- ▶ The seasonal nature of this, in terms of identifying peaks and troughs in the potential demand for major trauma services. Even assuming that the above 556 estimated cases is a fairly robust assessment, it is highly unlikely that these will occur evenly throughout the year;
  - ▶ No assessment has been made at this stage in terms of the transient population “the other way”, i.e. in terms of the number and length of time the permanent population of South Wales in similarly out of the area on day visits outside South Wales, holidays, etc;
  - ▶ No assessment at this stage has been undertaken in terms of changes in “applicable” population based on the working day. It is very likely, for example, that the average population in Cardiff is much higher (and other areas less so) between say, the hours of 8am – 6pm due to the number of people who live outside C&V but who travel to Cardiff to work. Similarly, no assessment at this stage has been made in terms of the evening/ night time population influx to, say, Cardiff and Swansea on a Friday and Saturday night. This will require much more sophisticated population modelling than has been currently undertaken.
- In terms of the EMRTS business case and activity, demand and patient flow modelling, this piece of work only covers those expected cases as described above, i.e. major and moderately severe trauma. It does not cover a range of other services, for which it is expected that the EMRTS service will also need to input, including:-
- ▶ Cardiac
  - ▶ Stroke
  - ▶ Neonates
  - ▶ Paediatrics
  - ▶ Maternity

None of this activity has been included in this high level modelling, other than that which will also be subject to a major trauma. Separately piece of work are also being progressed to estimate the impact of these patients on the proposed EMRTS service.

#### Next steps

This high level exercise has attempted to estimate the level and current proposed disposition of major trauma activity across South Wales. This will be used to inform some more detailed patient activity, demand and flow work required, including comparisons to current actual activity levels for both the EMRTS and Major Trauma Network business cases.

In terms of EMRTS, an assessment will also need to be made of the expected number of these total trauma cases that it is projected that will be required to be transported by the EMRTS service, as opposed to, say, the emergency ambulance service, etc.

Part of this assessment will also need the above expected future number and disposition of major trauma activity and cases to be compared to the current major trauma activity being delivered, especially at UHW and Morriston (for which it is expected that TARN data will be able to inform) and using the HB residency of such activity in comparison with the above estimates, to determine the likely increase levels of activity in these sites currently, and a proxy of where (and which other sites) these are likely to flow from.

Basis for splitting ABMU activity between Morriston Hospital and UHW

Estimated split of ABM activity:-

	Bridgend (to UHW)	Swansea/ NPT (to Morriston)	Check total ABM
Resident population	132,000	386,000	518,000
Plus estimate of transient population:-			
Day visitors (based on 2 year average per 2012 GB tourism survey)	2,240,000	5,565,000	7,805,000
Equivalent population	6,137	15,247	21,384
Plus estimate of 4 night stayers (used N Wales proportions as a proxy)	1,194,667	2,968,000	4,162,667
Equivalent population	13,092	32,526	45,618
<b>Total applicable population</b>	<b>151,229</b>	<b>433,773</b>	<b>585,002</b>
Expected incidence of major trauma to be modelled (ISS > 15) (per million per year)	185	185	
Expected incidence of 'moderately severe trauma' ISS 9-15 (per million per year)	185	185	
Likelihood of ISS 9-15 being transferred from TU to MTC	15%	15%	
Estimated numbers per year with ISS > 15	28	80	108
Estimated numbers per year with ISS 9-15	28	80	108
Estimated number of ISS 9-15 being transferred to MTC	4	12	16
<b>Estimated total number to MTC</b>	<b>32</b>	<b>92</b>	<b>124</b>

## Appendix E Capital items/equipment list

EMRTS		
Capital Equipment	Purchase Price (Exc VAT)	Purchase Price (Inc VAT)
	£	£
Vehicle Purchase and Conversion		
Vehicle	43,366	52,039
Ambulance conversion	13,500	16,200
Ambulance fit (Terrafix, AVL etc)	20,000	24,000
<b>Total</b>	<b>76,866</b>	<b>92,239</b>
Vehicle and Helicopter Equipment		
Pac Rac	200	240
Ferno Scoop	500	600
Stretcher	2,000	2,400
Monitoring	21,067	25,280
Syringe drivers x4	3,980	4,776
Airtraq rigid fibreoptic larygoscope x4 2 small/2 Large	120	144
Emma in line digital end tidal CO2 monitor	995	1,194
Pulse oximetry monitor	100	120
Suction unit	705	846
iStat 9000 arterial blood gas monitor	5,000	6,000
Lucas chest compression device	6,600	7,920
Ventilator	15,000	18,000
Ventilator	239	287
Ventilator	100	120
Crede Cube Blood transfer box	500	600
Thomas pack x2	900	1,080
Vacuum splints x1	424	509
Sager splint SX405	397	476
Kendric Traction Device	100	120
Pedi Pak spine board	300	360
EZIO bone drill /humeral /Adult/Paed IO	400	480
Gigli saw	20	24
Large trauma scissors	80	96
Buddy lite fluid warmer x2	3,200	3,840
Germa flight suits	600	720
HAIK Airpower X1 Crosstech Safety Rescue Boots	160	192
MSA USAR Helmet	180	216
Gloves	40	48
Contingency - Blood/Pharm/Sundries	14,000	16,800
<b>Total</b>	<b>77,907</b>	<b>93,488</b>
Data Collection & Infrastructure (As per Working Group Paper)	71,250	85,500
Omnicell Drug Cabinet	70,000	84,000
Glim Lighting	35,000	42,000
Training Equipment	31,000	37,200
Neonates Equipment		
1. Airborne Aviator incubator; the incubator chassis includes storage for two E-cylinders which can be adapted to take CD cylinders.		
2. Customer to supply Hamilton T1 ventilator		
3. SLE to supply mount for fixing Hamilton T1 to Aviator chassis		
4. Customer to supply Hamilton Tempus pro monitor with pole mount		
5. SLE to supply pole mount for fixing Tempus pro monitor		
6. Customer to supply CME T34 infusion pumps		
7. SLE to investigate mounting solution with CME		
8. Laerdal LCSU4 compact battery powered suction in air transfer mounting		
9. Neo-pod lightweight neonatal humidifier		
10. All of the above to be mounted on Airborne TS air-transport stretcher with fittings for Aerolite interior of EC135 helicopter		
11. SLE to obtain Supplemental Type Certificate (STC) from Aerolite (Switzerland) for the above system for a defined aircraft from the Wales Air ambulance fleet.		
<b>Total Neonates Equipment</b>	<b>100,000</b>	<b>120,000</b>
<b>Total</b>		
Note:-		
All cost as per information and quotes received		
VAT added at 20%		

## Appendix F Economic model

Capital		Cars	Helicopters	Data collection	HLS	HEMS	Other equipme	GLIMS
Swansea Air & Road	588	2.0	1.0	0.0	0.0	0.0	1.0	0.0
Option 2A GLIMS lighting	35	0.0	0.0	0.0	0.0	0.0	0.0	1.0
Swansea HLS	55	0.0	0.0	0.0	1.0	0.0	0.0	0.0
Swansea HEMS	250	0.0	0.0	0.0	0.0	1.0	0.0	0.0
Welshpool Air & Road	588	2.0	1.0	0.0	0.0	0.0	1.0	0.0
Caernarfon Air & Road	588	2.0	1.0	0.0	0.0	0.0	1.0	0.0
Cwmbran Road	511	2.0	0.0	0.0	0.0	0.0	1.0	0.0
Coordination Hub	226	1.0	0.0	1.0	0.0	0.0	0.0	0.0
Optimism bias (ASSUMED 15% - TO BE REFINED/ TESTED)	10%							
Capital cost per unit		154.772	77.907	71.250	55.000	250.000	201.000	35.000
5 year LCC		77.907	77.907	71.250	0.000	250.000	201.000	35.000
7 year LCC		76.865	0.000	0.000	0.000	0.000	0.000	
<b>Lifecycle</b>	UEL	Cost per unit						
Road Vehicle UEL 7 years	7	76.865						
Vehicle equipment UEL 5 years	5	77.907						
Data Collection infrastructure UEL 5 years	5	71.250						
HLS	0	55.000						
HEMS upgrade UEL 5 years	5	250.000						
Option 2A GLIMS	5	35.000						
Other equipment	5	201.000						
<b>Revenue Costs (12 months)</b>		Contingency % on capital charges (Removed)	Capital charges (Removed)	Revenue Cost				
Swansea Air & Road 7am - 7pm	880	10%	113	1,004				
Option 2A GLIMS maintenance	4	10%	12	17				
Swansea Air & Road 7pm - 7am	901	0%	-	901				
Swansea HLS to HLS 7pm - 7am	276	0%	14	290				
Swansea Night HEMS	25	0%	52	77				
Welshpool Air & Road 9am - 9pm	880	10%	113	1,004				
Caernarfon clinical lead only	24	0%	-	24				
Caernarfon Air & Road 7am - 7pm	795	10%	113	919				
Cwmbran Road 3pm - 3am	786	10%	97	893				
Top Cover	489	0%	-	489				
Management	210	0%	-	210				
Coordination Hub- do minimum	286	0%	42	328				
Coordination Hub- options 3 & 4	300	0%	42	342				
Coordination Hub- option 5	341	0%	42	383				
<b>Set up costs</b>								
Option 2	208	208						
Option 2A	208	208						
Option 3	254	254						
Option 4	274	274						
Option 5	330	330						

Economic model

Year end	DO MINIMUM OPTION						31-Mar-15	31-Mar-16	31-Mar-17	31-Mar-18	31-Mar-19	31-Mar-20	31-Mar-21	31-Mar-22	31-Mar-23	31-Mar-24	31-Mar-25
Real Inflator						Total	1.000	1.035	1.071	1.109	1.148	1.188	1.229	1.272	1.317	1.363	1.411
Real Discount Factor							1.000	0.966	0.934	0.902	0.871	0.842	0.814	0.786	0.759	0.734	0.709
Year							-	1	2	3	4	5	6	7	8	9	10
Capital		PHASE 1	PHASE 1E	PHASE 1C	PHASE 2	PHASE 3											
Swansea Air & Road		1.000	-	-	-	-	588.451	588.451									
GLIMS Lighting		-	-	-	-	-	-										
Swansea HLS		-	-	-	-	-	-										
Swansea HEMS		-	-	-	-	-	-										
Welshpool Air & Road		-	-	-	1.000	-	588.451	588.451									
Caermarfon Air & Road		-	-	-	-	-	-										
Cwmbran Road		-	-	-	-	-	-										
Coordination Hub		1.000	-	-	-	-	226.022	226.022									
Optimism bias (ASSUMED 15% - TO BE REFINED / TESTED)		-	-	-	-	-	140.292	81.447	58.845	-	-	-	-	-	-	-	-
<b>Total</b>							<b>1,543.216</b>	<b>895.920</b>	<b>647.296</b>								
Lifecycle 5 year																	
Swansea Air & Road		1.000	-	-	-	-	434.721	-	-	-	434.721	-	-	-	-	-	-
GLIMS Lighting		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Swansea HLS		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Swansea HEMS		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Welshpool Air & Road		-	-	-	1.000	-	434.721	-	-	-	-	434.721	-	-	-	-	-
Caermarfon Air & Road		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cwmbran Road		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Coordination Hub		1.000	-	-	-	-	149.157	-	-	-	149.157	-	-	-	-	-	-
Optimism bias (ASSUMED 15% - TO BE REFINED / TESTED)		-	-	-	-	-	101.860	-	-	-	58.388	43.472	-	-	-	-	-
<b>Total</b>							<b>1,120.459</b>				<b>642.266</b>	<b>478.193</b>					
Lifecycle 7 year																	
Swansea Air & Road		1.000	-	-	-	-	153.730	-	-	-	-	-	153.730	-	-	-	-
GLIMS Lighting		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Swansea HLS		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Swansea HEMS		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Welshpool Air & Road		-	-	-	1.000	-	153.730	-	-	-	-	-	-	153.730	-	-	-
Caermarfon Air & Road		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cwmbran Road		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Coordination Hub		1.000	-	-	-	-	76.865	-	-	-	-	-	76.865	-	-	-	-
Optimism bias (ASSUMED 15% - TO BE REFINED / TESTED)		-	-	-	-	-	38.433	-	-	-	-	-	23.060	15.373	-	-	-
<b>Total</b>							<b>422.758</b>						<b>253.655</b>	<b>169.103</b>			
Revenue																	
Swansea Air & Road 7am - 7pm		1.000	-	-	-	-	8,947.554	146.681	880.087	880.087	880.087	880.087	880.087	880.087	880.087	880.087	880.087
GLIMS Lighting		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Swansea Air & Road 7pm - 7am		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Swansea HLS to HLS 7pm - 7am		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Swansea Night HEMS		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Welshpool Air & Road 9am - 9pm		-	-	-	1.000	-	8,067.467	146.681	880.087	880.087	880.087	880.087	880.087	880.087	880.087	880.087	880.087
Caermarfon clinical lead only		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Caermarfon Air & Road 7am - 7pm		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cwmbran Road 3pm - 3am		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Top Cover		1.000	-	-	-	-	4,974.499	81.549	489.295	489.295	489.295	489.295	489.295	489.295	489.295	489.295	489.295
Management		1.000	-	-	-	-	2,135.691	35.011	210.068	210.068	210.068	210.068	210.068	210.068	210.068	210.068	210.068
Coordination Hub		1.000	-	-	-	-	2,905.572	47.632	285.794	285.794	285.794	285.794	285.794	285.794	285.794	285.794	285.794
<b>Total</b>							<b>27,030.784</b>	<b>310.874</b>	<b>2,011.926</b>	<b>2,745.332</b>							
Transition costs																	
Transition costs		1.000	-	-	-	-	208.040	208.040	-	-	-	-	-	-	-	-	-
<b>Grand total</b>							<b>30,325.257</b>	<b>1,414.834</b>	<b>2,659.222</b>	<b>2,745.332</b>	<b>2,745.332</b>	<b>2,745.332</b>	<b>2,998.986</b>	<b>2,914.435</b>	<b>2,745.332</b>	<b>2,745.332</b>	<b>2,745.332</b>
NPC							25,421.046										

Economic model

Year end	OPTION 2A					31-Mar-15	31-Mar-16	31-Mar-17	31-Mar-18	31-Mar-19	31-Mar-20	31-Mar-21	31-Mar-22	31-Mar-23	31-Mar-24	31-Mar-25
Real Inflation	Total					1.000	1.035	1.071	1.109	1.148	1.188	1.229	1.272	1.317	1.363	1.411
Real Discount Factor						1.000	0.966	0.934	0.902	0.871	0.842	0.814	0.786	0.759	0.734	0.709
Year						-	1	2	3	4	5	6	7	8	9	10
Capital	PHASE 1	PHASE 1B	PHASE 1C	PHASE 2	PHASE 3											
Swansea Air & Road	1.000	-	-	-	-	588.451	588.451									
GLIMS lighting	1.000	-	-	-	-	35.000	35.000									
Swansea HLS	-	-	-	-	-	-	-									
Swansea HEMS	-	-	-	-	-	-	-									
Welshpool Air & Road	1.000	-	-	-	-	588.451	588.451									
Caermarfon Air & Road	-	-	-	-	-	-	-									
Cwmbran Road	-	-	-	-	-	-	-									
Coordination Hub	1.000	-	-	-	-	226.022	226.022									
Optimism bias (ASSUMED 15% - TO BE REFINED / TESTED)	-	-	-	-	-	143.792	143.792	-	-	-	-	-	-	-	-	-
<b>Total</b>						<b>1,581.716</b>	<b>1,581.716</b>	-	-	-	-	-	-	-	-	-
Lifecycle 5 year																
Swansea Air & Road	1.000	-	-	-	-	434.721	-	-	-	434.721	-	-	-	-	-	-
GLIMS lighting	1.000	-	-	-	-	35.000	-	-	-	35.000	-	-	-	-	-	-
Swansea HLS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Swansea HEMS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Welshpool Air & Road	1.000	-	-	-	-	434.721	-	-	-	434.721	-	-	-	-	-	-
Caermarfon Air & Road	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cwmbran Road	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Coordination Hub	1.000	-	-	-	-	149.157	-	-	-	149.157	-	-	-	-	-	-
Optimism bias (ASSUMED 15% - TO BE REFINED / TESTED)	-	-	-	-	-	105.360	-	-	-	105.360	-	-	-	-	-	-
<b>Total</b>						<b>1,158.959</b>	-	-	-	<b>1,158.959</b>	-	-	-	-	-	-
Lifecycle 7 year																
Swansea Air & Road	1.000	-	-	-	-	153.730	-	-	-	-	-	153.730	-	-	-	-
GLIMS lighting	1.000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Swansea HLS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Swansea HEMS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Welshpool Air & Road	1.000	-	-	-	-	153.730	-	-	-	-	-	153.730	-	-	-	-
Caermarfon Air & Road	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cwmbran Road	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Coordination Hub	1.000	-	-	-	-	76.865	-	-	-	-	-	76.865	-	-	-	-
Optimism bias (ASSUMED 15% - TO BE REFINED / TESTED)	-	-	-	-	-	38.433	-	-	-	-	-	38.433	-	-	-	-
<b>Total</b>						<b>422.758</b>	-	-	-	-	-	<b>422.758</b>	-	-	-	-
Revenue																
Swansea Air & Road 7am - 7pm	1.000	-	-	-	-	8,947.554	146.681	880.087	880.087	880.087	880.087	880.087	880.087	880.087	880.087	880.087
GLIMS Maintenance	1.000	-	-	-	-	39.147	0.642	3.851	3.851	3.851	3.851	3.851	3.851	3.851	3.851	3.851
Swansea Air & Road 7pm - 7am	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Swansea HLS to HLS 7pm - 7am	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Swansea Night HEMS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Welshpool Air & Road 9am - 9pm	1.000	-	-	-	-	8,947.554	146.681	880.087	880.087	880.087	880.087	880.087	880.087	880.087	880.087	880.087
Caermarfon clinical lead only	1.000	-	-	-	-	244.289	4.005	24.028	24.028	24.028	24.028	24.028	24.028	24.028	24.028	24.028
Caermarfon Air & Road 7am - 7pm	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cwmbran Road 3pm - 3am	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Top Cover	1.000	-	-	-	-	4,974.499	81.549	489.295	489.295	489.295	489.295	489.295	489.295	489.295	489.295	489.295
Management	1.000	-	-	-	-	2,135.691	35.011	210.068	210.068	210.068	210.068	210.068	210.068	210.068	210.068	210.068
Coordination Hub	1.000	-	-	-	-	2,905.572	47.632	285.794	285.794	285.794	285.794	285.794	285.794	285.794	285.794	285.794
<b>Total</b>						<b>28,194.307</b>	<b>462.202</b>	<b>2,773.211</b>								
Transition costs																
Transition costs	1.000	-	-	-	-	208.040	208.040	-	-	-	-	-	-	-	-	-
<b>Grand total</b>						<b>31,565.780</b>	2,251.958	2,773.211	2,773.211	2,773.211	3,932.169	2,773.211	3,195.968	2,773.211	2,773.211	2,773.211
NPC						26,623.751										

Economic model

Year end	OPTION 3					31-Mar-15	31-Mar-16	31-Mar-17	31-Mar-18	31-Mar-19	31-Mar-20	31-Mar-21	31-Mar-22	31-Mar-23	31-Mar-24	31-Mar-25
Real Inflator	Total					1.000	1.035	1.071	1.109	1.148	1.188	1.229	1.272	1.317	1.363	1.411
Real Discount Factor						1.000	0.966	0.934	0.902	0.871	0.842	0.814	0.786	0.759	0.734	0.709
Year						-	1	2	3	4	5	6	7	8	9	10
Capital	PHASE 1	PHASE 1B	PHASE 1C	PHASE 2	PHASE 3											
Swansea Air & Road	1.000	-	-	-	-	588.451	588.451									
GLIMS Lighting																
Swansea HLS	-	1.000	-	-	-	55.000	55.000									
Swansea HEMS	-	-	1.000	-	-	250.000		250.000								
Welshpool Air & Road	-	-	-	1.000	-	588.451		588.451								
Caermarfon Air & Road	-	-	-	-	-											
Cwmbran Road	-	-	-	-	-											
Coordination Hub	1.000	-	-	-	-	226.022	226.022									
Optimism bias (ASSUMED 15% - TO BE REFINED / TESTED)	-	-	-	-	-	170.792	81.447	5.500	83.845	-	-	-	-	-	-	-
<b>Total</b>						<b>1,878.716</b>	<b>895.920</b>	<b>60.500</b>	<b>922.296</b>	-	-	-	-	-	-	-
Lifecycle 5 year																
Swansea Air & Road	1.000	-	-	-	-	434.721	-	-	-	-	434.721	-	-	-	-	-
GLIMS Lighting																
Swansea HLS	-	1.000	-	-	-											
Swansea HEMS	-	-	1.000	-	-	250.000						250.000				
Welshpool Air & Road	-	-	-	1.000	-	434.721							434.721			
Caermarfon Air & Road	-	-	-	-	-											
Cwmbran Road	-	-	-	-	-											
Coordination Hub	1.000	-	-	-	-	149.157					149.157					
Optimism bias (ASSUMED 15% - TO BE REFINED / TESTED)	-	-	-	-	-	126.860					58.388		68.472			
<b>Total</b>						<b>1,395.459</b>					<b>642.266</b>		<b>753.193</b>			
Lifecycle 7 year																
Swansea Air & Road	1.000	-	-	-	-	153.730	-	-	-	-	-	153.730	-	-	-	-
GLIMS Lighting																
Swansea HLS	-	1.000	-	-	-											
Swansea HEMS	-	-	1.000	-	-											
Welshpool Air & Road	-	-	-	1.000	-	153.730									153.730	
Caermarfon Air & Road	-	-	-	-	-											
Cwmbran Road	-	-	-	-	-											
Coordination Hub	1.000	-	-	-	-	76.865						76.865				
Optimism bias (ASSUMED 15% - TO BE REFINED / TESTED)	-	-	-	-	-	38.433							23.060		15.373	
<b>Total</b>						<b>422.758</b>						<b>253.655</b>			<b>169.103</b>	
Revenue																
Swansea Air & Road 7am - 7pm	1.000	-	-	-	-	8,947.554	146.681	880.087	880.087	880.087	880.087	880.087	880.087	880.087	880.087	880.087
GLIMS Lighting																
Swansea Air & Road 7pm - 7am	1.000	-	-	-	-	9,160.380	150.170	901.021	901.021	901.021	901.021	901.021	901.021	901.021	901.021	901.021
Swansea HLS to HLS 7pm - 7am	-	1.000	-	-	-	2,525.417	45.917	275.500	275.500	275.500	275.500	275.500	275.500	275.500	275.500	275.500
Swansea Night HEMS	-	-	1.000	-	-	216.667		16.667	25.000	25.000	25.000	25.000	25.000	25.000	25.000	25.000
Welshpool Air & Road 9am - 9pm	-	-	-	1.000	-	7,187.380			880.087	880.087	880.087	880.087	880.087	880.087	880.087	880.087
Caermarfon clinical lead only	-	-	-	-	-											
Caermarfon Air & Road 7am - 7pm	-	-	-	-	-											
Cwmbran Road 3pm - 3am	-	-	-	-	-											
Top Cover	1.000	-	-	-	-	4,974.499	81.549	489.295	489.295	489.295	489.295	489.295	489.295	489.295	489.295	489.295
Management	1.000	-	-	-	-	2,135.691	35.011	210.068	210.068	210.068	210.068	210.068	210.068	210.068	210.068	210.068
Coordination Hub	1.000	-	-	-	-	3,052.166	50.036	300.213	300.213	300.213	300.213	300.213	300.213	300.213	300.213	300.213
<b>Total</b>						<b>38,199.753</b>	<b>463.447</b>	<b>2,826.601</b>	<b>3,219.532</b>	<b>3,961.272</b>						
Transition costs																
Transition costs	1.000	-	-	-	-	253.560	253.560									
<b>Grand total</b>						<b>42,150.246</b>	<b>1,612.928</b>	<b>2,887.101</b>	<b>4,141.828</b>	<b>3,961.272</b>	<b>3,961.272</b>	<b>4,603.537</b>	<b>3,961.272</b>	<b>4,968.119</b>	<b>3,961.272</b>	<b>4,130.375</b>
NPC						35,144.186										

Economic model

Year end	OPTION 4					31-Mar-15	31-Mar-16	31-Mar-17	31-Mar-18	31-Mar-19	31-Mar-20	31-Mar-21	31-Mar-22	31-Mar-23	31-Mar-24	31-Mar-25	
Real Inflation						Total	1.000	1.035	1.071	1.109	1.148	1.188	1.229	1.272	1.317	1.363	1.411
Real Discount Factor							1.000	0.966	0.934	0.902	0.871	0.842	0.814	0.786	0.759	0.734	0.709
Year							-	1	2	3	4	5	6	7	8	9	10
Capital	PHASE 1	PHASE 1B	PHASE 1C	PHASE 2	PHASE 3												
Swansea Air & Road	1.000	-	-	-	-	588.451	588.451										
GLIMS Lighting																	
Swansea HLS	-	-	-	1.000	-	55.000		55.000									
Swansea HEMS	-	-	-	1.000	-	250.000			250.000								
Welshpool Air & Road	1.000	-	-	-	-		588.451										
Caernarfon Air & Road	-	-	-	1.000	-	588.451			588.451								
Cwbran Road	-	-	-	-	-	-											
Coordination Hub	1.000	-	-	-	-	226.022	226.022										
Optimism bias (ASSUMED 15% - TO BE REFINED / TESTED)	-	-	-	-	-	229.638	81.447	58.845	5.500	83.845	-	-	-	-	-	-	-
<b>Total</b>						<b>2,526.013</b>	<b>895.920</b>	<b>647.296</b>	<b>60.500</b>	<b>922.296</b>	-	-	-	-	-	-	-
Lifecycle 5 year																	
Swansea Air & Road	1.000	-	-	-	-	434.721	-	-	-	-	434.721	-	-	-	-	-	-
GLIMS Lighting																	
Swansea HLS	-	-	-	1.000	-	-	-	-	-	-	-	-	-	-	-	-	-
Swansea HEMS	-	-	-	1.000	-	250.000	-	-	-	-	-	-	-	-	250.000	-	-
Welshpool Air & Road	1.000	-	-	-	-	434.721	-	-	-	-	-	434.721	-	-	-	-	-
Caernarfon Air & Road	-	-	-	1.000	-	434.721	-	-	-	-	-	-	-	-	434.721	-	-
Cwbran Road	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Coordination Hub	1.000	-	-	-	-	149.157	-	-	-	-	149.157	-	-	-	-	-	-
Optimism bias (ASSUMED 15% - TO BE REFINED / TESTED)	-	-	-	-	-	170.332	-	-	-	-	58.388	43.472	-	-	68.472	-	-
<b>Total</b>						<b>1,873.652</b>	-	-	-	-	<b>642.266</b>	<b>478.193</b>	-	-	<b>753.193</b>	-	-
Lifecycle 7 year																	
Swansea Air & Road	1.000	-	-	-	-	153.730	-	-	-	-	-	-	153.730	-	-	-	-
GLIMS Lighting																	
Swansea HLS	-	-	-	1.000	-	-	-	-	-	-	-	-	-	-	-	-	-
Swansea HEMS	-	-	-	1.000	-	250.000	-	-	-	-	-	-	-	-	-	-	-
Welshpool Air & Road	1.000	-	-	-	-	153.730	-	-	-	-	-	-	-	-	153.730	-	-
Caernarfon Air & Road	-	-	-	1.000	-	153.730	-	-	-	-	-	-	-	-	-	-	153.730
Cwbran Road	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Coordination Hub	1.000	-	-	-	-	76.865	-	-	-	-	-	-	76.865	-	-	-	-
Optimism bias (ASSUMED 15% - TO BE REFINED / TESTED)	-	-	-	-	-	53.806	-	-	-	-	-	-	23.060	-	15.373	-	15.373
<b>Total</b>						<b>591.861</b>	-	-	-	-	-	-	<b>253.655</b>	-	<b>169.103</b>	-	<b>169.103</b>
Revenue																	
Swansea Air & Road 7am - 7pm	1.000	-	-	-	-	8,947.554	146.681	880.087	880.087	880.087	880.087	880.087	880.087	880.087	880.087	880.087	880.087
GLIMS Lighting																	
Swansea Air & Road 7pm - 7am	1.000	-	-	-	-	9,010.210		901.021	901.021	901.021	901.021	901.021	901.021	901.021	901.021	901.021	901.021
Swansea HLS to HLS 7pm - 7am	-	-	-	1.000	-	2,479.500			275.500	275.500	275.500	275.500	275.500	275.500	275.500	275.500	275.500
Swansea Night HEMS	-	-	-	1.000	-	200.000			25.000	25.000	25.000	25.000	25.000	25.000	25.000	25.000	25.000
Welshpool Air & Road 9am - 9pm	1.000	-	-	-	-	8,800.873		880.087	880.087	880.087	880.087	880.087	880.087	880.087	880.087	880.087	880.087
Caernarfon clinical lead only	1.000	-	-	-	-	240.284		24.028	24.028	24.028	24.028	24.028	24.028	24.028	24.028	24.028	24.028
Caernarfon Air & Road 7am - 7pm	-	-	-	1.000	-	6,358.738			794.842	794.842	794.842	794.842	794.842	794.842	794.842	794.842	794.842
Cwbran Road 3pm - 3am	-	-	-	-	-	-											
Top Cover	1.000	-	-	-	-	4,974.499	81.549	489.295	489.295	489.295	489.295	489.295	489.295	489.295	489.295	489.295	489.295
Management	1.000	-	-	-	-	2,135.691	35.011	210.068	210.068	210.068	210.068	210.068	210.068	210.068	210.068	210.068	210.068
Coordination Hub	1.000	-	-	-	-	3,052.166	50.036	300.213	300.213	300.213	300.213	300.213	300.213	300.213	300.213	300.213	300.213
<b>Total</b>						<b>46,199.516</b>	<b>313.277</b>	<b>3,684.800</b>	<b>3,960.300</b>	<b>4,780.142</b>							
Transition costs																	
Transition costs	1.000	-	-	-	-	274.080	274.080	-	-	-	-	-	-	-	-	-	-
<b>Grand total</b>						<b>51,465.121</b>	<b>1,483.278</b>	<b>4,332.096</b>	<b>4,020.800</b>	<b>5,702.438</b>	<b>4,780.142</b>	<b>5,422.408</b>	<b>5,258.335</b>	<b>5,033.797</b>	<b>5,702.438</b>	<b>4,780.142</b>	<b>4,949.245</b>
NPC						42,877.377											

Economic model

Year end	OPTION 5					31-Mar-15	31-Mar-16	31-Mar-17	31-Mar-18	31-Mar-19	31-Mar-20	31-Mar-21	31-Mar-22	31-Mar-23	31-Mar-24	31-Mar-25
Real Inflation	Total					1.000	1.035	1.071	1.109	1.148	1.188	1.229	1.272	1.317	1.363	1.411
Real Discount Factor						1.000	0.966	0.934	0.902	0.871	0.842	0.814	0.786	0.759	0.734	0.709
Year						-	1	2	3	4	5	6	7	8	9	10
Capital	PHASE 1	PHASE 1B	PHASE 1C	PHASE 2	PHASE 3											
Swansea Air & Road	1.000	-	-	-	-	588.451	588.451									
GLIMS Lighting																
Swansea HLS	-	-	-	-	-	-	-									
Swansea HEMS	-	-	-	-	-	-	-									
Welshpool Air & Road	-	-	-	1.000	-	588.451	588.451									
Caermarfon Air & Road	-	-	-	-	1.000	588.451		588.451								
Cwmbran Road	1.000	-	-	-	-	510.544		510.544								
Coordination Hub	1.000	-	-	-	-	226.022		226.022								
Optimism bias (ASSUMED 15% - TO BE REFINED / TESTED)	-	-	-	-	-	250.192	81.447	109.900	-	58.845	-	-	-	-	-	-
<b>Total</b>						<b>2,752.111</b>	<b>895.920</b>	<b>1,208.895</b>	-	<b>647.296</b>	-	-	-	-	-	-
Lifecycle 5 year																
Swansea Air & Road	1.000	-	-	-	-	434.721	-	-	-	434.721	-	-	-	-	-	-
GLIMS Lighting																
Swansea HLS	-	-	-	-	-	-	-									
Swansea HEMS	-	-	-	-	-	-	-									
Welshpool Air & Road	-	-	-	1.000	-	434.721	-	-	-	-	434.721	-	-	-	-	-
Caermarfon Air & Road	-	-	-	-	1.000	434.721	-	-	-	-	-	-	434.721	-	-	-
Cwmbran Road	1.000	-	-	-	-	356.814	-	-	-	-	-	356.814	-	-	-	-
Coordination Hub	1.000	-	-	-	-	149.157	-	-	-	-	149.157	-	-	-	-	-
Optimism bias (ASSUMED 15% - TO BE REFINED / TESTED)	-	-	-	-	-	181.013	-	-	-	-	58.388	79.154	-	43.472	-	-
<b>Total</b>						<b>1,991.147</b>	-	-	-	-	<b>642.266</b>	<b>870.689</b>	-	<b>478.193</b>	-	-
Lifecycle 7 year																
Swansea Air & Road	1.000	-	-	-	-	153.730	-	-	-	-	-	153.730	-	-	-	-
GLIMS Lighting																
Swansea HLS	-	-	-	-	-	-	-									
Swansea HEMS	-	-	-	-	-	-	-									
Welshpool Air & Road	-	-	-	1.000	-	153.730	-	-	-	-	-	-	153.730	-	-	-
Caermarfon Air & Road	-	-	-	-	1.000	153.730	-	-	-	-	-	-	-	-	-	153.730
Cwmbran Road	1.000	-	-	-	-	153.730	-	-	-	-	-	-	-	153.730	-	-
Coordination Hub	1.000	-	-	-	-	76.865	-	-	-	-	-	76.865	-	-	-	-
Optimism bias (ASSUMED 15% - TO BE REFINED / TESTED)	-	-	-	-	-	69.179	-	-	-	-	-	23.060	-	30.746	-	15.373
<b>Total</b>						<b>760.964</b>	-	-	-	-	-	<b>253.655</b>	<b>338.206</b>	-	<b>169.103</b>	
Revenue																
Swansea Air & Road 7am - 7pm	1.000	-	-	-	-	8,947.554	146.681	880.087	880.087	880.087	880.087	880.087	880.087	880.087	880.087	880.087
GLIMS Lighting																
Swansea Air & Road 7pm - 7am	-	-	-	-	1.000	6,457.317	-	-	150.170	901.021	901.021	901.021	901.021	901.021	901.021	
Swansea HLS to HLS 7pm - 7am	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Swansea Night HEMS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Welshpool Air & Road 9am - 9pm	-	-	-	-	1.000	8,507.511	-	586.725	880.087	880.087	880.087	880.087	880.087	880.087	880.087	
Caermarfon clinical lead only	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Caermarfon Air & Road 7am - 7pm	-	-	-	-	1.000	6,093.791	-	-	529.895	794.842	794.842	794.842	794.842	794.842	794.842	
Cwmbran Road 3pm - 3am	1.000	-	-	-	-	7,993.876	131.047	786.283	786.283	786.283	786.283	786.283	786.283	786.283	786.283	
Top Cover	1.000	-	-	-	-	4,974.499	81.549	489.295	489.295	489.295	489.295	489.295	489.295	489.295	489.295	
Management	1.000	-	-	-	-	2,135.691	35.011	210.068	210.068	210.068	210.068	210.068	210.068	210.068	210.068	
Coordination Hub	1.000	-	-	-	-	3,468.318	56.858	341.146	341.146	341.146	341.146	341.146	341.146	341.146	341.146	
<b>Total</b>						<b>48,578.557</b>	<b>451.147</b>	<b>3,293.604</b>	<b>3,586.967</b>	<b>4,267.032</b>	<b>5,282.830</b>	<b>5,282.830</b>	<b>5,282.830</b>	<b>5,282.830</b>	<b>5,282.830</b>	
Transition costs																
Transition costs	1.000	-	-	-	-	329.600	329.600	-	-	-	-	-	-	-	-	-
<b>Grand total</b>						<b>54,412.379</b>	<b>1,676.667</b>	<b>4,502.499</b>	<b>3,586.967</b>	<b>4,914.328</b>	<b>5,282.830</b>	<b>5,925.096</b>	<b>6,153.518</b>	<b>5,536.484</b>	<b>6,099.229</b>	<b>5,282.830</b>
NPC						45,130.769										

## Appendix G Affordability model

	Set Up	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Yr 9	Yr 10
Pay Inflation %		0.00%	1.00%	1.00%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%
General Inflation %		0.00%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%
Expenditure Type	£	£	£	£	£	£	£	£	£	£	£
Top Cover, Management and Support & Hub											
Pay	30,000	868,498	877,183	885,955	908,104	930,806	954,076	977,928	1,002,377	1,027,436	1,053,122
Non Pay		170,444	174,705	179,073	183,550	188,138	192,842	197,663	202,604	207,669	212,861
Capital		271,228	0	0	0	0	202,509	0	109,643	0	0
Swansea - Air and Road (7am to 7pm)											
Pay	148,520	611,812	617,930	624,109	639,712	655,705	672,098	688,900	706,123	723,776	741,870
Non Pay		450,579	461,843	473,390	485,224	497,355	509,789	522,534	535,597	548,987	562,711
Capital		748,144	0	0	0	0	637,735	0	219,287	0	0
		1,062,391	177,065								
Welshpool - Air and Road (9am to 9pm)											
Pay	29,520	633,655	639,992	646,391	662,551	679,115	696,093	713,495	731,333	749,616	768,356
Non Pay		432,204	441,008	450,012	461,263	472,794	484,614	496,730	509,148	521,876	534,923
Capital		706,144	0	0	0	0	590,216	0	219,287	0	0
Total											
Pay	208,040	2,113,965	2,135,105	2,156,456	2,210,367	2,265,626	2,322,267	2,380,324	2,439,832	2,500,827	2,563,348
Non Pay		1,053,227	1,077,557	1,102,475	1,130,037	1,158,287	1,187,245	1,216,926	1,247,349	1,278,533	1,310,496
Total Revenue	208,040	3,167,192	3,212,661	3,258,930	3,340,404	3,423,914	3,509,512	3,597,249	3,687,181	3,779,360	3,873,844
Total Capital Including Optimism Bias											
		1,898,066	0	0	0	0	1,573,507	0	603,039	0	0



## Appendix H Letter of stakeholder support

Dear (CE of all HB, WAST, WAA and North Staffordshire)

EMRTS – Submission of Strategic Outline Programme to Welsh Government

The Emergency Medical Retrieval and Transfer Service (EMRTS) Programme Board submitted the Strategic Outline Programme cost bid to Welsh Government on 04/07/14 for consideration and approval and simultaneously are submitting to Chief Executives of partner organisations for approval and support.

The Programme Board was established following the agreement in principal by all Wales Chief Executives and Welsh Government to develop a Strategic Outline Programme (SOP) for a Welsh EMRTS service.

The Programme Board is a multi-disciplinary team made up of representatives from Health Boards in Wales, Welsh Ambulance Service Trust, Welsh Air Ambulance, North Staffordshire Foundation Trust, Welsh Government and EY as appointment management consultancy support. The Board submitted the final Strategic Outline Programme case with an agreed preferred option based on value for money and cost benefit analysis.

The SOP is a bid made to the Minister and Welsh Government for a capital and revenue development to establish an EMTRS service in Wales. The incremental additional costs of establishing and running the service are outlined in the Case.

The impact of the proposed service on Patient Flows has been forecast (in patient numbers) for each Health Board with indicative costs for the potential impact. The costs and impact of the changes in flow are outside the case being submitted and the assumption and requirement is that Health Boards will develop an appropriate agreed mechanism to ensure that receiving organizations are appropriately reimbursed for any additional activity.

The Clinical and Operational models considered and recommended have been developed in conjunction with all relevant organisations (HB, WAST, WAA, WG) through a series of workshops, meetings and road shows. The Programme Board has approved, and recommended, a Clinical and Operational model as included in the SOP.

The Commissioning and Hosting arrangements for the service have not yet been finalised and it is proposed that the Programme Board continues (with a revised constitution) to complete this work, the implementation preparation, and further submission of Business Justification Cases (BJC) following Welsh Government and Ministerial decision.

I would be grateful if you can confirm your Organisation's support of the principles and recommendations included in the SOP submission and recognize the following:-

- The Case for capital and 'incremental' revenue costs to establish and run the EMRTS service to be funded by WG.
- Recommendation for HB's to agree a detailed financial mechanism to account for changes in patient flow
- HB commitment to support Consultant Sessions release and with reimbursement as detailed in the Workforce communication circulated via Directors of Finance.
- Commitment of your Organisations current resources currently invested in this Programme pathway

Please can you confirm your support in writing to myself by 18<sup>th</sup> July 2014.

Thank you for your support

Yours sincerely

Grant Robinson  
SRO, EMRTS Programme

## Appendix I EMRTS Terms of Reference

1.Purpose	The EMRTS Programme Board is to oversee the development of a Strategic Outline Case (SOC)/Outline Business Case (OBC) for an EMRTS - type service for Wales. This will evolve into a Full Business Case (FBC).
2.Scope	<p>The scope encompasses the development of an All Wales emergency medical retrieval and transport service for patients with life threatening and emergency services. In conjunction with the Welsh Air Ambulance Charity Trust, the service will provide:</p> <ul style="list-style-type: none"> <li>▶ Stabilisation and retrieval of critically ill and injured patients (adults and children) from the scene (primary response).</li> <li>▶ Transfer of time critical ill and injured patients from peripheral to specialist centres (delayed primary response), augmenting and not replacing the existing critical care network.</li> <li>▶ Provision of medical advisor and critical care support at mass casualty/major incident events.</li> <li>▶ Coordination of these activities on an all Wales basis.</li> </ul> <p>The service will also support major incident planning in Wales. The proposed clinical model (pre hospital trained doctors with critical care paramedics) was agreed, by CEOs in December 2013. The refinement of the agreed clinical model will also explore the inclusion of transfer services for neonates and, if viable, for paediatric and maternity patients.</p> <p>The Programme Board has been established to progress the development of an emergency medical retrieval and transport service to:</p> <ul style="list-style-type: none"> <li>▶ Support the development of the South Wales Trauma network and the existing collaborative between North Wales and the West Midlands Major Trauma network.</li> <li>▶ Equally the service will support cardiac and stroke networks in Wales.</li> <li>▶ Support transfer of neonates</li> </ul> <p>The EMRTS will allow their reconfiguration plans to proceed safely whilst allowing patients to gain equality of access to time critical specialist services.</p>
3.Outcomes	<p>Introduction of the service will enable patients:</p> <ul style="list-style-type: none"> <li>▶ Patients to be stabilised sooner</li> <li>▶ Patients to receive enhanced clinical care</li> <li>▶ Patients to be transported more rapidly to a specialist centre for treatment and</li> <li>▶ Reduction in costs across the health economy through demonstration of better outcomes (economic appraisal as part of evaluation)</li> </ul>
4.Objectives	<p>The Programme Board will :</p> <ul style="list-style-type: none"> <li>▶ Review the progress of the EMRTS Programme, against the plan, giving approval to progress to future milestones. Of note, the Programme Board will approve the SOC/OBC for submission to NHS Wales Chief Executives and Welsh Government.</li> <li>▶ Establish the structures and process which will ensure effective Programme management is being adhered to, throughout the Programme timeline.</li> <li>▶ Ensure that all stakeholders are appropriately engaged throughout the development of the SOC/OBC.</li> <li>▶ Approve appropriate actions to ensure that ABMU is able to meet its commitments, in relation to the Programme resource.</li> </ul>

5.Governance	<p>ABMU have been tasked on behalf of the NHS Wales Chief Executives with leading the development of the SOC/OBC. The Programme Board has been established to support ABMU develop an Outline Business Case and associated recommendations for submission. The Programme reports to the NHS Wales Chief Executives Group.</p> <p>Prior to presenting to Chief Executives, the Programme Board will agree the content of the Business Case with key All Wales Executive Director Peer Groups to include:</p> <ul style="list-style-type: none"> <li>▶ Directors of Finance</li> <li>▶ Directors of Planning</li> <li>▶ Medical Directors</li> </ul> <p>It is anticipated that a smaller group will be formulated from key stakeholders to assist with decision making. This is currently under discussion. The composition of this group and their decision making capacity will also need to be determined.</p>
6.Membership	<p>This is a complex programme of work and its delivery will require all of those involved, directly or indirectly, in the care of patients with life threatening emergency conditions, across Wales, to work together. The board's membership has been designed to reflect the breadth of organisations and professions involved in pre-hospital care.</p> <p>The Programme Board shall comprise of delegated representatives from all Health Boards, WAST, the Welsh Air Ambulance Charity and the Critical Care Networks A full list of Programme Board members is contained in Appendix 1.</p> <p>Dr Phil Kloer (Director of Clinical Services, Hywel Dda UHB) has been chairing the Programme board meetings so far. A decision is being made as to who will be chairing subsequent Programme board meetings.</p>
7.Roles & Responsibilities	<p>The Programme Board has delegated authority from the CEO Group to finalise the SOC/OBC, including development of the clinical model, relating to finalisation of the preferred option.</p> <p>The Programme Board will overview the development of the SOC/OBC, within the context of the preferred option. In developing the model, the Programme Board will consider proposed and foreseeable changes to other acute services across the NHS in Wales. The role of the Programme Board will be to support ABMU to:</p> <ul style="list-style-type: none"> <li>▶ Provide appropriate advice and clinical input to enable the development of supporting workforce and financial assessments;</li> <li>▶ Undertake scrutiny and challenge of proposals and the work programme, to provide assurance on the robustness and viability of plans;</li> <li>▶ Ensure that proposed changes are consistent with the strategic direction of travel described in national and regional plans.</li> <li>▶ Secure and allocate necessary resources to manage the planning scheme, including establishing supporting work streams as necessary;</li> <li>▶ Ensure the work programme delivers its objectives on time and to the required quality standards;</li> <li>▶ Participate in the validation of any options appraisal work conducted.</li> <li>▶ Ensure that there is consideration of impact of proposed changes on all services;</li> <li>▶ Resolve conflicts and alignment issues between work programmes and identify and consider strategic risks;</li> <li>▶ Ensure effective communication by members of the Programme board to their respective organisations.</li> <li>▶ Ensure effective communication and ownership of the plans;</li> <li>▶ Ensure effective reporting mechanisms are in place to track delivery.</li> </ul>

	<p>Individual Programme Board members are expected to act as advocates of the Programme, within their respective organisations, enabling a two way channel of communication between the Programme and organisations that they represent. Members are empowered to discuss the Programme with interested parties, outside of Programme Board meetings, subject to any confidential information that is shared at the Programme Board.</p> <p>As nominated lead Health Board, ABMU will manage the Programme on a day-to-day basis, ensuring that the SOC/OBC is produced within the specified time. In addition, their duties will include:</p> <ul style="list-style-type: none"> <li>▶ Development and ownership of Programme plan, associated key milestones and risk and issues log</li> <li>▶ Taking the lead in drafting the SOC/OBC</li> <li>▶ Escalation of risks and issues to Programme Board</li> <li>▶ Agreement of agenda with the Programme Board Chair and ensuring production and collation of papers;</li> <li>▶ Taking Programme Board minutes and recording matters arising</li> <li>▶ Following up on actions to be carried through</li> </ul> <p>In addition, EY have been commissioned to provide specific support in the development of the Business Case.</p>
<b>8. Reporting</b>	The Programme Board will meet monthly, commencing in February 2014 with meetings scheduled until July 2014 in the first instance.
<b>9. Communication &amp; Engagement</b>	<p>The Board will provide Chief Executives, Directors of Planning, Medical Directors, Directors of Finance and Welsh Government with regular updates on progress. It will also respond to requests from the above groups to information as required.</p> <p>It will engage widely with stakeholders, as necessary, to develop the Business Case, using a range of methods. These will include amongst other things meetings, workshops, and written correspondence.</p>
<b>10. Constraints</b>	The Programme has to submit the SOC/OBC to Welsh Government by July 2014. It is assumed that the respective Health Board representatives on this Programme Board will engage with their individual Boards to obtain their approval, within this timescale.
<b>11. Risks</b>	<p>The Programme Board will receive and agree Programme risk and issue logs and take action accordingly to mitigate risks and resolve issues that have been elevated from within the Programme team.</p> <p>Risks will be managed in line with ABMU's risk management procedures, adopting the same scoring system, and those assessed as significant will be transferred to the ABMU Corporate Risk Register, as required.</p>
<b>12. Quality Controls</b>	The Programme Board will establish, as necessary, appropriate sub-groups to provide assurances and exceptions about specific aspects of quality improvement.
<b>13. Evaluation</b>	The terms of reference will be evaluated at the end of the Programme.

## Programme Board membership

NOTE: It is likely that a smaller group of decision makers from each organisation will need to be defined in due course with ability to feedback to their respective organisations. Their decision making capacity will also need to be determined.

Name	Organisation representing
Grant Robinson	Unscheduled Care lead for Wales
Huw Llewellyn (Programme manager)	Assistant Director of Finance, ABM UHB
Darren Griffiths	Director of Planning, ABM UHB
Pete Hopgood	Financial Resource Manager, ABM UHB
Dinendra Gill (clinical lead)	ABM UHB
Rhys Thomas (clinical lead)	ABM UHB
Paula Speirs	EY (Programme Lead)
Louise Gemmill	EY (Finance Lead)
Andrew Carruthers	Welsh Government
Val Whiting	Welsh Government (capital planning)
Robert Wilkinson	Welsh Government (capital planning)
Mike Collins	Executive Lead, WAST
Gordon Roberts	WAST
Richard Lee	WAST
Angela Hughes	Chief Executive, Welsh Air Ambulance Charity Trust (WAACT)
Kyle Jacques	Vice Chair, WAACT
Dave Gilbert	Chair, WAACT
Jo Mower	Cardiff & Vale UHB
Alice Casey	Cardiff & Vale UHB
Claire Richards	Neonatal Network
Jack Parry-Jones	Aneurin Bevan UHB
Sue O'Keefe	Critical Care Network
Edward Farley-Hills	Betsi Cadwaladr UHB
Suman Mitra	Betsi Cadwaladr UHB
Graham Mayers	Betsi Cadwaladr UHB
John Glen	Betsi Cadwaladr UHB
Phillip Kloer	Director of Clinical Services, Hywel Dda UHB
Richard Jones	Cwm Taf UHB
<b>Dom Hurford</b>	Cwm Taf UHB
Brendan Lloyd	Powys LHB
Peter Oakley	University Hospital of North Staffordshire NHS Trust
Helen James	Head of Procurement, NHS Wales
Gareth Roberts	Pre-hospital Emergency Medicine Trainee

Finalised and agreed by Programme board on the 7<sup>th</sup> May 2014

## Appendix J Benefit Beneficiaries

<p><b>Reduce health inequity</b> – Ensure that no population group receive substandard health care as a result of reconfiguration or geography.</p> <p><b>Beneficiaries:</b></p> <ul style="list-style-type: none"> <li>▶ Welsh population</li> <li>▶ Welsh Government</li> <li>▶ NHS Wales</li> <li>▶ LHB's</li> </ul>	<p><b>Geographical Inequity</b></p> <ul style="list-style-type: none"> <li>▶ <i>Triage and transport the patient to the correct receiving facility irrespective of where in Wales they are injured or become seriously ill.</i></li> <li>▶ <i>Support reconfiguration plans across Wales to proceed safely and effectively.</i></li> <li>▶ <i>Maintains and promotes patient confidence in the reconfiguration process.</i></li> </ul> <p><b>Improved access for Trauma and Critical Care</b></p> <ul style="list-style-type: none"> <li>▶ <i>Support the development of the South Wales and Powys Trauma Network and promote existing links between North Wales and Stoke Major Trauma Centre.</i></li> <li>▶ <i>Improve equity of access for specialised services specifically cardiac, stroke and rehabilitation networks.</i></li> <li>▶ <i>Support reconfiguration of acute emergency, neonatal, paediatric and maternity services through the EMRTS provision.</i></li> </ul> <p><b>Language inequity</b></p> <ul style="list-style-type: none"> <li>▶ <i>Explore instigation of bilingual coordination hub</i></li> </ul>
<p><b>Quality assurance in Clinical Care</b> – measurable improvement in quality of services.</p> <p><b>Beneficiaries:</b></p> <ul style="list-style-type: none"> <li>▶ Welsh population</li> <li>▶ NHS Wales</li> <li>▶ LHB's</li> <li>▶ WAST</li> </ul>	<p><b>Senior decision making capability through consultant led care direct from point of injury leading to:</b></p> <ul style="list-style-type: none"> <li>▶ Increased provision of evidenced based critical care interventions prior to, and during primary and secondary care transfers.</li> <li>▶ Sustainable improvements in survival and morbidity from major trauma, cardiac disease, stroke and severe sepsis through provision of EMRTS.</li> <li>▶ Meet and exceed UK and International standards for trauma provision and care.</li> <li>▶ Reduction in reported adverse events through improvements in patient care during transit.</li> <li>▶ Improved and sustainable functional outcomes and reduction in disability and impairment.</li> <li>▶ Provide a senior medical advisor for major incidents and mass casualty incidents.</li> </ul>

	<p><b>Improved patient flows</b></p> <ul style="list-style-type: none"> <li>▶ Reductions in secondary conveyance by a second ambulance resource.</li> <li>▶ A tangible reduction in transport time during secondary retrieval leading to earlier arrival at the specialist receiving facility.</li> <li>▶ Free staff groups for other work in primary referring hospital that ordinarily would have undertaken transfer.</li> <li>▶ Reduction in transport time for neonatal and paediatric retrieval teams for time critical cases leading to improved outcome in these groups.</li> </ul>
<p><b>Economic benefits</b> – demonstrating sustainable and continuing savings as a result of improvement in clinical care.</p> <p><b>Beneficiaries:</b></p> <ul style="list-style-type: none"> <li>▶ Welsh population</li> <li>▶ NHS Wales</li> <li>▶ LHB's</li> <li>▶ WAST</li> <li>▶ Welsh Air Ambulance Charity Trust</li> </ul>	<p><b>To the Welsh population as a whole:</b></p> <ul style="list-style-type: none"> <li>▶ <i>Enhanced recovery of patients and earlier return to working status.</i></li> <li>▶ <i>Increased disability adjusted life years and its associated economic benefit.</i></li> </ul> <p><b>To the Welsh NHS as a whole:</b></p> <ul style="list-style-type: none"> <li>▶ <i>Reduced overall cost of rehabilitation through correct triage, treatment and transport resulting from:</i></li> <li>▶ <i>Reduced length of stay for all, particularly the elderly patient.</i></li> <li>▶ <i>Reduction in waiting times and faster turnover for rehabilitation beds.</i></li> <li>▶ <i>Reduction in ED waiting times.</i></li> <li>▶ <i>Improvement in Ambulance service response times.</i></li> <li>▶ <i>Reduction in ICU length of stay for trauma patients.</i></li> </ul> <p><b>Individual Health boards</b></p> <ul style="list-style-type: none"> <li>▶ <i>Reduced ED attendances leading to reduction in ED waiting time targets.</i></li> <li>▶ <i>Improved recruitment and retention thereby reducing expenditure on locums to fill unfilled posts.</i></li> <li>▶ <i>Reduced time critical secondary transfers by HB's leading to better utilisation of anaesthetic staff.</i></li> <li>▶ <i>Ability for EMRTS to initiate emergency anaesthesia in rural facilities where there is no inherent facility.</i></li> <li>▶ <i>Improved mortality/morbidity for specific HB patients as a result of utility of EMRTS.</i></li> </ul>

	<p><b>Welsh Ambulance Service</b></p> <ul style="list-style-type: none"> <li>▶ <i>Direct discharge of patients at scene and reduction in conveyance to ED freeing up resources.</i></li> <li>▶ <i>Reduction in number of separate time critical secondary transfers</i></li> <li>▶ <i>Enhanced training of paramedics through CCP programme and direct on the job training by prehospital specialist having widespread benefits to population.</i></li> <li>▶ <i>Improved response times.</i></li> </ul> <p><b>Wales Air Ambulance Charity Trust</b></p> <ul style="list-style-type: none"> <li>▶ <i>Enhanced support for the charity through inclusion in a sustainable quality assured and benchmarked prehospital system demonstrating better outcomes of the patients it transports and delivers from Neonates to Adults.</i></li> <li>▶ <i>Reduction in stand-down rates for air ambulance charity leading to improved revenue retention.</i></li> </ul>
<p><b>Workforce planning and development</b> – increased opportunity to train and educate staff.</p> <p><b>Beneficiaries:</b></p> <ul style="list-style-type: none"> <li>▶ NHS Wales</li> <li>▶ LHB's</li> <li>▶ Welsh Ambulance Service</li> <li>▶ Welsh Air Ambulance Charity Trust</li> <li>▶ Fire Service</li> <li>▶ Police Service</li> <li>▶ Maritime Coastguard Agency</li> <li>▶ Military</li> </ul>	<ul style="list-style-type: none"> <li>▶ Specialty specific recruitment and retention of high quality candidates to Wales which is currently suffering a significant recruitment problem particularly in Emergency Medicine.</li> <li>▶ On the job learning benefit to wider population of WAST personnel through involvement in prehospital critical care cases and subsequent debrief with EMRTS personnel at scene and at clinical governance days.</li> <li>▶ Support National Pre-hospital Emergency Medicine (PHEM) training in Wales.</li> <li>▶ Support the development of Critical Care Paramedics (CCP's) in Wales.</li> <li>▶ Extended working and training with other pre-hospital groups such as HART, Fire service, HMS Coastguard paramedics, Police Firearms teams through joint training initiatives.</li> <li>▶ Opportunities for WAST, Coastguard and Military Paramedics, medical students and junior doctors to gain exposure and training with EMRTS through the provision of observer shifts.</li> </ul>
<p><b>Vertical integration with community &amp; primary care</b> - Ensure improved integration with local community health</p>	<ul style="list-style-type: none"> <li>▶ Related to reducing health inequity is integration by serving rural populations which currently lack access to specialist care.</li> <li>▶ Supporting GP where emergencies occur in Minor Injury</li> </ul>

<p>providers.</p> <p><b>Beneficiaries:</b></p> <ul style="list-style-type: none"> <li>▶ Local community (inc. rural)</li> <li>▶ Primary care</li> </ul>	<p>Units.</p>
<p><b>Alignment with commissioners/stakeholder priorities</b> – ensure key stakeholder objectives are aligned with the proposal.</p> <p><b>Beneficiaries:</b></p> <ul style="list-style-type: none"> <li>▶ Welsh population</li> <li>▶ Welsh Government</li> <li>▶ NHS Wales</li> <li>▶ Health boards</li> <li>▶ WAST</li> <li>▶ Welsh Air Ambulance Charity Trust</li> </ul>	<ul style="list-style-type: none"> <li>▶ The phasing of EMRTS will support the proposed reconfiguration plans in Wales.</li> <li>▶ It is an essential enabler of the early reconfiguration of acute services in South Wales and an integral part of the changes being considered by Hywel Dda HB.</li> <li>▶ It underpins the successful development of the South Wales &amp; Powys Trauma Network under the South Wales Collaborative.</li> <li>▶ Allows the Air Ambulance Charity to transform from the traditional UK Paramedic model of care into a Physician led critical care service aligning with international standards and public perception.</li> <li>▶ Help WAST realise its clinical reform programme.</li> </ul>
<p><b>Technical deliverability</b> – option is practically deliverable from a technical perspective.</p> <p><b>Beneficiaries:</b></p> <ul style="list-style-type: none"> <li>▶ Welsh population</li> <li>▶ NHS Wales</li> <li>▶ LHB's</li> <li>▶ Welsh Ambulance Service</li> <li>▶ Welsh Air Ambulance Charity Trust</li> </ul>	<ul style="list-style-type: none"> <li>▶ Utilisation of existing infrastructure (e.g. WAACT helicopters, bases, pilots) and personnel (WAST paramedics).</li> <li>▶ The development of a central coordination hub has already commenced.</li> <li>▶ Several consultants already job planned and wide interest from high quality candidates outside Wales.</li> <li>▶ Ensuring that the lead organisation will have proven and sustainable ability to deliver the clinical governance framework for critical care doctors, procurement of critical care equipment and control of blood products and drugs that are not currently in use.</li> </ul>

## **Appendix K RPA1 - EMRTS**

### INTRODUCTION

It is **mandatory** for all Senior Responsible Owners (SRO) to complete an (RPA1) at the beginning of a programme/project and at key decision points in their lifecycles (if you need additional guidance on completion of the RPA1 please contact the Integrated Assurance Hub via the Programmes and Projects mailbox [Programmes&Projects@wales.gsi.gov.uk](mailto:Programmes&Projects@wales.gsi.gov.uk))

The WG Risk Potential Assessment form part 1, (RPA1) is designed to provide a standard set of high-level criteria for assessing the initial risk potential of a programme/project in a strategic context.

The RPA1 has two purposes: (a) for identifying potential risk of all programmes/projects across WG for use by the Integrated Assurance Hub, and (b) for determining the most applicable assurance method for a programme/project.

The RPA enables a conversation to be had about the risks and responsibilities that the SRO has for delivery. The RPA can also help the programme/project to identify areas where specific skills sets may be required.

### HOW TO COMPLETE THIS FORM

The RPA1 is the first step in the external assurance process, and requires the Senior Responsible Owner (SRO) supported by the programme/project manager, to consider the programme/project through a strategic assessment of the potential consequential impact, should the programme/project fail to deliver its objectives or outcomes.

These assessments are made using the knowledge and judgement of the SRO and programme/project team and should be considered in the light of a programme/project's strategic context. The majority of answers require the appropriate box to be checked, however, a short explanatory note of the reasoning for each mark is also required to provide further detail for the Integrated Assurance Hub and an audit trail of the considerations.

The completed RPA1 will be assessed by the Integrated Assurance Hub and where programmes/projects have been primarily assessed as medium risk or higher then completion of a further Complexity Assessment (**RPA2**) is required. Where programmes/projects have been primarily assessed as low risk, the Integrated Assurance Hub will advise the SRO of the outcome and offer further support if required.

## PART 1: For completion by the SRO

<b>SECTION A: PROGRAMME / PROJECT DETAILS</b>	
Programme/Project Name	EMERGENCY MEDICAL RETRIEVAL AND TRANSFER SERVICE (EMRTS)
SRO Name	DR GRANT ROBINSON, DIRECTOR OF CLINICAL STRATEGY, PUBLIC HEALTH WALES
SRO Contact Details	PA 01443 233382 WHTN: 1754 4882 Epost/Email: <a href="mailto:catherine.thomas28@wales.nhs.uk">catherine.thomas28@wales.nhs.uk</a> <a href="mailto:Grant.robinson@wales.nhs.uk">Grant.robinson@wales.nhs.uk</a>
Department/Division	
Programme/Project Type	<input type="checkbox"/> Policy <input type="checkbox"/> Legislation <input type="checkbox"/> ICT enabled (have you completed a ICT Project Approval Form (IPAF) <input checked="" type="checkbox"/> Business change <input type="checkbox"/> Infrastructure <input type="checkbox"/> Construction <input checked="" type="checkbox"/> Capital <input type="checkbox"/> Other (Please specify below:) <div style="border: 1px solid black; height: 40px; width: 100%; margin-top: 5px;"></div>
<p>Please provide a brief overview of the programme/project:</p> <p>The purpose of this Strategic Programme Business Case is to present proposals for the introduction of a new All Wales Emergency Medical Retrieval Transport Service (EMRTS). The overall level of capital spend required to deliver the preferred option is [to be confirmed] reflecting the preferred option, and a revenue commitment varying between [to be confirmed in next version]. This document:</p> <ul style="list-style-type: none"> <li>• Defines the required strategic outcomes for EMRTS</li> <li>• Defines a service model to deliver these outcomes</li> <li>• Develops a specification for this service model covering outcomes, key KPIs and scope of service in each level tested against a set of agreed benefits</li> <li>• Profiles the financial envelope in scope and the impact of future funding changes</li> <li>• Profiles the financial challenge presented by the demand</li> <li>• Appraises a set of options that will support delivery of the outcomes in the specification</li> <li>• Outlines the key next steps</li> </ul>	

**SECTION B: ORGANISATIONAL COMMITMENTS**

Does the programme/project satisfy a ministerial commitment?	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
If YES, please state who is the responsible minister(s)	Mark Drakeford
Does the programme/project cut across ministerial portfolios?	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
If YES, please state which portfolios	
Does the programme/project satisfy a major policy commitment?	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
If YES, which policy? Eg Programme for Government	NHS Wales Service Change Plans
Does the programme/project satisfy a legislative requirement?	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
If YES, please clarify:	Explanatory Note: <div style="border: 1px solid black; height: 60px; width: 100%;"></div>

<b>SECTION C: PROGRAMME / PROJECT BUDGET</b>					
How much is the projected budget for the programme/project?					
N.B. when completing this part of the form, please take into account the <u>whole-life costs</u> of the programme/project (as defined by HM Treasury Green Book)					
Up to £50k	£50k - £250K	£250K - £1m	£1m - £5m	£5m and above	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> x	
How long is the programme/project expected to run?					
Up to 1 yr	Up to 2yrs	Up to 3yrs	Up to 4yrs	Up to 5yrs	Unknown
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Is funding secured and in place for the entire lifecycle of the programme/project?			<input type="checkbox"/> YES		
			x <input type="checkbox"/> NO		
If NO, what is the deficit?			£		
			Time:		
			Explanatory Note:		
			<div style="border: 1px solid black; padding: 5px;">           A review planned at end of 12 months to evaluate benefits and determine any further phases. An initial Programme Case submitted to Welsh Government for initial phases Capital and Revenue.         </div>		
Does the programme/project receive external funding? Eg Wales Infrastructure Investment Plan Funding			n/a		

<b>SECTION D: STAFF IMPACT</b>					
Is the programme/project concerned with business, operational or ICT-enabled change?			<input checked="" type="checkbox"/> YES  <input type="checkbox"/> NO		
If YES please provide additional information:			<b>Explanatory Note:</b> Introduction of new medically-led Emergency Retrieval and Transfer Service (EMRTS) at two bases within NHS Wales.		
How many staff within the organisation will be affected by the programme/project?					
1-100	100-250	250-500	500-1,000	1,000 +	All staff
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Does the programme/project involve the physical movement of staff?			<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO		
If yes, how many approximately			It is a mobile service from two bases.		
Will there be any training requirements involved in the final delivery of the programme/project output(s)?			<input checked="" type="checkbox"/> YES  <input type="checkbox"/> NO		
If YES please provide more detail:			<b>Explanatory Note:</b> Given the specialist nature of the work, training will be required for paramedics and consultants.		

<b>SECTION E: PROGRAMME/PROJECT DEPENDENCIES</b>	
Is the programme/project dependant upon the delivery of another programme/project to meet its objectives?	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
If YES please clarify:	<b>Explanatory Note:</b> <div style="border: 1px solid black; padding: 5px;">           But benefits can be enhanced by other developments e.g. major trauma network         </div>
Is there another programme/project within the organisation that is dependant on this programme/project delivering to time and cost?	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
If YES please clarify:	<b>Explanatory Note:</b> <div style="border: 1px solid black; padding: 5px;">           But is an enabler to reconfiguration in South West Wales particularly.         </div>
Has a scoping exercise been undertaken to ensure that there is no duplication of work in any other part of the organisation?	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
Does the programme/project have external stakeholders?	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
Have all key stakeholders been identified and engaged?	<input checked="" type="checkbox"/> YES – all key stakeholders identified and engaged  <input type="checkbox"/> Most stakeholders identified and engaged  <input type="checkbox"/> Some stakeholders identified but no engagement to date  <input type="checkbox"/> Stakeholders not yet identified

<b>SECTION F: SECURITY</b>	
Has Privacy Impact Assessment (PIA) screening been undertaken?	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
If NO please complete the PIA screening tool:	

 gateway hub - template - pia f...	
Does screening indicate that a formal PIA assessment is required?	<input type="checkbox"/> YES <input type="checkbox"/> NO
If YES, has the PIA been undertaken?	<input type="checkbox"/> YES <input type="checkbox"/> NO
<b>Please supply the following documentary evidence:</b> <ul style="list-style-type: none"> <li>• Copy of completed PIA screening tool</li> <li>• Copy of PIA report (where formal PIA undertaken)</li> </ul>	

<b>Section G: SRO ENDORSEMENT</b>	
I am satisfied that the initial Risk Potential Assessment provides an accurate reflection of the programme/project at this stage of development.	
Signed (Senior Responsible Owner)	Date
I will re-asses the programme/project if there is a significant change to the programme/project scope or budget or if significant changes emerge that may threaten successful delivery.	
Signed (Senior Responsible Owner)	Date

<b>SECTION H: ASSESSMENT BY INTEGRATED ASSURANCE HUB</b>	
I am satisfied that the SRO's assessment of the programme/project, as recorded above, is an accurate reflection of the programme/project's risk potential at this stage of development.	
Signed (Integrated Assurance Hub)	Date
Based on the information provided, the risk potential of this programme/project is assessed as:	<input type="checkbox"/> Very High Risk <input type="checkbox"/> High Risk <input type="checkbox"/> Medium Risk <input type="checkbox"/> Low Risk
Does the programme/project require external assurance?	<input type="checkbox"/> YES - RPA2 required for validation <input type="checkbox"/> NO

<b>SECTION I : FILING / RECORDING ARRANGEMENTS BY THE PROGRAMME/PROJECT</b>
---

Retain a copy of this completed and signed form with the official record for the programme or project. <input type="checkbox"/>
--

If this assessment relates to a grant-funded project, a copy of this form must be sent to the Grants team.
--

<input type="checkbox"/> sent          date:
--

If this assessment relates to a Wales Infrastructure Investment Plan funded project, a copy of this form must be sent to the WIIP team.
---

<input type="checkbox"/> sent          date:
--

If this assessment relates to a Programme and Project Management-funded project, a copy of this form must be sent to the Programme and Project Management Division.
---

<input type="checkbox"/> sent          date:
--

## Appendix L EMRTS proposed Data Specification and dataset



# NHS WALES EMERGENCY MEDICAL RETRIEVAL & TRANSFER SERVICE (EMRTS)

Database Specification & Data-set

David Rawlinson & Clinical Leads

### Document History

Date	Change	Author
01/03/2014	Created	DR
19/03/2014	Euro consensus	DR
26/03/2014	Scot EMRS KPI's	DR
11/04/2014	Prof R Lyons Comments, DB spec added	DR
12/04/2014	Added information on table relationship in database	DR
15/04/2014	Change to number of records	DR
27/04/2014	Inclusion of cost breakdown for suppliers	DR
01/05/2014	Reduced dataset/ transfer separate section	DR

## Introduction

This document details the preliminary data-set for the Wales EMRTS.

### Aims

- ▶ Clinical care record
- ▶ Handover of care to other health care professionals
- ▶ Database for research into the effectiveness of the service/ Trauma Network
- ▶ Output suitable for
  - ▶ Trauma Audit & Research Network (TARN) UK
  - ▶ Resuscitation Council (UK)
  - ▶ Wales version of “VSTORM” with Swansea University
  - ▶ Trauma network
- ▶ Provide evidence of “measurable benefits” of the service
- ▶ Provide Key Performance Indicators
- ▶ Logistical planning of the service
- ▶ Training benefits
- ▶ Individual health care professional Logbooks for professional development/ revalidation evidence
- ▶ Medico-Legal
- ▶ Public/ Press relations information output
- ▶ Financial Planning
- ▶ Comparison with other services

### Methods

Combination of published Data-sets, dictionaries and outcome information from the following sources

- ▶ Victorian State Trauma Outcomes Registry (VSTORM)
- ▶ Trauma Audit & Research Network (TARN) UK
- ▶ Ulstein Trauma Template (Euro TARN)
- ▶ Resuscitation Council UK (RC UK)
- ▶ Welsh Critical Care Network
- ▶ UK HEMS
- ▶ Royal College of Physicians proposed data standard for ambulance services, NHS Informatics Unit
- ▶ Trauma.org
- ▶ Scotland Emergency Medical Retrieval Service
- ▶ Wessex working group report
- ▶ Information Health Record (IHR)
- ▶ A Consensus-based template for documenting and reporting in physician-staffed pre-hospital services, Kruger et al. Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine 2011, 19:71
- ▶ North Staffordshire BASICS EPRF Project

## Data Collection

### Overview

The following sections detail the data headings for each data set. We have divided data collection into Pre-Hospital, Hospital and Outcome/ Follow up data to represent the different sources of data collection. These data-sets will be linked into a bespoke registry database, which in turn will be used to produce reports required for various parts of the service, and external agencies. These reports are detailed later in the document. Data-points described will be recorded as a single instance per record unless otherwise specified e.g. observations where there will be multiple instances for each data-point in each record.

### Database Specification

- ▶ Accessible securely via internet across Wales at multiple sites, including mobile usage.
- ▶ 100 Users, with varied levels of individual access
- ▶ 8 Mobile terminals linked to database (3<sup>rd</sup> party system with universal output)
- ▶ Web interface
- ▶ 3200 New records per year
- ▶ 500 Data Points
- ▶ Multimedia Data collection including digital photographs, annotated diagrams.
- ▶ Ability to work offline on mobile terminals (Data Input only)
- ▶ Customizable dashboards for management, clinicians, research and partner agencies.
- ▶ Export in universal format, or print.

Figure 1 aims to give an overview of data flow within the system

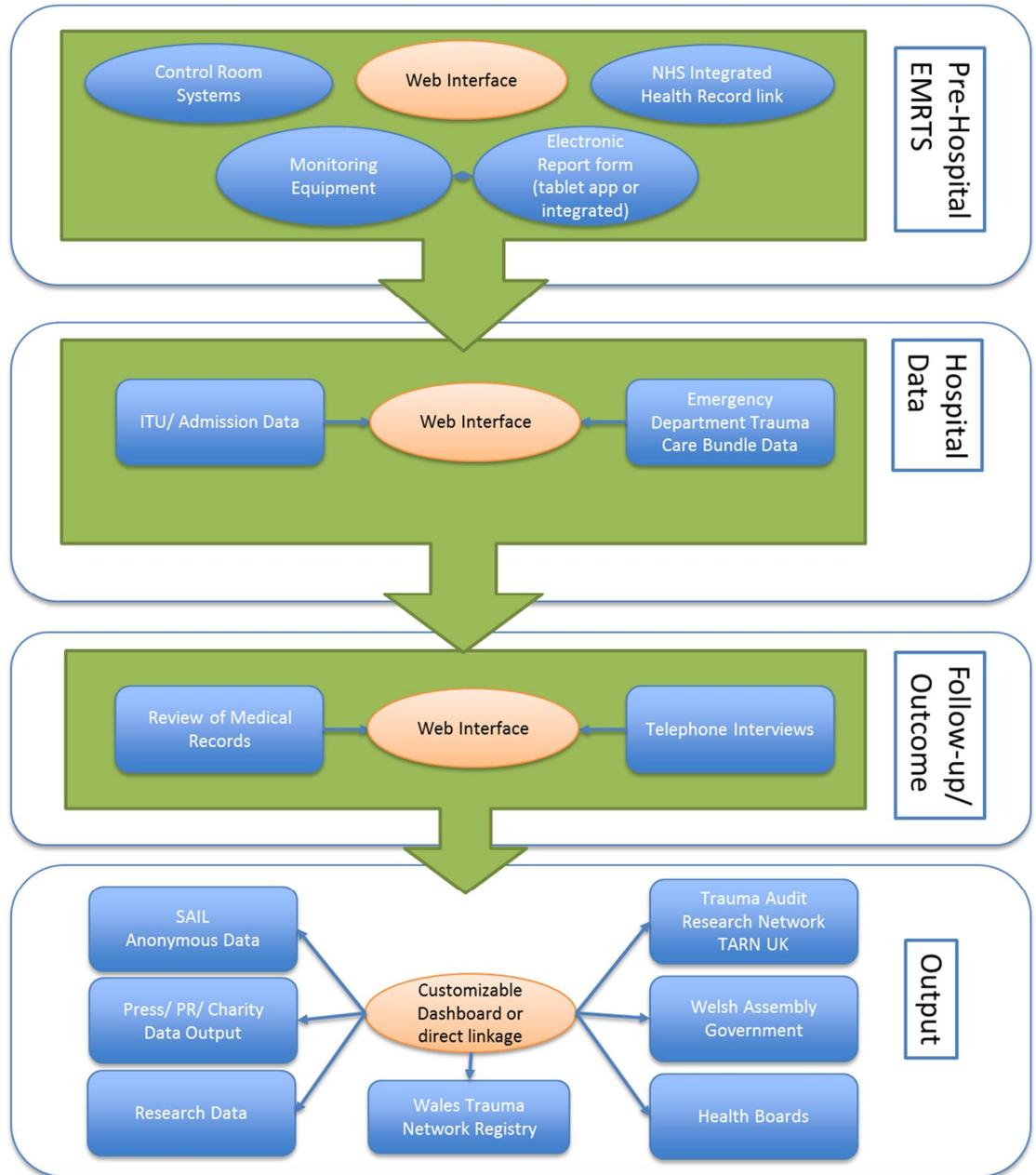


Figure 2 Data Flow Diagram

## Costs – information for potential suppliers

### Envisaged breakdown of Costs

- ▶ Database Design, creation, implementation
- ▶ User interface design (data entry) – web form
  - ▶ Pre-Hospital
  - ▶ Control Room
  - ▶ Emergency Department
  - ▶ Ward
  - ▶ ITU
  - ▶ Follow-up
- ▶ Hosting of database
- ▶ Ongoing service commitment
- ▶ Updates to design
- ▶ Dashboard Design
  - ▶ Pre-Hospital Service (EMRTS)
  - ▶ Emergency Department
  - ▶ Trauma Network
  - ▶ Critical Care Network
  - ▶ Health Boards
  - ▶ Management
- ▶ Integration
  - ▶ Import/ link Functions
    - ▶ Monitoring equipment
    - ▶ Electronic Patient Report Form
    - ▶ Control Room systems
    - ▶ Integrated Health Record (NHS)
  - a. Export/ Link/ Reporting
    - ▶ TARN
    - ▶ SAIL
    - ▶ Press Release
    - ▶ Charity- Air Ambulance
    - ▶ Welsh Assembly Government
    - ▶ Health Boards

## Pre-Hospital Data

To be collected from both electronic patient report form (EPRF), and in control room where appropriate/ possible.

- ▶ Exported to Master database from EPRF.
- ▶ Covers Transfers and Primary Response
- ▶ Sources:
  - ▶ Direct entry by staff
  - ▶ Control room
  - ▶ Automated physiological observations
  - ▶ Autocompleted from Integrated Health Record (IHR) data
  - ▶ Look-up tables of commonly used data (postcodes, Staff, hospitals etc.)
  
- ▶ General
  - ▶ Unique ID (key)
  - ▶ Call-Sign
  - ▶ Response Vehicle
  - ▶ Source of call
  - ▶ Source Specifics
  - ▶ Incident Number
  - ▶ Type of Dispatch
  - ▶ Result of Dispatch
- ▶ Times
  - ▶ Incident
  - ▶ Call Received
  - ▶ Dispatch
  - ▶ Crew Mobile
  - ▶ First on scene?
  - ▶ Time of First amb on Scene
  - ▶ Arrival
  - ▶ With Patient
  - ▶ Left Scene
  - ▶ Arrived at Destination
  - ▶ Clear
- ▶ Incident
  - ▶ Type
  - ▶ Location
  - ▶ Normal place of residence?
  - ▶ Triage urgency code
  - ▶ Post-dispatch instructions
  - ▶ Other agencies present
  - ▶ Other Vehicle Call sign
  - ▶ Pre-alert
  - ▶ Time Critical?
  - ▶ Notes
  - ▶ Photo/ Diagram
- ▶ Patient

- ▶ First Name
- ▶ Surname
- ▶ Date of birth
- ▶ Patient sex
- ▶ Gender
- ▶ NHS number
- ▶ House Number
- ▶ House Name
- ▶ Road
- ▶ Area
- ▶ City/ Town
- ▶ Postcode
- ▶ Patient telephone number
- ▶ Relevant contacts
- ▶ Participation in research
- ▶ General Practitioner (GP)
  - ▶ GP name
  - ▶ GP practice details
  - ▶ GP practice identifier
- ▶ Responsible HCP
  - ▶ Responsible health or care professional
  - ▶ Health or care professional(s) present
- ▶ Medical Details
  - ▶ Medical Problem
  - ▶ Presenting complaints or issues
  - ▶ Relevant past medical, surgical and mental health history
  - ▶ Co-Morbidity
  - ▶ Drug History
  - ▶ Systems Review
  - ▶ Allergies
  - ▶ Examination Details
  - ▶ Examination Diagram
  - ▶ Problems and issues
  - ▶ Diagnosis
  - ▶ Differential diagnosis
  - ▶ Information and advice given
- ▶ Injury
  - ▶ Dominating Type of Injury
  - ▶ Injury Cause
  - ▶ Injury Intent
  - ▶ Injury Activity
  - ▶ Injury Place
  - ▶ Injury Type
  - ▶ Entrapment
  - ▶ Entrapment Time
- ▶ Social
  - ▶ Smoking
  - ▶ Alcohol intake
  - ▶ Recreational substance use
- ▶ Legal
  - ▶ Consent

- ▶ Record of refusal
- ▶ Deprivation of liberty
- ▶ Mental capacity assessment
- ▶ Advance decision
- ▶ Advance statement
- ▶ Lasting or enduring power of attorney or similar
- ▶ Consent relating to child
- ▶ Safeguarding issues
- ▶ Organ and tissue donation
- ▶ Observations (Multiple Instances per record)
  - ▶ Time
  - ▶ HR
  - ▶ Rhythm
  - ▶ FiO2 %
  - ▶ SpO2 %
  - ▶ RR
  - ▶ BP Sys mmHG
  - ▶ BP Dia mmHG
  - ▶ MAP
  - ▶ BM
  - ▶ Temp
  - ▶ ETCO2 Confirmed
  - ▶ ETCO2
  - ▶ GCS E
  - ▶ GCS V
  - ▶ GCS M
  - ▶ GCS
  - ▶ L pupil size
  - ▶ R pupil size
  - ▶ L pupil React
  - ▶ R pupil React
  - ▶ Pain Score
  - ▶ Manual Entry?
- ▶ Procedures (Multiple Instances per record)
  - ▶ Procedure
  - ▶ Clinician
  - ▶ Site
  - ▶ Size
  - ▶ Laterality
  - ▶ Attempts
  - ▶ Success?
  - ▶ Extra/ Specifics for skill
- ▶ Drugs/ Fluid (Multiple Instances per record)
  - ▶ Time Given
  - ▶ Medication name
  - ▶ Route
  - ▶ Dose
  - ▶ Units
  - ▶ Medicine batch number
  - ▶ Medicine expiry date
  - ▶ Infusion Rate

- ▶ Infusion Units
- ▶ Clinician
- ▶ Disposition
  - ▶ Disposition type
  - ▶ Disposition location
  - ▶ Local Hospital bypass
  - ▶ Local Hospital bypass reason
  - ▶ Bypass exception
- ▶ Referral
  - ▶ Referral to
  - ▶ Reason for referral
  - ▶ Referral Date
  - ▶ Referral Time
  - ▶ Person to attend with patient
  - ▶ Attachments
  - ▶ Referral criteria
  - ▶ Expectation of referral
- ▶ Discharge
  - ▶ Discharge date
  - ▶ Discharge time
  - ▶ Discharge reason
  - ▶ Discharge destination
  - ▶ Discharged into care of
  - ▶ Discharge address
  - ▶ Life extinct (ROLE)
  - ▶ Evidence for decision
  - ▶ Date and time life extinct confirmed
- ▶ Handover
  - ▶ Person receiving handover
  - ▶ Name
  - ▶ Designation or role
  - ▶ Grade
  - ▶ Specialty
  - ▶ Contact details
- ▶ Person completing record
  - ▶ Name
  - ▶ Designation or role
  - ▶ Grade
  - ▶ Specialty
  - ▶ Contact details
  - ▶ Date completed
- ▶ Miscellaneous
  - ▶ Press release information
  - ▶ M&M record of review
  - ▶ M&M record of actions
  - ▶ Critical Incident
  - ▶ Critical incident detail
  - ▶ Equipment failure

## Calculated Values

- ▶ Registry Procedures
  - ▶ Diagnostic Procedures
  - ▶ Therapeutic Procedures
  - ▶ Drugs to facilitate airway procedure
  - ▶ Device used in successful airway management
  - ▶ Breathing procedures used
  - ▶ Circulation procedures used
  - ▶ Disability procedures used
  - ▶ Medication, drugs administered
  - ▶ Type of medication
- ▶ Registry Observations (To be derived from Observation Data Table)
  - ▶ GCS first
  - ▶ GCS last
  - ▶ Heart Rate first
  - ▶ Heart Rate last
  - ▶ Systolic BP first
  - ▶ Systolic BP Last
  - ▶ Cardiac Rhythm- first
  - ▶ Cardiac Rhythm- Last
  - ▶ SpO2- First
  - ▶ SpO2-Last
  - ▶ Pain-First
  - ▶ Pain-Last
  - ▶ Respiratory Rate- First
  - ▶ Respiratory Rate-Last

## Transfers

Data to be collected for Wales Critical Care Network for retrievals.

May be some common areas with primary missions, so just different data entry form

- ▶ Transfer General
  - ▶ Transfer Reason
  - ▶ Transfer Details
  - ▶ Transferred from
  - ▶ Recipient Hospital
  - ▶ Clinical Diagnosis (inc. Injuries)
  - ▶ Reason for Transfer
- ▶ Transfer Staff Arranging
  - ▶ Referring Doctor
  - ▶ At receiving Hospital
  - ▶ Escorting Personnel
  - ▶ Escort 1
  - ▶ Escort 2
  - ▶ Pre Transfer Observations
  - ▶ Pre-Transfer Investigations
- ▶ Transfer Ambulance Details
  - ▶ Time of ambulance control contact
  - ▶ Time requested for
  - ▶ Time patient ready
  - ▶ Time arrived
  - ▶ Time departure
  - ▶ Time arrival at receiving hospital
- ▶ Transfer other
  - ▶ Spinal Immobilisation
  - ▶ Checklist
  - ▶ Airway details
  - ▶ Lines & Catheters
  - ▶ Monitors
  - ▶ Obs Chart
  - ▶ Summary of transfer clinician
  - ▶ Summary of transfer receiving clinician
  - ▶ Signatures

Transfer form

## Hospital Data

Data to be collected in hospital by research assistant by review of medical notes, and / or attendance at trauma cases.

- ▶ **ADMISSION**
  - ▶ Admission Number
  - ▶ Hospital
  - ▶ Hospital Number
  - ▶ Arrival Date/ Time
  - ▶ Source
  - ▶ Source other
  - ▶ Referral Hospital
  - ▶ Trauma team activation
  - ▶ Triage Category
  - ▶ FiO2
  - ▶ Temperature
  - ▶ PH
  - ▶ Intubation
  - ▶ Intubation date
  - ▶ Head CT
  - ▶ Head CT Date
  - ▶ Alcohol test type
  - ▶ Alcohol
  - ▶ Departure status
  - ▶ Departure time
  - ▶ ICU length of stay
  - ▶ ICU longer than 24 hours
  - ▶ Ventilated Hours
  - ▶ Blood Given
  - ▶ Paediatric Airway
  - ▶ Paediatric CNS
  - ▶ Paediatric cutaneous
  - ▶ Paediatric skeletal injury
  - ▶ paediatric weight
- ▶ **INJURIES (Multiple Instances per record)**
  - ▶ AIS Code
  - ▶ Injury description
  - ▶ ISS body region
- ▶ **OPERATIONS AND PROCEDURES (Multiple Instances per record)**
  - ▶ Operation code
  - ▶ Operation start time
  - ▶ Operation finish time
  - ▶ Operation urgent
  - ▶ Operation description
- ▶ **ICD DIAGNOSES (Multiple Instances per record)**
  - ▶ ICD diagnosis code

- ▶ DHS prefix
- ▶ ICD PROCEDURES (Multiple Instances per record)
  - ▶ ICD procedure code
- ▶ DISCHARGE
  - ▶ Discharge date
  - ▶ Discharge type
  - ▶ Discharge other
- ▶ TRANSFER
  - ▶ Transfer hospital
  - ▶ Transfer reason
- ▶ Variables for APACHE / SAPS 2
  - ▶ Temperature
  - ▶ BP Sys
  - ▶ MAP
  - ▶ HR
  - ▶ RR
  - ▶ FiO2
  - ▶ PaO2
  - ▶ PaCO2
  - ▶ A-a gradient
  - ▶ Mech Vent/ CPAP?
  - ▶ PH
  - ▶ K
  - ▶ NA
  - ▶ Creat
  - ▶ Hct
  - ▶ Bicarbonate
  - ▶ Bilirubin
  - ▶ WCC
  - ▶ Blood Urea Nitrogen
  - ▶ GCS
  - ▶ Chronic Dx
  - ▶ Age
  - ▶ Admission Type
  - ▶ Urine Output 1st 24 Hr
  - ▶ AIDS
  - ▶ Metastatic carcinoma
  - ▶ Hematologic malignancy
- ▶ TIS 28
  - ▶ List of options to select from therapeutic interventions

## Outcome/ Follow up data

To be collected by telephone interview, or visits by research assistant and Critical Care Paramedics.

- ▶ Outcome
  - ▶ Coroner
- ▶ Initial contact
  - ▶ Type of letter sent
  - ▶ Letter date
  - ▶ Letter returned
  - ▶ Re-sent letter
  - ▶ Type of contact
  - ▶ Contact date
  - ▶ Contact person
  - ▶ Reason for contact
  - ▶ Death date
  - ▶ Notes
- ▶ Patient demographics
  - ▶ Working/ Studying prior to injury
  - ▶ Occupation prior to injury
- ▶ Contact attempts
  - ▶ Date/ Time of contact attempt
  - ▶ Contact attempt notes
  - ▶ Contact attempt status
  - ▶ Death date
  - ▶ Completion date
  - ▶ Contact person
  - ▶ Consent for further interviews
  - ▶ Additional comments
- ▶ Patient interview
  - ▶ Current residential status
  - ▶ Current residential status (specify)
  - ▶ Return to work
  - ▶ Return to work (same organisation)
  - ▶ Return to work (same role)
- ▶ EQ5D
  - ▶ EQ5D 1
  - ▶ EQ5D 2
  - ▶ EQ5D 3
  - ▶ EQ5D 4
  - ▶ EQ5D 5
- ▶ Global Outcome Assessment/ Glasgow Outcome Score
  - ▶ GBL1
  - ▶ GBL2
  - ▶ GOS1
  - ▶ GOS2A
  - ▶ GOS2B
  - ▶ GOS2C
  - ▶ GOS3A

- ▶ GOS3B
- ▶ GOS4A
- ▶ GOS4B
- ▶ GOS5A
- ▶ GOS5B
- ▶ GOS5C
- ▶ GOS6A
- ▶ GOS6B
- ▶ GOS6C
- ▶ GOS7A
- ▶ GOS7B
- ▶ GOS7C
- ▶ GOS8A
- ▶ GOS8B
- ▶ Epilepsy medication
- ▶ epileptic fits
- ▶ GOS Overall rating
- ▶ GOS-E Overall rating

## Appendix M Project Board Costs

Programme Board - To cover BJC and Implementation Phase - Period of 6 Months

	£
Clinical Lead Payments ( 2 x 3 sessions)	35,100
Programme Manager ( Band 8c) 1.0 wte	30,469
Admin Support (Band 4) 0.5 wte	6,875
Project Support	11,700
Financial Support	25,000
<b>Total</b>	<b>109,144</b>

All costs are as stated for a 6 month period

## **Appendix N Letter of Response on Patient Flows from Cardiff and Vale LHB**



**Ysbyty Athrofaol Cymru  
University Hospital of Wales**

Parc y Mynydd Bychan  
Caerdydd CF14 4XW  
Ffôn 029 2074 7747  
Ffacs 029 20743838  
Minicom 029 2074 3632

Heath Park  
Cardiff CF14 4XW  
Phone 029 2074 7747  
Fax 029 2074 3838  
Minicom 0 2074 3632

Eich cyf/Your ref:  
Ein cyf/Our ref:  
Rhwydwaith Ffôn Iechyd Cymru/  
Welsh Health Telephone Network:  
Llinell uniongyrchol/Direct Line:

Pete Hopgood,  
Head of Locality Finance (Neath, Port Talbot and Bridgend)  
Abertawe Bro Morgannwg University Health Board  
27<sup>th</sup> June 2014

Dear Pete,  
**EMRTS – Development of Outline Business Case**

I write in response to your request for information on patient flows to support the development of the Business Case for an All Wales Emergency Medical Retrieval and Transfer Service.

As a provider and commissioner, the UHB is happy to support the development of this service for which the estimated increase upon current patient flows has been calculated as 140. This additional activity is based upon a 24 hour service with a 12 hour service likely to be circa 60% of this, albeit the cardiac component could be slightly higher. The estimated impact of a 24 hour service is summarised in the following table.

Additional patient flows to UHW with a 24 hour service

Health Board	Major Trauma	Moderate Trauma	Out of Hospital Cardiac Arrests with ROSC	Total
ABMU	6	-12	24	18
Aneurin Bevan	17	0	8	25
Cardiff and Vale	0	0	26	26
Cwm Taf	16	28	16	60
Hywel Dda	9	0	0	9
Powys	0	0	2	2
<b>Total</b>	<b>48</b>	<b>16</b>	<b>76</b>	<b>140</b>

**Notes**

- 50% of the major trauma cases are predicted to be severe head injuries
- 35% of the moderate trauma cases are predicted to be moderate head injuries

It is important to note that this excludes non traumatic brain injuries where current clinical flows will need to be maintained. This and other patient flows will need to be monitored to ensure that further patient drift to UHW is identified, controlled and managed in order to ensure that the UHB's clinical capacity is not compromised. The UHB has specific concerns regarding long term growth in neurosciences which will need to be managed.

Support to this business case is however only provided on the basis that the UHB will be appropriately paid by other Health Boards for expected changes in clinical flows. In addition the UHB will insist that arrangements be put in place to repatriate patients to more local services when patients are stabilised and deemed clinically appropriate for transfer. This should include pathways for repatriation to critical care units after "life-saving" / highly specialised treatment has been completed.

In respect of charges to cover the additional costs of patient flows the UHB intends to apply the English tariff with the average cost of trauma derived from the current case mix contained in the latest TARN data. The tariff cost excludes any MFF and has been abated by 10% for costs not funded such as WRP, capital charges and other fixed costs etc. The UHB expects to incur all other costs associated with this service. The English tariff works on the same basis that the UHB is proposing where patients are repatriated when appropriate to do so with financial incentives and penalties in place to ensure that this is consistently adhered to. The UHB is therefore, proposing an episode tariff plus a bed day tariff in case a delayed transfers. In addition, as is currently the case, any use of ICU will be charges for on a bed day basis. The UHB has assessed that the delivery of a 24 hour service would necessitate an additional £100k cost in operational support for the helipad at UHW. It is assumed that this will be met from within the tariff charge. A summary of the charges the UHB intends to apply to pay for additional patients flows is set out in the following table and is detailed in Appendix 1, which is attached.

	Episode cost £	Additional bed day charge £	Critical care cost per day £
Major Trauma	6,935	219	1,140
Moderate Trauma	5,065	238	1,140
OOH cardiac arrest with ROSC	3,034	208	1,140

The UHB's support to this business case is predicated on the basis that it will get reimbursed for all additional work undertaken at appropriate rates, as currently proposed. It is recognized that the application of this might require refinement to current LTA working arrangements. The approach adopted by the UHB reflects the limited time available to work through the financial implications of this additional patient activity and further work will be done to refine this. It is important that the clinical and financial planning of these patient flow models and pathways commences and gets finalised as soon as possible. A summary of the cost implications of episode costs based upon proposed charges and estimated additional activity is included below.

#### Episode costs at 100% activity excluding additional bed days and critical care

Health Board	Major Trauma £	Moderate Trauma £	Out of Hospital Cardiac Arrests with ROSC £	Total £
ABMU	41,610	-60,780	72,816	53,646
Aneurin Bevan	117,895	0	24,272	142,167
Cardiff and Vale	0	0	78,884	78,884
Cwm Taf	110,960	141,820	48,544	301,324
Hywel Dda	62,415	0	0	62,415
Powys	0	0	6,068	6,068
<b>Total</b>	<b>332,880</b>	<b>81,040</b>	<b>230,584</b>	<b>644,504</b>

## Episode costs at 60% activity excluding additional bed days and critical care

Health Board	Major Trauma £	Moderate Trauma £	Out of Hospital Cardiac Arrests with ROSC £	Total £
ABMU	24,966	-36,468	43,690	32,188
Aneurin Bevan	70,737	0	14,563	85,300
Cardiff and Vale	0	0	47,330	47,330
Cwm Taf	66,576	85,092	29,126	180,794
Hywel Dda	37,449	0	0	37,449
Powys	0	0	3,641	3,641
<b>Total</b>	<b>199,728</b>	<b>48,624</b>	<b>138,350</b>	<b>386,702</b>

Whilst the number of additional patients estimated to flow to UHW is relatively small, this will generate capacity pressures. Major pressure points are likely to include:

- Cardiology
- Critical care
- Radiology (Neuro-radiology)
- Neurosurgery
- Theatres

The UHB will need to flex its capacity in order to manage this. The financial impact of this has not been costed in detail as this will be resourced from the additional income that will need to flow to support the additional activity. Whilst critical care capacity is currently a major constraining factor, this will be addressed via the physical expansion of the service that is already planned. Whilst noting the key pressure points, the UHB is still in a position to manage the anticipated activity increases that are set out in this business case.

I hope that this clearly sets out the UHB's income expectations that underpins its support for this development and provides you with assurance that it can provide the additional capacity in order to support this.

Yours sincerely,

**Chris Lewis,**

Deputy Director of Finance, Cardiff and Vale UHB

Copied to:

Adam Cairns, Chief Executive, Cardiff and Vale UHB

Alice Casey, Chief Operating Officer, Cardiff and Vale UHB

Charlotte Moar, Director of Finance, Cardiff and Vale UHB

Additional 48 Major Trauma Cases - Estimated based on Profile of 2012-13 TARN Data

		Spell Based - PBR (Excl CC)				
		Add'l No's	Non-elective spell tariff (£)	Additional Bed Day Cost	Trauma BPT	Total PBR
Severe Head Injuries 50% of Additional 48 - 24						
AA02A	Intracranial Procedures for Trauma with Diagnosis of Intracranial Injury with CC	13	6,162	204	2,832	116,922
AA03A	Intracranial Procedures for Trauma with Diagnosis of Head Injury / Skull Fracture with CC	2	5,445	204	2,832	16,554
AA26A	Muscular Balance Cranial or Peripheral Nerve disorders; Epilepsy; Head Injury with CC	7	1,191	204	2,832	28,161
AA26B	Muscular Balance Cranial or Peripheral Nerve disorders; Epilepsy; Head Injury without CC	1	666	204	2,832	3,702
PA07A	Head Injury without Intracranial Injury with CC	1	626	294	2,832	3,458
Total		24		208		168,797

Average PBR Excl Critical Care 7,033

Spinal Cord Injury

HC01Z	Extradural Spine Major 2	1	8,507	235	2,832	11,339
HC02B	Extradural Spine Major 1 with CC	1	8,734	235	2,832	11,566
HC03B	Extradural Spine Intermediate 2 with CC	1	6,238	235	2,832	9,070
HC20B	Vertebral Column Injury without Procedure with CC	1	3,937	235	2,832	6,769
Total		4		235		38,744

Average PBR Excl Critical Care 9,686

Other Trauma

VA10A	Multiple Trauma Diagnoses score <=23, with no Interventions	4	1,477	230	2,832	18,156
VA10B	Multiple Trauma Diagnoses score 24-32, with no Interventions	2	1,776	230	2,832	9,216
VA10C	Multiple Trauma Diagnoses score 33-50, with no Interventions	2	3,757	230	2,832	13,178
VA10D	Multiple Trauma Diagnoses score >=51, with no Interventions	5	5,713	230	2,832	42,725
VA11D	Multiple Trauma Diagnoses score >=51, with Interventions score 1-8	3	7,743	230	2,832	31,725
VA12B	Multiple Trauma Diagnoses score 24-32, with Interventions score 9-18	1	5,027	230	2,832	7,859
VA12D	Multiple Trauma Diagnoses score >=51, with Interventions score 9-18	2	9,755	230	2,832	25,174
VA13D	Multiple Trauma Diagnoses score >=51, with Interventions score 19-29	1	11,439	230	2,832	14,271
Total		20		230		162,304

Average PBR Excl Critical Care 8,115

GRAND TOTAL 48 369,845

Average All Categories PBR Excl Critical Care 7,705

Abated Average Cost - Major's (90%) 6,935

Average Additional Bed Day Cost 219

Critical Care costs are charged in addition to PBR at local tariff; LTA rates for C & V are £1,140 per patient day.

Profile of HRG's used reflects the profile of the relevant coded HRG's supplied by TARN for 2012-13 this cohort relates to Major Trauma (ISS score >15) only. A proportion of this data could not be matched, this has been excluded. The analysis assumes that the profile of additional activity will be similar to the current profile.

## References

### Chapter 2

Together for Health: A 5-year vision for the NHS in Wales. WG 14021: ISBN 978 0 7504 6808 4.

1000 lives plus campaign: <http://www.1000livesplus.wales.nhs.uk/home>.

Unscheduled Care: developing a whole systems approach: Welsh National Audit Office. December 2009.

Review of Unscheduled Care: Welsh Audit Office 2013.

Together for Health: South Wales Programme: Report of the South Wales Programme Board to Health Boards/WAST, January 2014.

Regional Networks for Major Trauma: NHS Clinical Advisory Groups Report: September 2010.

Ambulance Service Reform Programme:

<http://wales.gov.uk/about/cabinet/decisions/dr2013/julsep/health/md2459/?lang=en>.

Civil Contingencies Act: Parliament of the United Kingdom: Dec 2004.

NHS Wales Emergency Planning Guidance 2010: Welsh Government Guidance.

Joint Royal Colleges Liaison Service Committee (JRCALC) Guidance 2013.

### Chapter 3

Phillip Hyde *et al.* Availability and utilisation of physician-based pre-hospital critical care support to the NHS ambulance service in England, Wales and Northern Ireland: *Emerg Med J* doi: 10.1136.

Air Ambulance Association. Framework for a High Performing Air Ambulance Service 2013: <http://www.associationofairambulances.co.uk/resources/events/AOAA-Framework%202013-OCT13-%20Final%20Document.pdf>.

Morrison J *et al.* En-Route Care Capability from Point of Injury Impacts Mortality After Severe Wartime Injury: *Ann Surg* 2013; 257: 330–334.

Botker MT *et al.* A systematic review of controlled studies: do physicians increase survival with prehospital treatment? *Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine* 2009, 17:12.

Trauma: Who Cares? National Confidential Enquiry into Patient Outcome and Death. 2007.

NHS emergency planning guidance. Planning for the development and deployment of Medical Emergency Response Incident Teams in the provision of advanced medical care at the scene of an incident: Dept of Health best practice guidance 2010.

Dinh MM *et al.* A trauma quality improvement programme associated with improved patient outcomes: 21 years of experience at an Australian major trauma centre, *Injury-International Journal of the Care of the Injured* 2014; 45(14): 830-834.

[Celso B](#) *et al.* A systematic review and meta-analysis comparing outcome of severely injured patients treated in trauma centers following the establishment of trauma systems. *Trauma* 2006 Feb; 60(2):371-8.

Myocardial infarction with ST-segment elevation: NICE Guideline 2013.

Porter KM. Pre-hospital care training doctors in pre-hospital care: the West Midlands (UK) approach. *Emerg Med J* 2004; 21(4): 509-510.

A Framework for Practice: Neonatal Support for Stand Alone Midwifery Led Units: British Association of Perinatal Medicine May 2011.

Professor Siobhan McClelland: A Strategic Review of Welsh Ambulance Services 2013.

### Evidence Based Review and Appendices

- Von Vopelius-Feldt J, Bengler J. Who does what in pre-hospital critical care? An analysis of competencies of paramedics, critical care paramedics and pre-hospital physicians. *Emerg Med J* online first: 21 August 2013, 10.1136.
- Botker M *et al.* A systematic review of controlled studies: do physicians increase survival with pre-hospital treatment? *Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine* 2009; 17; 1-8.
- [Davis PR](#) *et al.* Determining the composition and benefit of the pre-hospital medical response team in the conflict setting. *R Army Med Corps*. 2007 Dec; 153(4):269-73.
- [Ringburg AN](#) *et al.* Lives saved by helicopter emergency medical services: an overview of literature. *Air Med J* 2009 Nov-Dec; 28(6):298-302.
- [Jayaraman S](#), [Sethi D](#). Advanced trauma life support training for ambulance crews. *Cochrane Database Syst Rev*. 2010 Jan 20; (1):CD003109.
- [Morrison JJ](#) *et al.* En-route care capability from point of injury impacts mortality after severe wartime injury. *Ann Surg* 2013 Feb; 257(2): 330-4.
- [Hesselfeldt R](#). Impact of a physician-staffed helicopter on a regional trauma system: a prospective, controlled, observational study. *Acta Anaesthesiol Scand* 2013 May; 57(5):660-8.
- [Roudsari BS](#). International comparison of pre-hospital trauma care systems. *Injury* 2007 Sep; 38(9):993-1000.
- [Yeguiayan JM](#). Medical pre-hospital management reduces mortality in severe blunt trauma: a prospective epidemiological study. *Crit Care* 2011; 15(1):R34.
- [Gomes E](#). The importance of pre-trauma centre treatment of life-threatening events on the mortality of patients transferred with severe trauma. *Resuscitation*. 2010 Apr; 81(4):440-5
- De Jongh MA *et al.* The effect of Helicopter Emergency Medical Services on trauma patient mortality in the Netherlands. *Injury*. 2012 Sep; 43(9):1362-7.
- McQueen C. Prehospital anaesthesia performed by physician/critical care paramedic teams in a major trauma network in the UK: a 12 month review of practice. *Emerg med J* 2013.
- Chesters A *et al.* Prehospital anaesthesia performed in a rural and suburban air ambulance service staffed by a physician and paramedic: a 16-month review of practice. *Emerg Med J*. 2014 Jan; 31(1):65-8.
- Gunning M *et al.* Emergency intubation: a prospective multicentre descriptive audit in an Australian helicopter emergency medical service. *Emerg Med J*. 2009 Jan; 26(1):65-9. doi: 10.1136/emj.2008.059345.
- Taylor C *et al.* The cost-effectiveness of physician staffed Helicopter Emergency Medical Service (HEMS) transport to a major trauma centre in NSW, Australia: *Injury*. 2012 Nov; 43(11):1843-9
- [Ringburg AN](#) *et al.* Cost-effectiveness and quality-of-life analysis of physician-staffed helicopter emergency medical services. *Br J Surg* 2009 Nov; 96(11):1365-70.
- Hyde P. Prehospital Critical Care Pilot Project: South Central Strategic Health Authority 2010.
- [Hyde P](#) *et al.* Availability and utilisation of physician-based pre-hospital critical care support to the NHS ambulance service in England, Wales and Northern Ireland. *Emerg Med J* 2012 Mar; 29(3):177-81.
- [Gabbe BJ](#) *et al.* Reduced burden of road transport related major trauma after introduction of an inclusive trauma system. *Ann Surg* 2014.
- Littlewood N, Parker A, Hearn S, Corfield A. "The UK helicopter ambulance tasking study", *Injury* 2010; 41(1):27-9.
- McQueen C, Apps R, Mason F *et al.* 'Interception': a model for specialist pre-hospital care provision when helicopters are not available. *Emerg Med J* 2013; 30:956-957.