Evaluation of Options for Primary Emergency Care Provision in the HSE Midlands Area

Pre-Hospital Emergency Care Council

July 2005

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and the

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1 Introduction

1.1 Background

The aim of this study is to identify spatial configuration options for Ambulance services that will assist in reducing the cumulative times for the delivery of emergency care to patients.

The study uses the term Spatial Cover[1] to identify broad geographic areas that represent service areas from each Ambulance station. Theoretical models of emergency care provision are developed that illustrate 'Response' times for Ambulance services and the relationships with locations of secondary emergency care centres. The models assume that all current Ambulance stations (see Table 1) provide 24/7 cover and that these can provide full service at all times. The sections in the study that examine 'Return-to-hospital' times assume that within the region secondary emergency care is provided in the first case (model 3) from hospitals in Tullamore, Mullingar and Portlaoise and secondly (model 4) from just two centres in Tullamore and Mullingar. A third model of 'Return-to-hospital' times examines how hospitals and Ambulances in neighbouring HSE areas can assist in delivering emergency services to the region when only these two hospitals are utilised.

In addition to standard Emergency Medical Technician (EMT) services, Advanced Paramedic (AP) services are modelled from a number of locations; these are evaluated in the study. Other similar studies assumed that Ambulance personnel undertook minimal medical procedures and the focus of the studies was on times taken to get patients to hospital. As AP services are specifically focused on undertaking procedures to stabilise patients with life threatening conditions the focus in this study is on 'Intervention' time i.e. the time elapsed between receipt of the emergency call and arrival at scene.

Table 1

HSE Ambulance Station and cover

HSE Area	Station	COUNTY	COVER
Midlands	Portlaoise	Laois	24-Hour 'On-Duty'
Midlands	Longford	Longford	24-Hour 'On-Duty'
Midlands	Tullamore	Offaly	24-Hour 'On-Duty'
Midlands	Athlone	Westmeath	24-Hour 'On-Duty'
Midlands	Mullingar	Westmeath	24-Hour 'On-Duty'

A number of models are presented below that encompass a variety of configurations of services; the target times for these are 25-minutes for 'Response' time and 60-minutes for 'Return-to-hospital' and 'Intervention' time.

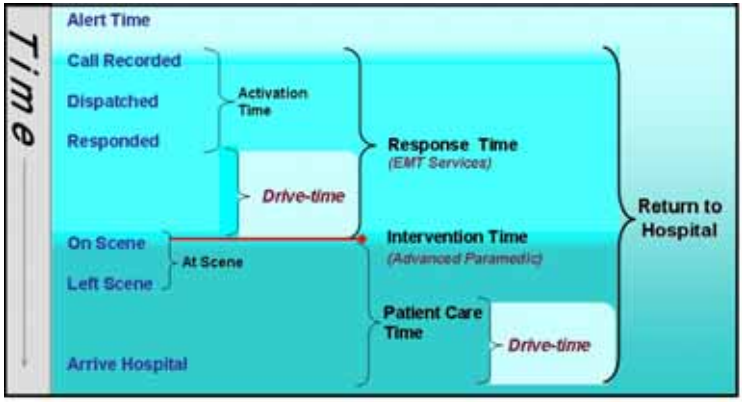
[1] The authors use the term 'Spatial Cover' to differentiate between it and the term 'Ambulance Cover' which relates to hours of availability and staffing arrangements at individual stations.

1.2 Critical Time Elements

The assessment of 'Response' time, 'Return-to-hospital' time and 'Intervention' time are based on a number of separate activities in the delivery of care, these are;

Alert Time	*The time from the moment of the accident to the call to emergency services.*
Response Time	*The time from receipt of the call to arrival at the scene. Includes activation and drive time.*
Return to Hospital Time	*The sum of 'Response' time and the time from arrival at 'Scene' to arrival at appropriate hospital. Includes Patient care and return drive-time.*
Intervention Time	*The time from receipt of call to arrival at the scene of an Advanced Paramedic team.*

Figure 1 *Critical Time Elements*



'Alert' time, is the time between an emergency incident occurring and notification of the emergency services. It is difficult to estimate and varies according to context, however, it is assumed here that this time interval has reduced considerably in recent years due to the prevalence of mobile phones and is likely in many instances to be less than a minute.

'Response' time has been shown to have a wide range in Ireland (Breen et al, 2000)[2]. Key factors that influence 'Response' time include crew availability, distances and travel conditions. Crew availability primarily affects 'activation time' and with the widespread use of 24 hour cover in most Ambulance stations it is assumed that average 'activation times' have reduced. We assume an activation time of 5-minutes which reflects the median activation time for 'on-duty' crews found by Breen. From this figure a nominal target of 25 minutes 'Response' time is used in the study made of 5 minutes activation time and minutes drive-time.

Patient care time will vary considerably according to the nature of the incident, and will thereby influence the 'Return-to-hospital' time. To simplify matters a five-minute stay is assumed at the incident and a slightly slower driver time to bring the patient to the required hospital. On this basis a nominal target of 60 minutes 'Return-to-hospital' time is chosen.

It is important to stress that the nominal targets do not represent a definitive quality target for Ambulance services but are instead intended to provide broad standardised objectives that can be used to compare the spatial cover between stations and regions only in the context of this study.

[2] Breen N, Wood J, Bury G, Murphy AW, Brazier H (2000).'A national census of ambulance response times to emergency calls in Ireland'. Journal of Accident and Emergency Medicine, 2000, 17: 392-5.

1.3 GIS Analysis

A GIS drive-time model is used to estimate the relevant spatial distances from each Ambulance station. The model uses road distance travelled and road quality. A delay factor has been applied for urban areas, where other road users are likely to delay progress of Ambulances. The average road speeds for Ambulances that have been used in the study are listed below. Although these vary according to the time of day and day of the week a standard delay factor has been applied which maintains the relative clarity of the model. The times used in the model are listed below in Table 2.

The first part of the model produces drive-time distances for each Ambulance station. These then are combined with return drive times for the study area back to specified hospital locations. The model assumes that each accident/incident will be served by the closest Ambulance station (by time) and that the Ambulance will return to the nearest appropriate secondary care centre. The model is flexible and different Ambulance stations, and hospital configurations can be used to test optimum service patterns.

Table 2

Average Road Speeds used in Model

	Average		Kilometres
Road Type	**MPH**	**KMH**	**Per Minute**
Motorway	68	109.4	1.82
National Primary	60	96.5	1.61
National Secondary	50	80.5	1.34
Regional Road	48	77.2	1.29
Third Class	32	51.5	0.86
Fourth Class	25	40.2	0.67
Northern Ireland (B) Road	50	80.5	1.34
Urban Normal Road	35	56.3	0.94
Urban Slow (Congested areas)	20	32.2	0.54

The drive-times used have been assessed by Ambulance personnel in the region and have been found to be broadly accurate with actual drive-times of Ambulances. However it must be stressed that these drive times represent an average approximation under controlled circumstances and assumptions in respect of different types of Ambulance times.

Estimation of population within the specified targets is carried out through 'overlaying' the GIS datasets of Electoral Divisions (ED)[3] with the results of the drive-time model. Invariably the results of the model and ED boundaries are not conterminous, in these cases an evaluation is made on where to assign the relevant population. The evaluation is made on the basis of the percentage of the ED within the particular drive-time distance and the local geography of the ED, which will influence the likely location of population within each ED.

For the Road Traffic Accidents a simple overlay procedure is used, and accidents for each drive-time distance allocated solely on the basis of whether it lies within a particular drive-time band.

1.3.1 Data sources

A number of datasets were utilised in the study, these are listed in Table 3. The NRA Road Traffic Accidents database was used to provide information on all road traffic accidents in

[3] Electoral Divisions are the smallest aerial unit that is published by the CSO.

each region. The NRA compiles the database from records provided by An Garda Síochána[4]. The database lists all road traffic accidents where injury or damage to vehicles occurred from 1990 to the present. The database is very comprehensive and includes information on; numbers of people and vehicles involved; the age and sex of drivers, passengers and pedestrians; types of injuries sustained by drivers, passengers and pedestrians; time and location of each incident; the road type; the weather and driving conditions and possible cause of the accident.

The location attributes of the database are very important to this study as individual accidents can be located to +/- 100 metres and this allows close analysis of the spatial patterns of the RTA's.

In the Road Traffic Accidents database injuries are classified as 'Fatal', 'Serious Injury' or 'Minor Injury'. Fatal injuries occur when at least one person is killed as a result of the accident within 30 days of the accident. Serious injury is defined as an injury for which the person is detained in hospital as an 'in patient', or has sustained any of the following injuries whether or not they were detained in hospital: fractures; concussion; internal injuries; crushing; severe cuts and lacerations; and, severe general shock requiring medical treatment. Minor injuries are an injury of a minor nature such as a sprain or bruise (NRA, 2000).

Table 3

GIS Datasets used in the Study			
Data Set	***Type***	***Source***	***Description***
Roads 1:210,000	*GIS Vector*	*OSI*	*All roads classified by NRA Road Code*
Administrative *(County) Boundaries,* 1:210,000	*GIS Vector*	*OSI*	
DED Boundaries *(*SABE*)*	*GIS Vector*	*Eurogeographics*	*Small Area Statistics administrative boundaries*
Lakes Rivers *and* ***Background mapping*** 1:210,000	*GIS Vector*	*OSI*	
Main Towns *Polygons and points* (1:210,000)	*GIS Vector*	*OSI*	
Census of Population *1996*	*Numeric*	*CSO*	*Total Population*
Census of Population *2002*	*Numeric*	*CSO*	*Total Population*
Service points *– Ambulance Stations*	*Text /Numeric*	*HSE Midlands Area*	*Coordinates and details of emergency services, including operational data of the Ambulance Services.*

[4] These are carried out on CT68 forms for all reported accidents.

1.4 Analysis Options

We consider two aspects of the operation of emergency care provision; (1) examining options that improve 'Response' times after an Ambulance has been called and (2) examining options for improving 'Intervention time'.

(A) 'Response' Time:

Two models that assess 'Response' time are presented, firstly where Ambulance services within the region alone are assessed and secondly where Ambulance services from neighbouring HSE areas augment the service. The response models are;

i) **Model 1 (Baseline).** Quantifies the 'Response' times from the use of existing Ambulance stations as listed in Table 1.

ii) **Model 2** Ambulance services from stations based in Athy, Carlow, Roscrea, Nenagh, Roscommon, Virgina, and Navan assist the existing services in the Midlands Area.

(B) 'Return-to-hospital' – 'Intervention' Time:
A number of scenarios are examined:

iii) **Model 3** Evaluation of the 'Return-to-hospital' times using existing EMT Ambulance services within the region together with hospitals in Tullamore, Mullingar and Portlaoise providing secondary emergency care. The 'Response' times are based on model 1.

iv) **Model 4 (Baseline 'Return-to-hospital' Time)** Evaluation of 'Return-to-hospital' times with two centres providing secondary emergency care; Tullamore and Mullingar. This model examines the spatial cover that would occur should A&E services be withdrawn from Portlaoise. Model 1 is used as the 'Response' time model.

v) **Model 5 (Augmented by Neighbouring Emergency Services)** Both neighbouring Ambulance services (model 2 response) and hospital services are included to augment existing ambulance services and secondary emergency care at Tullamore and Mullingar. Neighbouring hospitals that were examined include Naas, Kilkenny, Limerick, Sligo and Cavan.

vi) **Model 6 ('Intervention' Time)** Examination of the potential impact on 'Intervention' times through the use of AP services. A number of location options for AP services were examined. The locations presented in this model are Athlone, Navan, Naas, Carlow and Nenagh. The sites outside the Midlands Area were found in other reports in this series to address emergency service requirements within their respective regions.

1.5 Model Assumptions and Operational Contingencies

The fundamental assumption used in this study, that there are always Ambulance resources available at the nearest station to a particular incident is required to allow comparisons of the geographic relationship between Ambulance service provision and centres of secondary emergency care. Commonly in operational practice this assumption does not prevail and a particular station may not have resources available due to other emergency commitments or patient transport duties. In addition certain critical time elements can be considered to reflect optimum minimal times under 'best case' conditions; including for example short 'at scene' times, dry weather travel times etc.

These 'normalising' assumptions allow comparisons between different areas and enable comparisons of the geographic distribution of emergency services. To reflect real operational contingencies it is necessary to model real incidents and Ambulance responses taken from operational records. This type of analysis has relevance for the distribution and availability of Ambulance resources within any region and the relationship to areas of highest demand for those resources. As such this builds on and complements the current study by including operational contingencies in addition to the geographic patterns of service potential presented here. The Pre-Hospital Emergency Care Council is engaged in preliminary studies on methods of using actual incident records to undertake this second phase of spatial analysis of emergency care provision.

2 Response Times

2.1 Model 1 Current Ambulance Provision (Baseline)

The 'Response' times portrayed in Map 1 and the respective population and Road Traffic Accident data are provided in Tables 4 & 5 below.

Table 4

Response-time Populations *(Model 1)*				
Location	**Total Population**			
	2002	***%***	***1996***	***%***
S. Laoise (1)	7,026	*3.1%*	6,609	*3.2%*
S. Offaly (2)	14,188	*6.3%*	13,791	*6.7%*
NE. Offaly (3)	6,796	*3.0%*	5,746	*2.8%*
E. Longford (4)	765	*0.3%*	750	*0.4%*
Outside 25 Minutes	**28,775**	*12.8%*	**26,896**	*13.1%*
Within 25 Minutes	**196,588**	*87.2%*	**178,646**	*86.9%*
Total	*225,363*	*100%*	*205,542*	*100%*

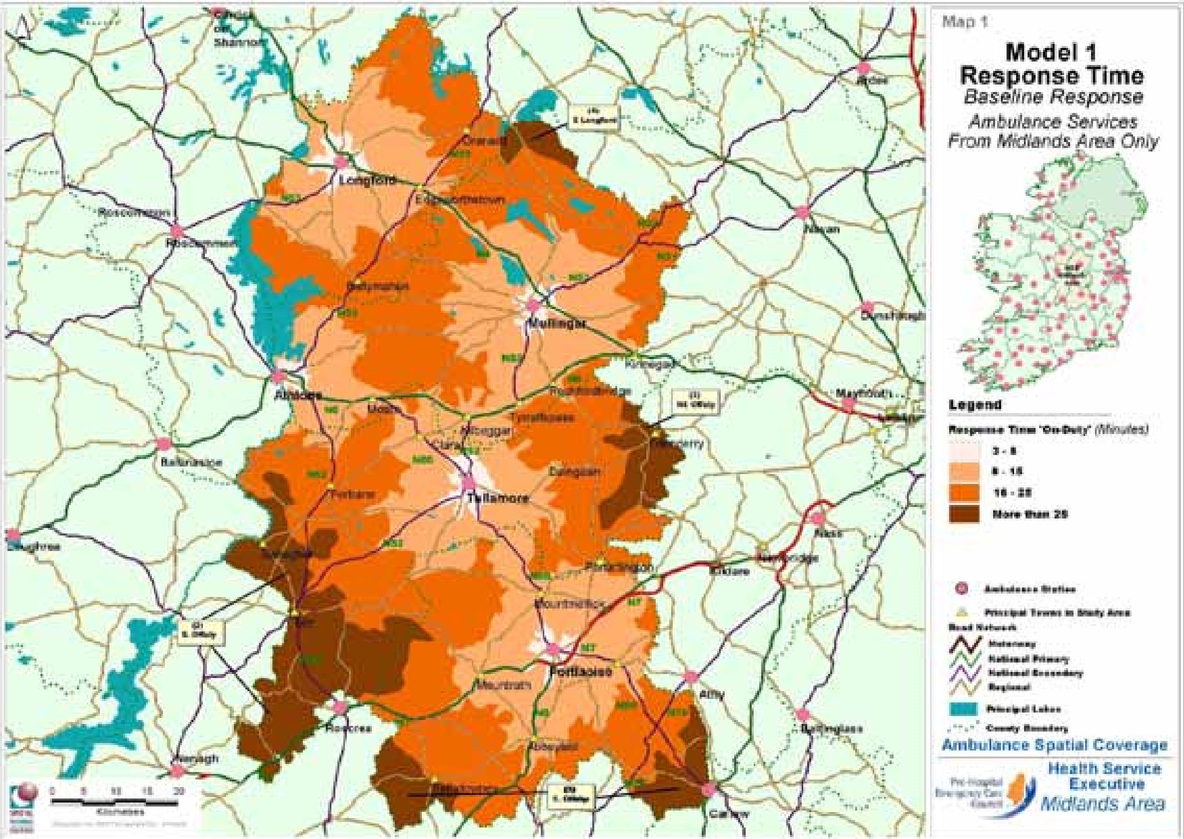
Source: CSO 2002, SPS Drive-time Model

Table 5

Response-time RTA's 1997 - 2001 *(Model 1)*								
Location	**RTA's**		**Fatal Injuries**		**Serious Inj.**		**Minor Inj.**	
	No.	*%*	*No.*	*%*	*No.*	*%*	*No.*	*%*
S. Laoise (1)	28	*1.3%*	*4*	*2.2%*	12	*1.9%*	33	*1.2%*
S. Offaly (2)	108	*5.1%*	*8*	*4.4%*	39	*6.1%*	133	*4.7%*
NE. Offaly (3)	29	*1.4%*	*4*	*2.2%*	5	*0.8%*	48	*1.7%*
E. Longford (4)	5	*0.2%*	*1*	*0.5%*	1	*0.2%*	4	*0.1%*
Outside 25 Min.	**170**	*8.0%*	**17**	*9.3%*	**57**	*9.0%*	**218**	*7.8%*
Within 25 Min.	**1,942**	*92.0%*	***165***	*90.7%*	**579**	*91.0%*	**2,588**	*92.2%*
Total	*2,112*	*100%*	*182*	*100%*	*636*	*100%*	*2,806*	*100%*

Source: NRA Road Traffic Accidents Database, SPS Drive-time Model

In total 28,775 people were resident in areas outside the 25-minute target representing 12.8% of the regions population. The model indicated that 170 RTA's occurred in out-of-target locations, in which 17 people died. Four principal areas were found to lie out-side the 25-minute target, the largest of these in South Offaly had 14,188 people and 108 RTA's (8 fatalities). South Laoise and North East Offaly had similar populations at 7,026 and 6,796 people respectively.


Map 1
Model 1
Response Time
Baseline Response
Ambulance Services
From Midlands Area Only
Legend
Response Time 'On-Duty' (Minutes)
3 - 8
8 - 15
15 - 25
More than 25
Ambulance Station
Principal Towns in Study Area
Road Network
Motorway
National Primary
National Secondary
Regional
Principal Lakes
County Boundary
Ambulance Spatial Coverage
Health Service
Executive
Midlands Area
Longford
Mullingar
Athlone
Tullamore
Portlaoise
Roscommon
Ballinasloe
Roscrea
Nenagh
Navan
Naas
Athy
Carlow
Kilometres

2.2 Model 2 Additional Services from Neighbouring Areas

The distribution of out-of-target areas in the context of this model suggests that the use of Ambulance services in neighbouring HSE areas would be capable of enhancing the services in the Midlands area. This is indeed the case as is apparent in Tables 6 and 7 below and Map 2.

Table 6

Response-time Populations *(Model 2)*

Location	Total Population			
	2002	***%***	***1996***	***%***
S. Laoise (1)	0	*0.0%*	0	*0.0%*
S. Offaly (2)	3,405	*1.5%*	3,255	*1.6%*
NE. Offaly (3)	6,796	*3.0%*	5,746	*2.8%*
E. Longford (4)	209	*0.1%*	199	*0.1%*
Outside 25 Minutes	**10,410**	*4.6%*	**9,200**	*4.5%*
Within 25 Minutes	**214,953**	*95.4%*	**196,342**	*95.5%*
Total	*225,363*	*100%*	*205,542*	*100%*

Source: CSO 2002, SPS Drive-time Model

Table 7

Response-time RTA's 1997 - 2001 *(Model 2)*

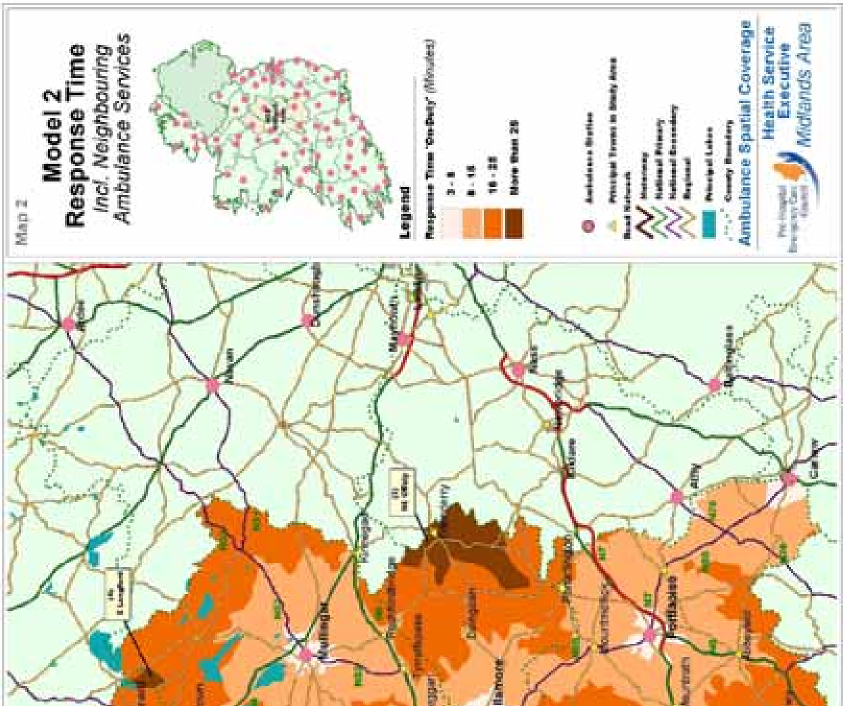
Location	RTA's		Fatal Injuries		Serious Inj.		Minor Inj.	
	No.	*%*	*No.*	*%*	*No.*	*%*	*No.*	*%*
S. Laoise (1)	0	*0.0%*	*0*	*0.0%*	0	*0.0%*	0	*0.0%*
S. Offaly (2)	12	*0.6%*	*1*	*0.5%*	2	*0.3%*	17	*0.6%*
NE. Offaly (3)	28	*1.3%*	*4*	*2.2%*	5	*0.8%*	47	*1.7%*
E. Longford (4)	1	*0.0%*	*0*	*0.0%*	1	*0.2%*	0	*0.0%*
Outside 25 Min.	**41**	*1.9%*	**5**	*2.7%*	**8**	*1.3%*	**64**	*2.3%*
Within 25 Min.	**2,071**	*98.1%*	**177**	*97.3%*	**628**	*98.7%*	**2,742**	*97.7%*
Total	*2,112*	*100%*	*182*	*100%*	*636*	*100%*	*2,806*	*100%*

Source: NRA Road Traffic Accidents Database, SPS Drive-time Model

Neighbouring Ambulance services from Carlow town, Roscrea and to a lesser extent Nenagh eliminate the out-of-target areas in South Laoise and reduce the South Offaly areas significantly resulting in 3,405 people (12 RTA's) remaining out-of-target in South Offaly, a reduction of 10,783 people. There is no change in the out-of-target areas in North East Offaly, but Ambulance services from Virgina in county Cavan improve the 'Response' times for East Longford.

Overall there is a reduction of 18,365 people in population (a 63.8% reduction) and 129 RTA's in people living in areas beyond the 25-minute response target, resulting in 95.4% of the regions population based within the target 'Response' time. Clearly neighbouring Ambulance services in Carlow, Roscrea, Nenagh and Virgina have an important role in the delivery of emergency care provision in the Midlands.

Of the principal remaining out-of-target areas in South Offaly and North East Offaly new deployment points in Banagher or Edenderry would result in these areas being within target. Low population figures in the South Offaly area around Banagher make the case for a new deployment point in this region weak, however higher figures around Edenderry make that case more convincing.


Map 2
Model 2
Response Time
Incl. Neighbouring
Ambulance Services
Legend
Ambulance Spatial Coverage
Health Service
Executive
Midlands Area

2.2 Response Time Findings

It was found that the use of current Ambulance services based exclusively within the Midlands area (model 1) resulted in 87.2% of the regions population (196,588 people) living in areas estimated to lie within the 25-minute response target, leaving 28,775 people located outside the 25-minute target. The most populous out-of-target area was located in the South Offaly region.

In comparison with other regions the Midlands Area had the second highest population located in areas beyond the 25-minute target when only Ambulance services within the region are utilised.

Table 8 **National Results of Base-line Response Model**
(No cross regional services modelled)

Outside 25-minute Response-time, *(Population)*			
HSE Area	**Population** ***2002***	**Region** **%**	**National** **%**
Western	56,784	14.9%	*1.45%*
North Eastern	13,322	3.9%	*0.34%*
South Eastern	17,808	4.2%	*0.45%*
Eastern	8,121	0.6%	*0.21%*
North Western	22,401	10.1%	*0.57%*
Southern	4,923	0.8%	*0.13%*
Midlands	28,775	12.8%	*0.73%*
Mid-Western	15,041	4.5%	*0.38%*
Outside 25 Min. ***(000's)***	**167.2**	4.3%	***4.3%***
Within 25 Min. ***(000's)***	**3,746.4**	95.7%	***95.7%***
National Total (000's)	*3,913.6*	*100%*	*100%*

Source: CSO 2002, SPS Drive-time Model

With the use of neighbouring services the total population residing within the target 'Response' time was 95.4%., resulting in 10,410 people located outside the 25-minute target. Ambulance stations based in Carlow, Roscrea, Nenagh and Virginia had a significant impact on response targets for the Midlands. The most populous area remaining outside the target 'Response' time was found around North East Offaly centred on Edenderry.

3 Return-to-Hospital & Intervention Time

Four models are examined in this section which deal with the total time between receipt of emergency call to delivery of a secondary emergency care centre ('Return-to-hospital') or arrival of AP Ambulance services ('Intervention' time).

Currently there are three principal centres for secondary emergency care within the region, Tullamore, Mullingar and Portlaoise. These are utilised in the initial 'Return-to-hospital' model (model 3). In order to reflect the possibility of the withdrawal of A&E services from Portlaoise the second 'Return-to-hospital' model (model 4) examines the impact on return times using only Tullamore and Mullingar, this forms the baseline model for the subsequent models.

As was apparent in model 2 the use of neighbouring emergency services has a significant impact on the patterns of spatial cover for the region; model 5 uses this response model together with the inclusion of neighbouring hospitals in other HSE regions.

The final model (model 6) evaluates the spatial cover of 'Intervention' time with the use of AP services. AP locations were chosen on the basis of optimum locations within the region that could serve the highest populations but also address out-of-target locations indicated in model 5 and include possible AP locations in neighbouring regions found to usefully service the populations of those regions. The model envisages an AP service based in Athlone together with AP services from neighbouring regions with bases at Carlow, Nenagh, Naas, Sligo and Navan.

3.1 Model 3 'Return-to-Hospital' – Three Centres

With three secondary emergency care centres located in Tullamore, Mullingar and Portlaoise assumed and the use of model 1 'Response' times (i.e. Ambulance services based in the Midlands Area alone) the population found to reside in areas beyond the 60-minute target is estimated to be 40,073 people (17.8% of region's population) and 260 RTA's occurred during the study period (7.8%).

The areas found to be out-of-target were broadly similar to those found in the response models, with an additional area found north of Athlone around Lough Ree. Figures listed in Tables 9 and 10, indicate that the out-of-target area in South Offaly had the highest population with 16,583 people. Three of the remaining out-of-target areas in South Laoise, North East Offaly and East Longford had similar populations levels of around 6,500 in each. It is worth noting that the North East Offaly area is undergoing considerable population growth as the Dublin commuter belt expands into this part of Offaly (see 1996 population figures in Table 9.)

In the area around Lough Ree the population identified as residing beyond the 25-minute 'Response' time is 3,279 people.

Table 9

Return-to-Hospital Populations *(Model 3)*

Location	Total Population			
	2002	*%*	*1996*	*%*
S. Laoise (1)	6,758	*3.0%*	6,385	*3.1%*
S. Offaly (2)	16,583	*7.4%*	16,221	*7.9%*
NE. Offaly (3)	6,796	*3.0%*	5,746	*2.8%*
E. Longford (4)	6,657	*3.0%*	6,685	*3.3%*
Lough Ree (5)	3,279	*1.5%*	3,308	*1.6%*
Outside 60 Minutes	**40,073**	*17.8%*	**38,345**	*18.7%*
Within 60 Minutes	**185,290**	*82.2%*	**167,197**	*81.3%*
Total	*225,363*	*100%*	*205,542*	*100%*

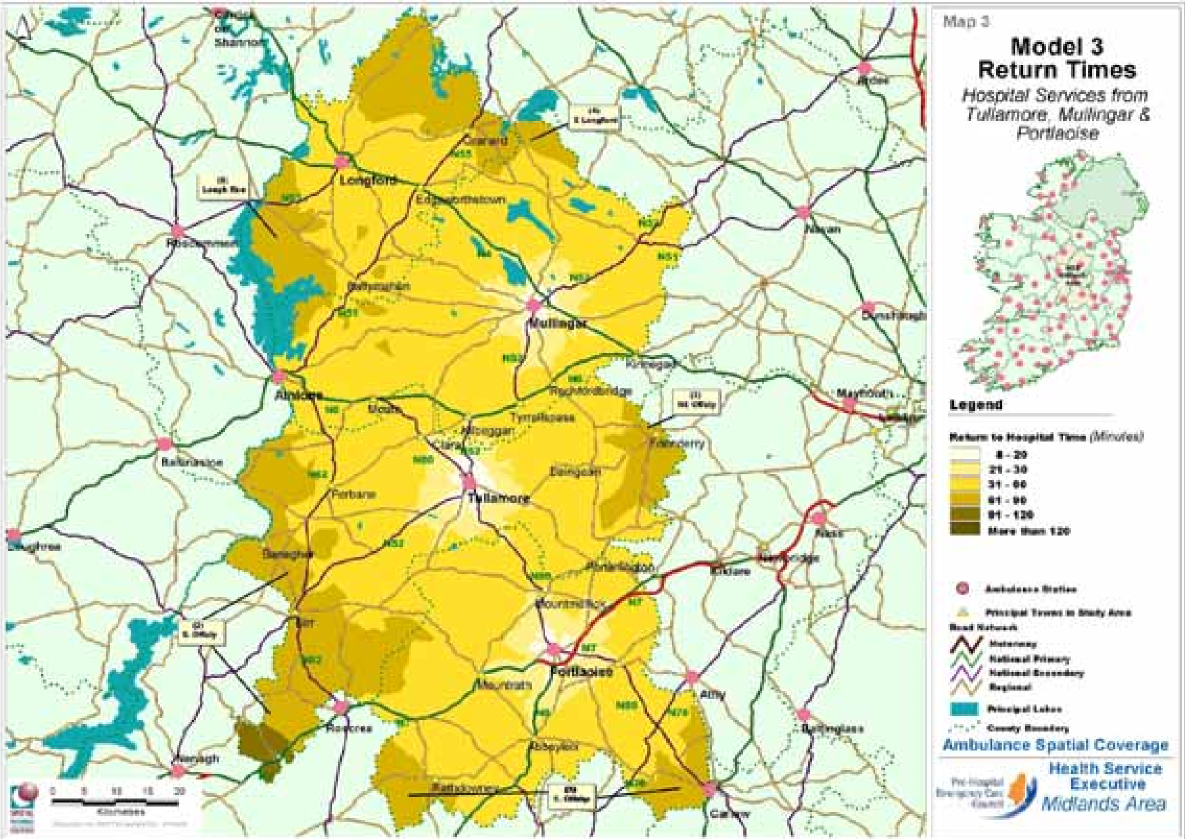
Source: CSO 2002, SPS Drive-time Model

Table 10

Return-to-Hospital RTA's 1997 - 2001 *(Model 3)*

Location	RTA's		Fatal Injuries		Serious Inj.		Minor Inj.	
	No.	*%*	*No.*	*%*	*No.*	*%*	*No.*	*%*
S. Laoise (1)	28	*1.3%*	*4*	*2.2%*	12	*1.9%*	33	*1.2%*
S. Offaly (2)	115	*5.4%*	*8*	*4.4%*	36	*5.7%*	141	*5.0%*
NE. Offaly (3)	28	*1.3%*	*4*	*2.2%*	5	*0.8%*	47	*1.7%*
E. Longford (4)	63	*3.0%*	*5*	*2.7%*	20	*3.1%*	74	*2.6%*
Lough Ree (5)	26	*1.2%*	*1*	*0.5%*	2	*0.3%*	39	*1.4%*
Outside 60 Min.	**260**	*12.3%*	**22**	*12.1%*	**75**	*11.8%*	**334**	*11.9%*
Within 60 Min.	**1,852**	*87.7%*	***160***	*87.9%*	**561**	*88.2%*	**2,472**	*88.1%*
Total	*2,112*	*100%*	*182*	*100%*	*636*	*100%*	*2,806*	*100%*

Source: NRA Road Traffic Accidents Database, SPS Drive-time Model


Map 3
Model 3
Return Times
Hospital Services from Tullamore, Mullingar & Portlaoise
Legend
Return to Hospital Time (Minutes)
8 - 20
21 - 30
31 - 60
61 - 90
91 - 120
More than 120
Ambulance Station
Principal Towns in Study Area
Road Network
Motorway
National Primary
National Secondary
Regional
Principal Lakes
County Boundary
Ambulance Spatial Coverage
Health Service Executive
Midlands Area
Longford
Mullingar
Athlone
Tullamore
Portlaoise
Roscommon
Navan
Naas
Athy
Carlow
Roscrea
Nenagh
Birr
Ballinasloe
Kilometres

3.2 Model 4 'Return-to-Hospital' – Two Centres (Baseline Model)

The impact on return times of withdrawal of secondary emergency care services from Portlaoise hospital is assessed in this model and the only centres utilised are Tullamore and Mullingar. The use of these two hospitals within the model is not intended to indicate any policy recommendations in the context of this report but merely to provide information on the types of primary emergency care configurations that can service the Midlands Area.

Not surprisingly under these assumptions the out-of-target areas to south of the region have increased considerably. In total 57,741 (25.6%) people and 430 RTA's (20.4%) are located in out-of-target areas, this is a relative increase of 44.1% in population from model 3.

With the requirement to bring patients to Tullamore the South Laois out-of-target area is the most extensive with a population of 21,982 people. The South Offaly out-of-target area has also increased with a population of 18,179 as has North East Offaly where areas just to the North of Portlaoise town are not capable of being serviced within the target return time.

Table 11

Return-to-Hospital Populations *(Model 4)*

Location	Total Population			
	2002	*%*	*1996*	*%*
S. Laoise (1)	21,982	*9.8%*	20,862	*10.1%*
S. Offaly (2)	18,179	*8.1%*	17,736	*8.6%*
NE. Offaly (3)	7,644	*3.4%*	6,528	*3.2%*
E. Longford (4)	6,657	*3.0%*	6,685	*3.3%*
Lough Ree (5)	3,279	*1.5%*	3,308	*1.6%*
Outside 60 Minutes	**57,741**	*25.6%*	**55,119**	*26.8%*
Within 60 Minutes	**167,622**	*74.4%*	**150,423**	*73.2%*
Total	*225,363*	*100%*	*205,542*	*100%*

Source: CSO 2002, SPS Drive-time Model

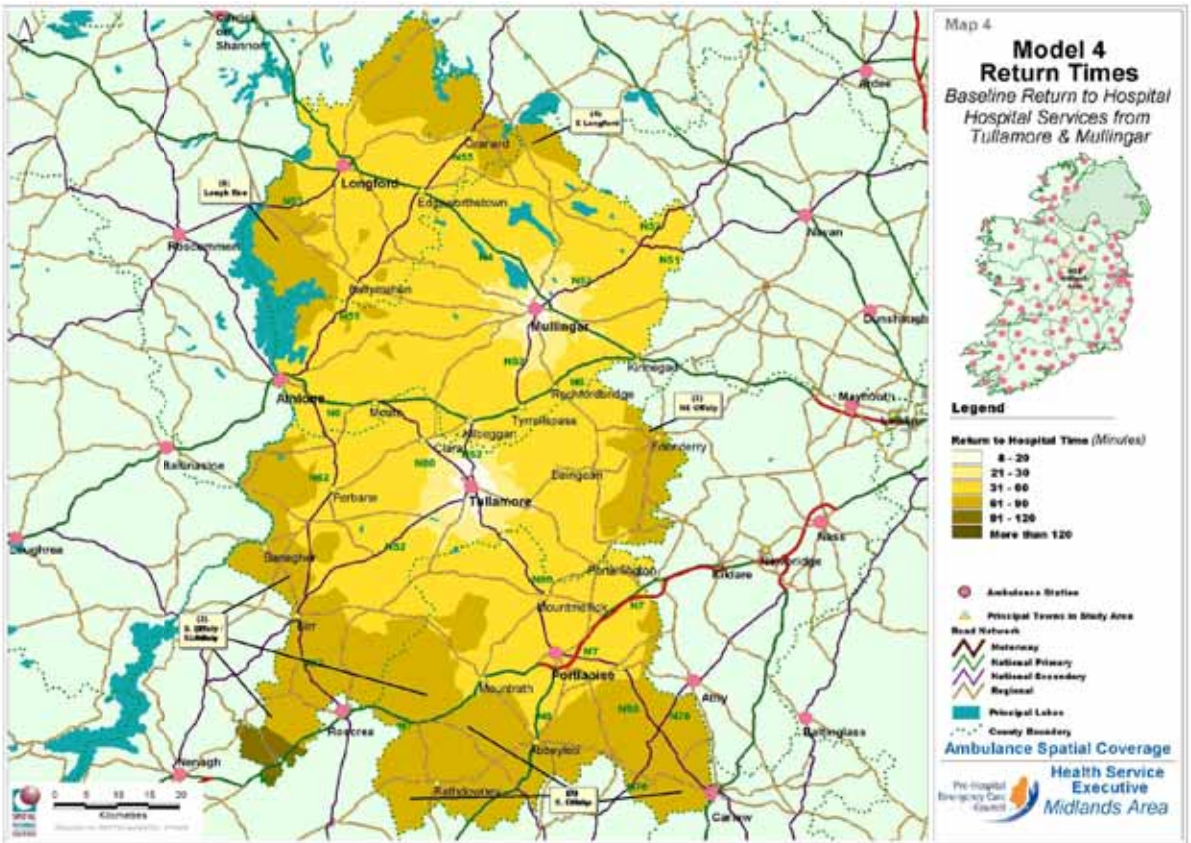
Table 12

Return-to-Hospital RTA's 1997 - 2001 *(Model 4)*

Location	RTA's		Fatal Injuries		Serious Inj.		Minor Inj.	
	No.	*%*	*No.*	*%*	*No.*	*%*	*No.*	*%*
S. Laoise (1)	195	*9.2%*	*24*	*13.2%*	64	*10.1%*	248	*8.8%*
S. Offaly / Laoise (2)	115	*5.4%*	*8*	*4.4%*	36	*5.7%*	141	*5.0%*
NE. Offaly (3)	31	*1.5%*	*5*	*2.7%*	5	*0.8%*	50	*1.8%*
E. Longford (4)	63	*3.0%*	*5*	*2.7%*	20	*3.1%*	74	*2.6%*
Lough Ree (5)	26	*1.2%*	*1*	*0.5%*	2	*0.3%*	39	*1.4%*
Outside 60 Min.	**430**	*20.4%*	**43**	*23.6%*	**127**	*20.0%*	**552**	*19.7%*
Within 60 Min.	**1,682**	*79.6%*	***139***	*76.4%*	**509**	*80.0%*	**2,254**	*80.3%*
Total	*2,112*	*100%*	*182*	*100%*	*636*	*100%*	*2,806*	*100%*

Source: NRA Road Traffic Accidents Database, SPS Drive-time Model

The distribution of out-of-target areas on the borders of the region matches closely to the patterns apparent in the response models and suggests that use of neighbouring emergency services may alleviate the patterns of poor spatial cover when services within the region alone are utilised.


Map 4
Model 4
Return Times
Baseline Return to Hospital
Hospital Services from
Tullamore & Mullingar
Legend
Return to Hospital Time (Minutes)
8 - 20
21 - 30
31 - 60
61 - 90
91 - 120
More than 120
Ambulance Station
Principal Towns in Study Area
Road Network
Motorway
National Primary
National Secondary
Regional
Principal Lakes
County Boundary
Ambulance Spatial Coverage
Health Service
Executive
Midlands Area
Longford
Edgeworthstown
Granard
Ballymahon
Mullingar
Athlone
Moate
Tyrrellspass
Kilbeggan
Clara
Tullamore
Birr
Portlaoise
Mountmellick
Portarlington
Edenderry
Kinnegad
Rochfordbridge
Maynooth
Naas
Kildare
Carlow
Athy
Abbeyleix
Roscrea
Nenagh
Ballinasloe
Ballinamore
Kilometres

3.3 Model 5 'Return to Hospital' – Including Neighbouring Services

This model assesses the potential impact on 'Return-to-hospital' times when Ambulances services and hospital services in both the Midlands and neighbouring HSE regions are utilised. The Ambulance response model used is taken from model 2 where neighbouring Ambulance services were found to reduce areas outside the 25-minute response target. The neighbouring hospitals included in the model are Naas, Kilkenny, Limerick, Sligo and Cavan.

In total the use of neighbouring emergency services reduces the population based outside the 60-minute target return time by 27.7%, a reduction of 16,015 people, resulting in a population of 41,726 people,. For RTA's the reduction in accidents that occurred beyond the 60-minute return time was 149, a reduction of 34.7%, resulting in a total of 281 RTA's located in out-of-target areas (26 Fatalities). The reductions in out-of-target areas were principally the result of improved 'Response' times as opposed to better access to hospital services. South Offaly had the largest reduction in out-of-target population with a reduction of 7,485, followed by South Laoise with a reduction of 6,428. The Ambulance stations located close to these areas, Roscrea and Carlow contributed mostly to these reductions. The East Longford area benefited from services from Cavan Hospital and had a reduction of 2,102 people in out-of-target areas. There was no impact on the out-of-target areas in North East Offaly and Lough Ree.

Table 13

Return-to-Hospital Populations *(Model 5)*

Location	Total Population			
	2002	***%***	***1996***	***%***
S. Laoise (1)	15,554	*6.9%*	14,916	*7.3%*
S. Offaly (2)	10,694	*4.7%*	10,592	*5.2%*
NE. Offaly (3)	7,644	*3.4%*	6,528	*3.2%*
E. Longford (4)	4,555	*2.0%*	4,592	*2.2%*
Lough Ree (5)	3,279	*1.5%*	3,308	*1.6%*
Outside 60 Min.	**41,726**	*18.5%*	**39,936**	*19.4%*
Within 60 Min.	**183,637**	*81.5%*	**165,606**	*80.6%*
Total	*225,363*	*100%*	*205,542*	*100%*

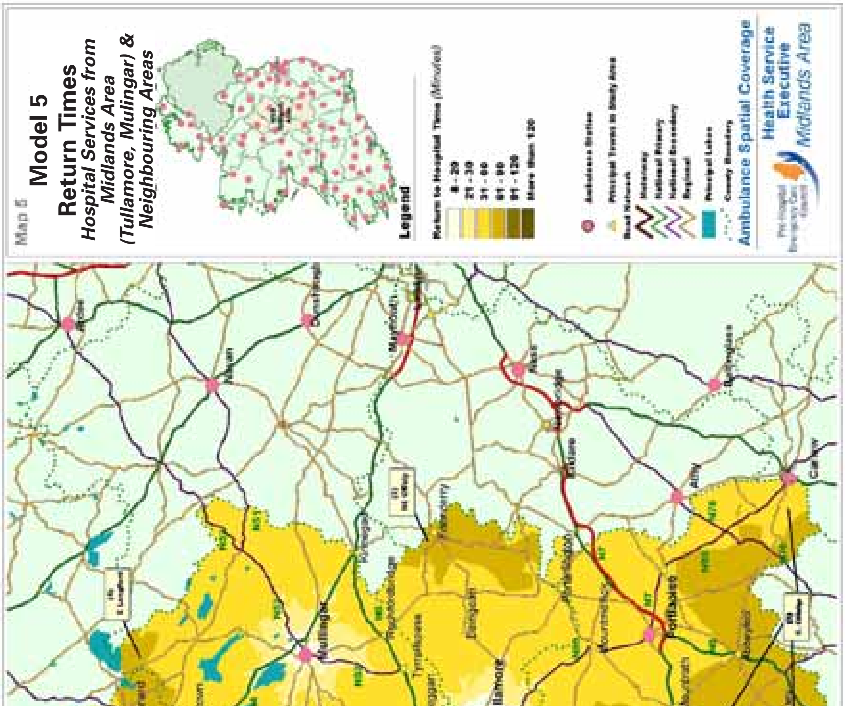
Source: CSO 2002, SPS Drive-time Model

Table 14

Return-to-Hospital RTA's 1997- 2001 *(Model 5)*

Location	RTA's		Fatal Injuries		Serious Inj.		Minor Inj.	
	No.	*%*	*No.*	*%*	*No.*	*%*	*No.*	*%*
S. Laoise (1)	142	*6.7%*	*16*	*8.8%*	47	*7.4%*	192	*6.8%*
S. Offaly / Laoise (2)	48	*2.3%*	*2*	*1.1%*	13	*2.0%*	66	*2.4%*
NE. Offaly (3)	29	*1.4%*	*4*	*2.2%*	5	*0.8%*	49	*1.7%*
E. Longford (4)	36	*1.7%*	*3*	*1.6%*	11	*1.7%*	39	*1.4%*
Lough Ree (5)	26	*1.2%*	*1*	*0.5%*	2	*0.3%*	39	*1.4%*
Outside 60 Min.	**281**	*13.3%*	**26**	*14.3%*	**78**	*12.3%*	**385**	*13.7%*
Within 60 Min.	**1,831**	*86.7%*	***156***	*85.7%*	**558**	*87.7%*	**2,421**	*86.3%*
Total	*2,112*	*100%*	*182*	*100%*	*636*	*100%*	*2,806*	*100%*

Source: NRA Road Traffic Accidents Database, SPS Drive-time Model



Map 5
Model 5
Return Times
Hospital Services from Midlands Area (Tullamore, Mullingar) & Neighbouring Areas
Legend
Return to Hospital Time (Minutes)
0 - 20
21 - 30
31 - 60
61 - 90
91 - 120
More than 120
Ambulance Station
Principal Towns in Study Area
Road Network
Motorway
National Primary
National Secondary
Regional
Principal Lakes
County Boundary
Ambulance Spatial Coverage
Health Service Executive Midlands Area
Longford
Mullingar
Tullamore
Athlone
Portlaoise
Birr
Edenderry

3.4 Model 6 Intervention Time – Use of AP Services

The results from Model 5 indicate that while the use of neighbouring facilities do contribute to reductions in the out-of-target areas from the baseline model that these were principally related to reductions in 'Response' time from the use of additional Ambulance stations located in Carlow and Roscrea. The neighbouring Ambulance stations in Nenagh and Virgina which were found to have an impact on 'Response' time targets did not have as much an impact on 'Return-to-hospital' targets due to distances involved in transporting patients to hospitals.

Other studies in this series indicated that AP services based in Carlow, Nenagh, Navan and Naas had the potential to provide enhanced 'Intervention' times within their respective regions. To complement these services in relation to the Midlands this final model envisages the development of AP services based in Athlone. The results from the use of the above AP development sites indicate that the entire region is within the target 'Intervention' time of 60-minutes (see Tables 15 & 16 and Map 6).

In the study on the HSE Western area an AP base located in Athlone was well placed to address emergency incidents in that region. The use of Athlone can address those out-of-target areas found along the western border of the Midlands, while AP bases located in Carlow, Nenagh, Navan and Naas provide spatial cover for the remaining areas in the Midlands.

Table 15

Intervention Time Population *(Model 6)*

Location	Total Population			
	2002	***%***	***1996***	***%***
Outside 60 Min.	**0**	*0.0%*	**0**	*0.0%*
Within 60 Min.	**225,363**	*100.0%*	**205,542**	*100.0%*
Total	*225,363*	*100%*	*205,542*	*100%*

Source: CSO 2002, SPS Drive-time Model

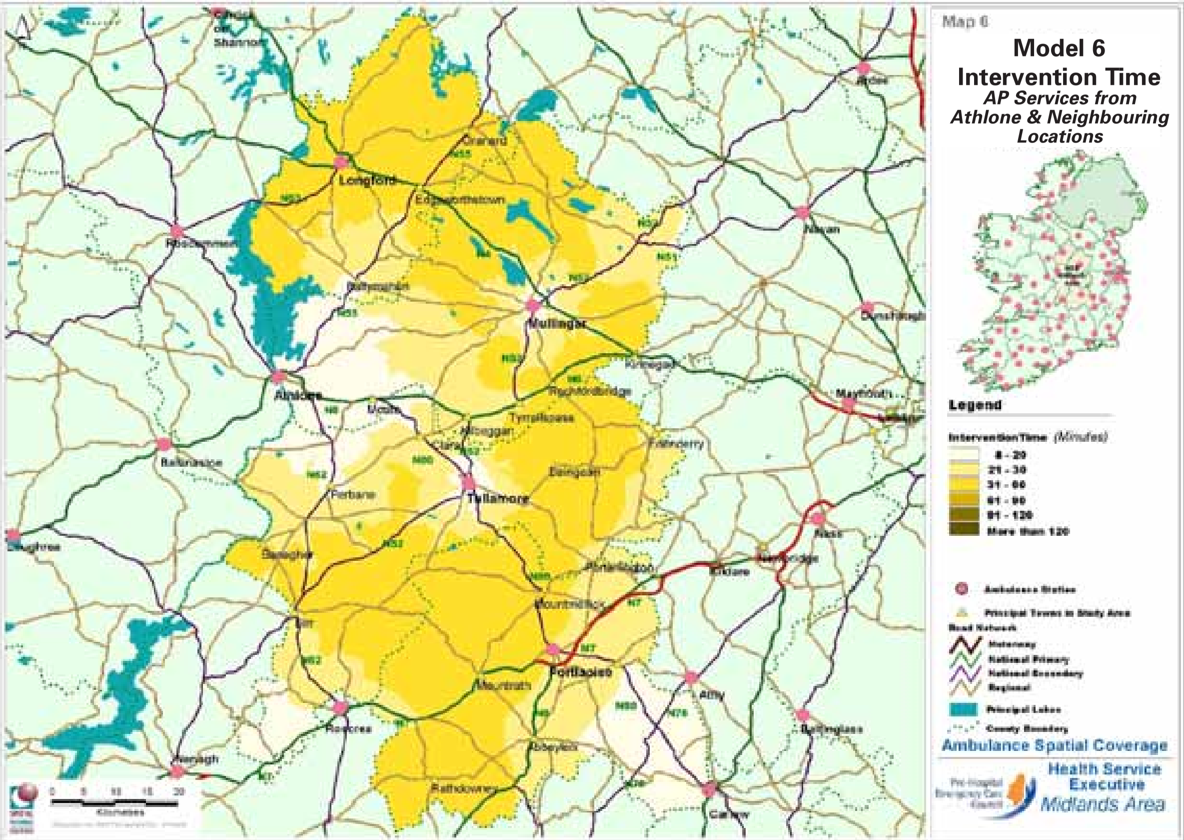
Table 16

Intervention Time RTA's 1997- 2001 *(Model 6)*

Location	RTA's		Fatal Injuries		Serious Inj.		Minor Inj.	
	No.	*%*	*No.*	*%*	*No.*	*%*	*No.*	*%*
Outside 60 Min.	**0**	*0.0%*	**0**	*0.0%*	**0**	*0.0%*	**0**	*0.0%*
Within 60 Min.	**2,112**	*100.0%*	**182**	*100.0%*	**636**	*100.0%*	**2,806**	*100.0%*
Total	*2,112*	*100%*	*182*	*100%*	*636*	*100%*	*2,806*	*100%*

Source: NRA Road Traffic Accidents Database, SPS Drive-time Model

The development of an AP services based in Portlaoise was examined and it was found that this would result in a high level of duplication of services with Carlow which was shown in studies of the HSE South Eastern Area and Eastern Regional Area to have a significant impact on 'Intervention' times for these regions.



Map 6
Model 6
Intervention Time
AP Services from
Athlone & Neighbouring
Locations
Legend
Intervention Time (Minutes)
8 - 20
21 - 30
31 - 60
61 - 90
91 - 120
More than 120
Ambulance Station
Principal Towns in Study Area
Road Network
Motorway
National Primary
National Secondary
Regional
Principal Lakes
County Boundary
Ambulance Spatial Coverage
Health Service
Executive
Midlands Area
Longford
Edgeworthstown
Roscommon
Mullingar
Athlone
Ballinasloe
Tullamore
Birr
Portlaoise
Roscrea
Nenagh
Mountmellick
Mountrath
Athy
Kildare
Naas
Navan
Maynooth
Carlow
Baltinglass
Loughrea
Rathdowney
Daingean
Ferbane
Kilkenny
0 5 10 15 20
Kilometres

4. Conclusions and Recommendations

4.1 Conclusions

1) The baseline Response Model (model1) where Ambulance services from the Midlands Area alone provide emergency services indicated that 28,775 people (12.8% of regions population) and 170 RTA's, (8% of region's RTA's in which 17 people died) were located in areas beyond the 25-minute response target.

2) The use of neighbouring Ambulance services from HSE areas was found to have a significant impact on the 'Response' time target with reductions of 18,365 people and 219 RTA's, giving overall reductions in the population and number of RTA's from the baseline response model of 63.8% and 75.8% respectively. With the use of neighbouring services the total population and RTA's based in areas beyond the 25-minute response target was 10,410 people and 41 RTA's. The majority of these (6,796 people) were based in North East Offaly around Edenderry.

3) Model 3 examined the 'Return-to-hospital' times for the region where Ambulance services from the region were used to take patients to three hospitals, Tullamore, Mullingar and Portlaoise. A total of 40,073 people (17.8% of the region's population) were found to be outside the 60-minute return time target.

4) Model 4 examined the impact on return times of having only two secondary emergency care centres, at Tullamore and Mullingar. Under this assumption and again using only Ambulance services from within the region the total population located outside the 60-minute return target was 57,741 people (25.6% of the region's population) and 430 RTA's from which 43 people died.

5) The use of neighbouring Ambulance resources and to a lesser extent hospital facilities had a significant impact on the pattern of spatial cover for return times in model 5. Use of Ambulance services from Carlow, Nenagh, Virginia and Roscrea resulted in reductions of out-of-target populations for the southern parts of the region (South Offaly and South Laoise) of 13,913 people, a percentage reduction of 34.6%. The East Longford area benefited from access to Cavan Hospital. In total there was a reduction of 27.7% in numbers of people outside the 60-minute target from the baseline model (model 4) when neighbouring HSE emergency services are used.

6) The use of AP services from selected locations in Athlone, Carlow, Nenagh, Navan and Naas was assessed in model 6. It was demonstrated that under the assumptions used in the modelling process the entire region could be reached within the target 'return-to hospital' time of 60-minutes.

4.2 Recommendations

1) Assessment of an individual health area's Ambulance resources and secondary care centres should take account of resources located in neighbouring areas. Analysis of actual incident records will assist such evaluations.

2) The development of an additional EMT deployment point in Edenderry would enhance spatial cover for 'Response' times in the North East Offaly area; further additional deployment points are not likely to enhance the emergency service provision to the same extent.

3) Use of AP services based in Athlone will have a significant impact on 'Intervention' times for the region together. This is considered to be the optimum location for AP services for the region and together with services located in other HSE areas at Carlow town, Nenagh, Navan and Naas will provide effective services for 'Intervention' time in the region and also be capable of assisting other areas outside the Midlands Area.

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