

The Transport Impact of Proposed Models of Paediatric Cardiac Centralisation in North-East England

Dr Mark Darowski,
Lead Clinician,
North East and West Yorkshire Paediatric Critical Care Network

Background:

Children's Heart Surgery services are undergoing a national review (Safe and Sustainable) which is designed to produce services and centres which

- improve outcomes and
- provide workloads that enable both the maintenance of skills and critical masses of specialists - particularly surgeons.

The emphasis in this process has been on historical results, with little apparent consideration of demographics.

The proposal is that, in North of England, the existing 3 centres (Liverpool, Leeds, Newcastle) are reduced to 2 (Liverpool and Newcastle or Leeds).

I have undertaken an analysis of the impact of these proposals on transport in the geographical areas served by the current centres in Newcastle and Leeds. These include the whole of the current Yorkshire and the Humber SHA and North-East SHA areas with the addition of Cumbria, Chesterfield and parts of North Derbyshire and Bassetlaw.

The areas, their population from birth to the 15th birthday and the major hospitals serving those areas and the postcodes of those hospitals are described in Appendix 1.

Mileages and travelling times between the cardiac centres (Newcastle, Leeds and, where applicable, Birmingham and Liverpool) and referring hospitals have been calculated using Google maps with postcodes for the hospitals obtained from each hospital's website. Where alternative routes have been proposed I have taken the fastest travelling time and the associated mileage.

Populations were derived from ONS 2009 update for population estimates of children aged 0 - 14 for each of the counties/urban areas.

Referring hospitals have been taken as the major acute unit serving each area. For the large, less densely populated areas of Northumberland, County Durham and North Yorkshire I have taken Ashington, Durham and York as the population centres of those areas and have based mileages on the Hospitals in those towns. I have used major acute hospitals as the base since they are where children with congenital heart disease present acutely - either in a neonatal unit or through A&E. In a number of other areas that are served by more than one hospital I have taken the one with the largest paediatric department

The impact of transport models is assessed by the population-distance index (PDI) which is derived by multiplying the distance travelled by the population affected divided by 1000

The above data are shown in Appendix 2.

I have also calculated the population impact of referral patterns that are based on the nearest centre.

Finally I have calculated the numbers of centres and populations that are less than 1.5 more than 1.5, 2 and 3 hours travel distance from their nearest centre in each model.

Results:

The total population age 0-14 years of the geographical area is 1.525 million. Of these 0.516 million are in the Newcastle catchment area and 1.009 million reside in Leeds catchment area.

The current service generates a population-distance index (PDI) of 42.

Two centres are more than 1 hr 30 min from the nearest cardiac unit (Grimsby, 1hr 32min and West Cumberland 2hr 25min)

Centralisation of the service in Leeds produces a PDI of 77, an 83% increase from the current configuration.

One centre is > 3 hrs travel from Leeds, 2 centres with a population of 79,000 are between 2 and 3 hours distance and 8 centres with a population of 336,000 are between 1hr 30 min and 2 hrs away. Travel time are less than 1 hr 30 min for 1,081,000 children.

Option B (Newcastle + Liverpool) results in a PDI of 124, a 199% increase on the current configuration.

One centre is > 3 hrs travel from Newcastle and 14 centres with a population of 487,000 are between 2 and 3 hours away, 1 centre with a population of 135,000 is between 1 hr 30 min and 2 hours away. Travel times are less than 1 hr 30 min for 873,000 children.

Most of the population centres in Yorkshire are closer to Liverpool than to Newcastle, and in the case of South Yorkshire travel to Birmingham becomes an equally attractive option.

If the population moves to the nearest centre, with Yorkshire patients going to Liverpool the PDI for that configuration is 100 (138% increase over current configuration). Five centres are more than 2 hrs away from Liverpool and a further 5 are more than 1 hr 30 min away. Moreover, this configuration would only increase the catchment population for Newcastle from 516,000 to 651,000 and leave the remaining 874,000 of Yorkshire's population travelling to other centres.

These data are summarized in table 1 below:

Table 1: Numbers of centres and population affected in centralisation models.						
	Option B		Centralisation in Leeds		Newcastle + Yorkshire go to Liverpool	
Patient Distance Index (Affected patients x distance travelled/1000)	124		77		100	
Travel time to cardiac centre	Hospitals	Population Affected (thousands)	Hospitals	Population Affected (thousands)	Hospitals	Population Affected (thousands)
Less than 1 hr 30 min	15	873	19	1,081	16	919
1 hr 30 min – 2hrs	1	135	8	336	10	422
2 – 3 hrs	13	487	2	79	5	211
More than 3.0 hr	1	30	1	28.5	0	0

Commentary.

The travel impact of models of care after the safe and sustainable process must be considered. The Patient Distance Index (PDI) used in this paper provides a population-weighted method to evaluate that impact.

Times and distances travelled are of critical importance to the:

- Outcomes of babies born with transposition of the great arteries whose oxygenation does not improve with prostin. These babies, whose outcome is excellent with timely treatment, require time-critical transfers and increasing the journey times may result in some avoidable deaths. The greater the PDI the greater the risk.
- Transport services that will be charged with moving children and neonates from their presenting hospitals to cardiac centres for ongoing care. Reconfiguration will require substantial investment in such services, and the larger the PDI the greater the investment need.
- Families of children that are receiving care in the cardiac centres. Distance adds a substantial additional economic, time and emotional burden to families that are already under great stress.

This analysis also demonstrates that centralisation of the service in Newcastle would have one of two outcomes:

1. expose the far larger population of Yorkshire to prolonged travelling times or
2. if the population moved to its nearest centre (Liverpool and/or Birmingham), this results in travelling times of > 2 hrs for the population of Hull and the East Coast and leaves Newcastle with only a marginal increase in its catchment population.

I have examined the population impact based solely on current population estimates. These do not take into account any differences in either birth rates or of incidence of congenital heart disease, both of which are particularly high in the ethnic minority populations of West Yorkshire. Both of these factors will continue to increase the demand for congenital cardiac services in Yorkshire at a greater rate than in the rest of the Region. The impact of travel is also highly significant for this economically deprived community.

We have clearly demonstrated that, from a demographic point of view,

- Newcastle is not a viable centre
- The needs of the population of North of England would best be served by a solution which includes Leeds.

Appendix 1. Populations 0 -14 yrs (to 15 th birthday) and Postcodes				
	Census Area	Population <16 (x1000)	Hospital	Post code
North West Region	Carlisle and Eden	26.4	Cumberland Royal	CA2 7HY
	Allerdale and Copeland	28.5	West Cumberland	CA28 8JG
N.W. Population		54.9		
North East Region	County Durham	88.3	Durham	DH1 5TW
	Darlington	19.3	Darlington Memorial	DL3 6HX
	Gateshead	33.6	Gateshead	NE9 6SX
	Newcastle	45.6	Royal Victoria	NE1 4LP
	Hartlepool	27.5	Hartlepool	TS24 9AH
	Middlesbrough	27.5	James Cook*	TS4 3BW
	Redcar and Cleveland	37.2	James Cook	TS4 3BW
	Stockton-on-Tees	18.1	North Tees	TS19 8PE
	North Tyneside	34.9	North Tyneside	NE29 8NH
	Northumberland	53.0	Ashington	NE63 9JJ
	South Tyneside	26.5	South Tyneside	NE34 0PL
	Sunderland	49.4	Sunderland Royal	SR4 7TP
N.E. Population		460.9		
"Newcastle population"		515.8		
Yorkshire	North Yorkshire and York	135.0	York district	YO31 8HE
	Bradford and Airedale	114.5	Bradford Royal	BD9 6RJ
	Leeds	133.4	Leeds General	LS1 3EX
	Calderdale	40.2	Calderdale Royal	HX3 0PW
	Kirklees	83.4	Dewsbury	WF13 4HS
	Wakefield	59.8	Pinderfields	WF1 4DG
	Barnsley	42.5	Barnsley	S75 2EP
	Sheffield	93.5	Sheffield Children's	S10 2TH
	Rotherham	49.0	Rotherham	S60 2UD
	Doncaster	55.6	Doncaster	DN2 5LT
	East Riding of Yorkshire	47.1	Hull Royal*	HU3 2JZ
	Hull Teaching	56.9	Hull Royal	HU3 2JZ
	North Lincolnshire	30.1	Scunthorpe	DN15 7BH
	North East Lincolnshire	30.2	Grimsby	DN33 2BA
Yorkshire Population		971.2		
Trent	Bassetlaw	20.3	Bassetlaw	S81 0BD
	Derbyshire County (north)	17.8	Chesterfield	S44 5BL
Trent Population		38.1		
"Leeds population"		1009.3		
Total population		1525.1		

* James Cook University Hospital and Hull Royal Infirmary are acute the hospitals for two districts.

Appendix 2	Freeman (NE7 7DN)			Leeds (LS1 3EX)			Alderhey (L12 2AP)		
Hospital	Distance (Mi)	Time (hr.min)	PDI (population x Distance)	Distance (Mi)	Time (hr.min)	PDI (population x Distance)	Distance (Mi)	Time (hr.min)	PDI (population x Distance)
Cumberland Royal	60.5	1.26	1.6	127	2.35	3.4	128	2.19	3.4
West Cumberland	99	2.25	2.8	150	3.15	4.3	131	2.53	3.7
Durham	17.8	0.36	1.6	85.7	1.43	7.6			
Darlington Memorial	37.6	0.52	0.7	64.9	1.24	1.3			
Gateshead	6	0.16	0.2	94.1	1.51	3.2			
Royal Victoria	2.9	0.09	0.2	98.3	1.56	4.5			
Hartlepool	33.4	0.37	0.9	78.9	1.36	2.2			
James Cook	44.7	1.02	1.2	66.5	1.22	1.8	139	2.26	
James Cook	44.7	1.02	1.7	66.5	1.22	2.5	139	2.26	
North Tees	36.8	0.54	0.7	69.7	1.25	1.3			
North Tyneside	7.6	0.19	0.3	101	1.59	3.5			
Ashington	15.3	0.28	0.8	115	2.18	6.1			
South Tyneside	10	0.23	0.3	98.6	1.56	2.6			
Sunderland Royal	15.8	0.3	0.8	93.2	1.51	4.6			
			13.7			48.7			
York district	91	1.54	12.3	27.5	0.47	3.7	99.9	1.54	
Bradford Royal	102	2.19	11.7	11.9	0.3	1.4	67	1.18	7.7
Leeds General	99.5	2.01	13.3			0.0	70	1.16	9.3
Calderdale Royal	123	2.2	4.9	21.1	0.3	0.8	57.3	1.04	2.3
Dewsbury	111	2.11	9.3	9.9	0.24	0.8	62.7	1.14	5.2
Pinderfields	108	2.04	6.5	12.6	0.22	0.8	74.9	1.21	4.5
Barnsley	118	2.13	5.0	22.4	0.37	1.0	85.7	1.31	3.6
Sheffield Children's	131	2.33	12.2	36.1	0.51	3.4	74.3	1.44	6.9
Rotherham	132	2.25	6.5	37.3	0.43	1.8	99.7	1.43	4.9
Doncaster	117	2.16	6.5	34.8	0.47	1.9	97	1.45	5.4
Hull Royal	143	2.4	6.7	60.6	1.1	2.9	123	2.08	5.8
Hull Royal	143	2.4	8.1	60.6	1.1	3.4	123	2.08	7.0
Scunthorpe	136	2.3	4.1	53.6	1.1	1.6	116	2	3.5
Grimsby	163	3.01	4.9	80.8	1.32	2.4	143	2.3	4.3
Bassetlaw	131	2.29	2.7	49	1	1.0	94.3	2	1.9
Chesterfield	141	2.4	2.5	53.4	1.04	1.0	77	1.5	1.4
			117.2			27.9			80.9