

Modelling of minimum UK paediatric intensive care capacity required during the covid-19 pandemic

Analysis performed by the Paediatric Intensive Care Audit Network (PICANet) working with the Paediatric Intensive Care Society (PICS)

PICANet team: Hannah Buckley, Richard Feltbower, Elizabeth Draper

PICS team: James Fraser, Padmanabhan Ramnarayan, Peter Davis, Katherine Brown

Why did we do this modelling?

Predicted demand for adult critical care during the covid-19 pandemic is extremely high and is likely to significantly outstrip available capacity. As part of individual hospital (and regional) surge plans, paediatric intensive care units (PICUs) across the UK are preparing to reduce their PICU bed base (in some instances quite significantly) so that beds can be released for adult critical care services. The nature of PICU admissions (~60% being emergencies) however means that the scope for freeing up PICU beds from cancellation of elective surgery may be limited. Many 'elective' paediatric surgical cases (e.g. cardiac, neonatal) cannot be postponed safely for more than a few days to weeks, at which point they become an emergency. Balancing the needs of critically ill children and ensuring their safety with a minimum number of PICU beds with the expected surge in demand for adult critical care beds is challenging, especially in the absence of data.

What did we do?

We analysed data from PICANet covering the period November-July 2018/19 submitted by all paediatric intensive care units (PICUs) in the UK. We present three models:

1. Bed activity based on historical data from 2018/19 by PICU and by critical care network.
IMPORTANT: This estimates the number of patients that might pass through a PICU bed per day, not the number of beds
2. Bed activity based on historical data from 2018/19 by PICU and by critical care network, assuming a 10% reduction in activity due to cancellation of non-essential elective work.
IMPORTANT: This estimates the number of patients that might pass through a PICU bed per day, not the number of beds
3. Bed numbers derived from HRG XBO-1Z-XBO-6Z codes, based on historical data from 2016-18.
IMPORTANT: This might be regarded as the minimum bed base that must be maintained at a regional and operational delivery network level.

What did we find and how should this data be used?

There is a wide variation in demand for PICU beds across the UK. The greatest demand in PICU beds is in London which will likely require a PCC bed base > 100 beds. This data might inform surge planning in 3 ways:

- a) Individual PICUs should be making plans to scale up capacity but may need to retain some PIC capacity for essential patients.
- b) Stand-alone children's hospitals should scale up to capacity to absorb diverted patients from neighbouring PICUs.
- c) Operational Delivery Networks and NHS England should utilise this data to ensure that essential PCC capacity is maintained at a regional and national level.

			MEDIAN TOTAL BED ACTIVITY NOV 2018 – JULY 2019	BED ACTIVITY REDUCED BY 10% TO TAKEN INTO ACCOUNT REDUCTION ELECTIVE WORK				BED NUMBERS ESTIMATES USING XB01Z-XB06Z CODES
			Median	Median (range)	Median (range)	Median (range)	Median (range)	
				April 2019	May 2019	June 2019	July 2019	
North East			23	20.4 (8.0,29.0)	16.3 (6.0,31.0)	16.6 (6.0,28.0)	19.1 (7.0,32.0)	19
K2	Freeman	9	7.0 (2.0,10.0)	6.3 (2.0,10.0)	5.8 (3.0,9.0)	6.6 (2.0,11.0)	9	
K3	Great North	11	10.4 (5.0,14.0)	7.0 (3.0,14.0)	7.8 (3.0,12.0)	9.5 (5.0,15.0)	8	
S	Middlesbrough	4	3.0 (1.0,5.0)	3.0 (1.0,7.0)	3.0 (0.0,7.0)	3.0 (0.0,6.0)	2	
Yorkshire & Humber			25	20.3 (11.0,29.0)	21.4 (10.0,29.0)	19 (8.0,29.0)	17.4 (6.0,29.0)	21
I	Leeds	13	9.4 (5.0,14.0)	9.6 (5.0,14.0)	11.1 (5.0,18.0)	10.1 (4.0,15.0)	11	
Q	Sheffield	12	10.9 (6.0,15.0)	11.8 (5.0,15.0)	7.9 (3.0,11.0)	7.3 (2.0,14.0)	10	
North West			44	38.9 (28.0,42.0)	43.7 (32.0,53.0)	39.4 (29.0,50.0)	38.8 (25.0,52.0)	32
P	Liverpool	19	14.9 (9.0,19.0)	18.1 (12.0,24.0)	15.5 (10.0,21.0)	16.6 (10.0,21.0)	18	
D	Manchester	25	24.0 (19.0,33.0)	25.6 (20.0,29.0)	23.9 (19.0,29.0)	22.2 (15.0,31.0)	14	
East Midlands			29	28.7 (18.0,39.0)	28.9 (19.0,41.0)	24.1 (14.0,33.0)	24.5 (14.0,37.0)	21
M	Nottingham	15	15.8 (12.0,20.0)	14.9 (12.0,18.0)	14.4 (11.0,17.0)	12.9 (8.0,18.0)	10	
X1	Glenfield	8	6.9 (3.0,10.0)	8.0 (4.0,12.0)	4.7 (1.0,9.0)	6.6 (3.0,11.0)	7	
X2	Leicester Royal	6	6.0 (3.0,9.0)	6.0 (3.0,11.0)	5.0 (2.0,7.0)	5.0 (3.0,8.0)	4	
East			9	8.0 (4.0,12.0)	8.0 (3.0,11.0)	9.2 (2.0,13.0)	5.7 (2.0,12.0)	7
A	Cambridge	9	8.0 (4.0,12.0)	8.0 (3.0,11.0)	9.2 (2.0,13.0)	5.7 (2.0,12.0)	7	
West Midlands			36	34.7 (24.0,44.0)	30.2 (21.0,40.0)	30.8 (22.0,39.0)	29.8 (18.0,41.0)	32
V	Birmingham	31	29.2 (22.0,36.0)	27.2 (20.0,34.0)	26.3 (20.0,33.0)	26.0 (18.0,33.0)	28	
L	Stoke	6	5.5 (2.0,8.0)	3.0 (1.0,6.0)	4.5 (2.0,6.0)	3.8 (0.0,8.0)	4	
South West			15	16.0 (12.0,20.0)	14.8 (10.0,19.0)	13.6 (9.0,19.0)	13.8 (9.0,18.0)	14
W	Bristol	15	16.0 (12.0,20.0)	14.8 (10.0,19.0)	13.6 (9.0,19.0)	13.8 (9.0,18.0)	14	
South East			28	27.3 (18.0,39.0)	23.9 (14.0,36.0)	22.5 (12.0,32.0)	19.6 (9.0,30.0)	22

	R	Southampton	15	14.3 (10.0,21.0)	13.9 (9.0,18.0)	11.7 (7.0,17.0)	12.5 (7.0,16.0)	12
	N	Oxford	13	13.0 (8.0,18.0)	10.0 (5.0,18.0)	10.8 (5.0,15.0)	7.1 (2.0,14.0)	10
North London			68	59.2 (37.0,84.0)	62.2 (41.0,83.0)	59.4 (42.0,81.0)	55.9 (36.0,79.0)	64
	E1	GOSH PICU	21	20.2 (15.0,25.0)	21.0 (14.0,26.0)	19.7 (15.0,25.0)	20.6 (16.0,27.0)	19
	E2	GOSH CICU	20	16.9 (11.0,23.0)	17.6 (12.0,23.0)	17.0 (12.0,23.0)	16.3 (11.0,23.0)	17
	U	St Mary's	8	5.0 (3.0,9.0)	7.0 (5.0,11.0)	7.0 (5.0,8.0)	6.0 (1.0,9.0)	7
	O	Brompton	14	12.1 (5.0,17.0)	10.6 (6.0,16.0)	10.7 (6.0,18.0)	8.0 (4.0,13.0)	16
	Z	Royal London	6	5.0 (3.0,10.0)	6.0 (4.0,7.0)	5.0 (4.0,7.0)	5.0 (4.0,7.0)	5
South London			42	43.5 (32.0,53.0)	38 (24.0,49.0)	38.6 (25.0,53.0)	34 (17.0,49.0)	34
	F	Evelina	19	19.7 (14.0,24.0)	16.5 (12.0,21.0)	16.3 (11.0,21.0)	14.4 (9.0,19.0)	15
	H	King's	12	11.8 (8.0,14.0)	9.8 (4.0,14.0)	11.3 (6.0,16.0)	9.7 (4.0,16.0)	11
	T	St George's	12	12.0 (8.0,15.0)	11.7 (8.0,14.0)	11.0 (8.0,16.0)	9.9 (4.0,14.0)	8
Wales			7	7.0 (5.0,13.0)	5.8 (3.0,10.0)	8.0 (4.0,11.0)	6.3 (1.0,10.0)	6
	C	Cardiff	7	7.0 (5.0,13.0)	5.8 (3.0,10.0)	8.0 (4.0,11.0)	6.3 (1.0,10.0)	6
Scotland			34	30.8 (16.0, 42.0)	30.9 (22.0,41.0)	32.8 (22.0,42.0)	23.9 (13.0,42.0)	24
	ZA	Glasgow	20	16.7 (9.0,24.0)	15.9 (10.0,20.0)	18.8 (14.0,23.0)	12.9 (8.0,22.0)	15
	Y	Edinburgh	14	14.1 (7.0,18.0)	15.0 (12.0,21.0)	14.0 (8.0,19.0)	11.0 (5.0,18.0)	9
Northern Ireland			9	7.9 (4.0,10.0)	6.0 (4.0,10.0)	7.9 (4.0,10.0)	3.9 (2.0,5.0)	7
	ZB	Belfast	9	7.9 (4.0,10.0)	6.0 (4.0,10.0)	7.9 (4.0,10.0)	3.9 (2.0,5.0)	7
NHS England			319	297	287.4	273.4	258.6	266
UK NHS Total			369	342.7	330.1	321.9	292.7	303