



Analytical Framework to Establish Requisite Bed Capacity when Cohorting Patients

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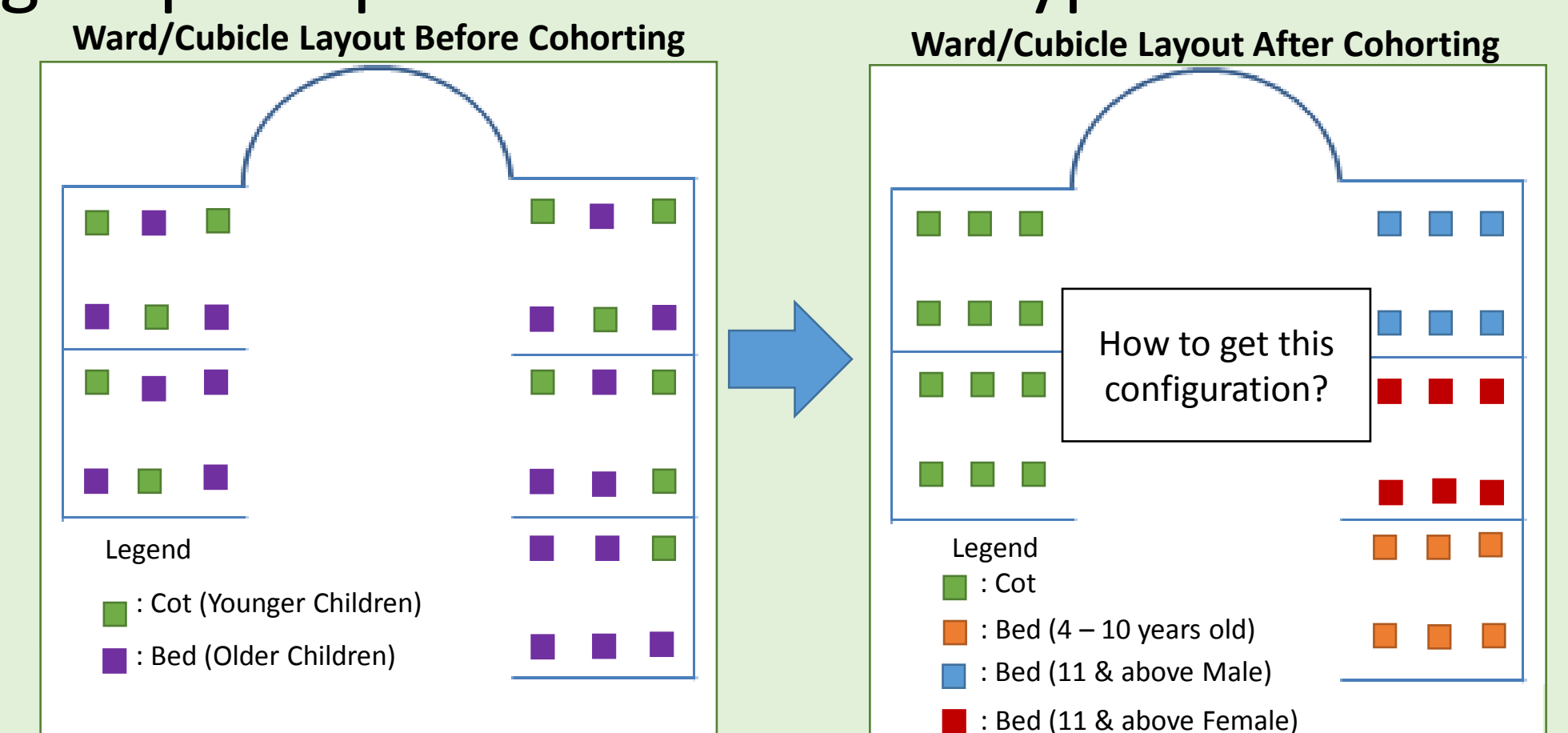
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BACKGROUND: Paediatric patients are housed in shared cubicles without reference to age or gender. Older patients housed with young children do not get proper rest as babies and younger children cry often. Parents are also concerned when teenaged boys and girls are housed beside one another. In addition, shifting of beds occurs frequently because different age groups require different bed types.

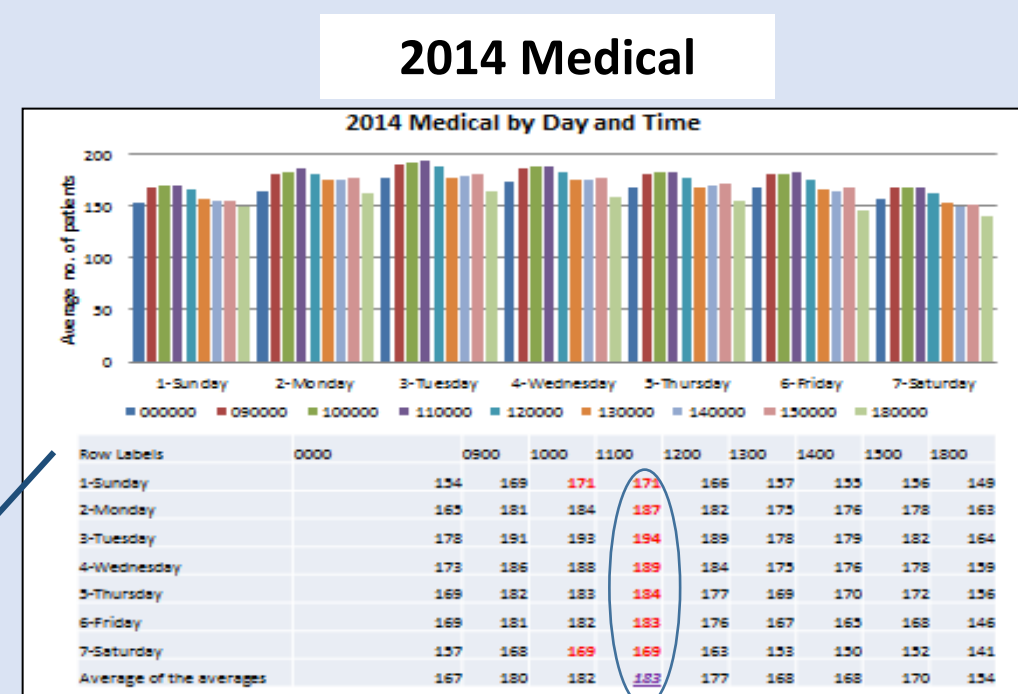
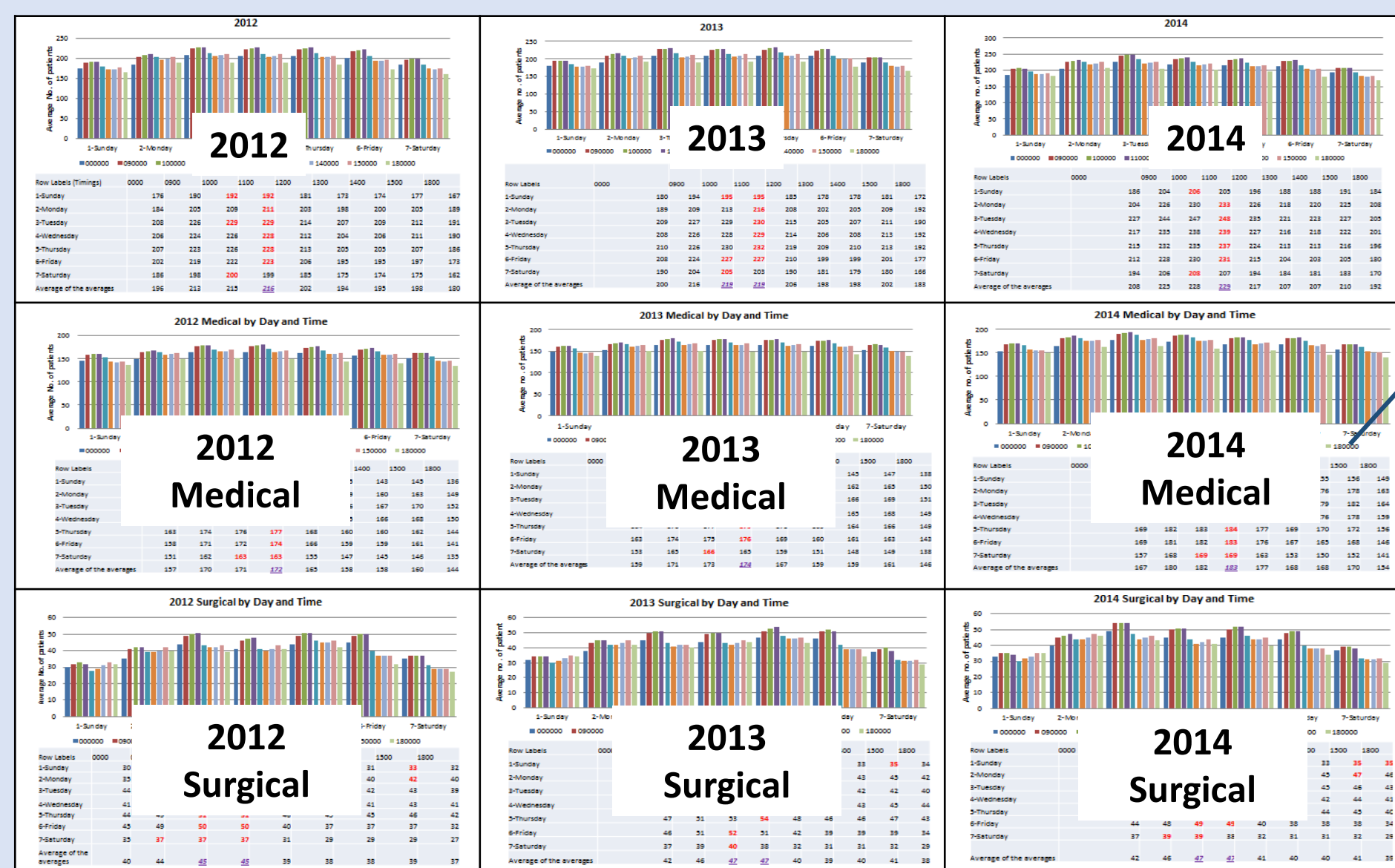
Bed-shifting is a labour-intensive exercise. It also creates tensions between the porters (who need time to find and shift the beds), the nursing staff (under pressure to get the bed space ready) and the admission staff (facing anxious parents with unwell children waiting to get to the ward). Finally, when the bed is moved in, neighbouring patients are disturbed.

AIM: To cohort paediatric patients by age/gender (under 3 months old, 3 months to 4 years old, 4 to under 11 years old, males aged 11 & above, and females aged 11 & above), bed class (A, B1, B2+, B2 and C) and specialty (Medical and Surgical).



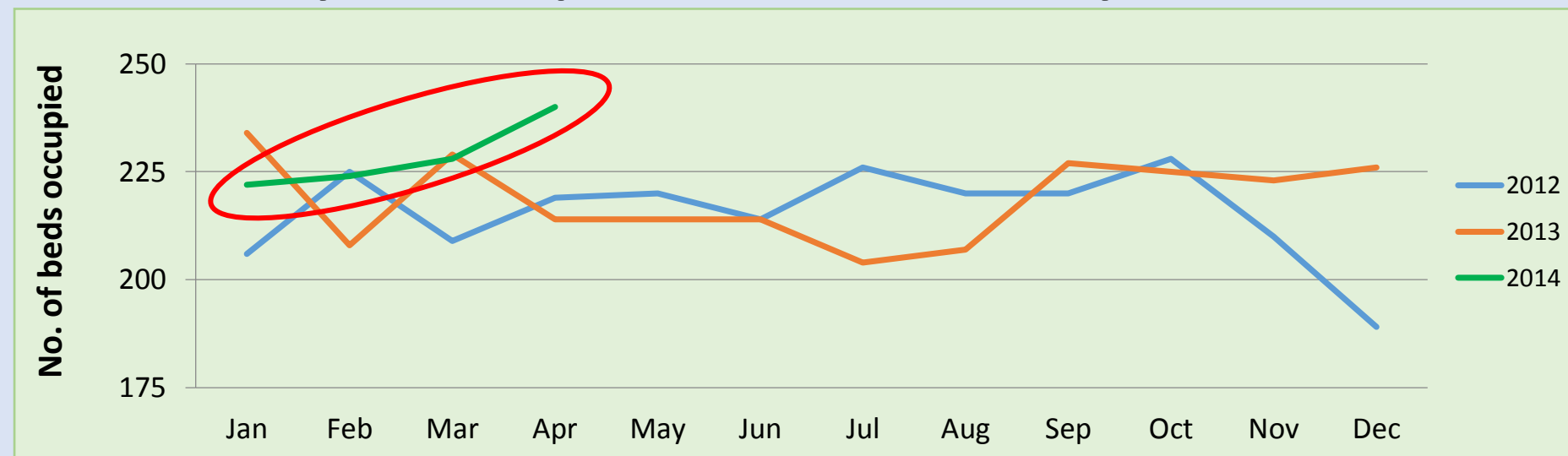
METHODOLOGY

- 1) Define cohorting categories and prep 3 years' data for analysis, including
 - Assign age groups to different bed types
 - Reassign bed class by preferred choice (not final allocation)
- 2) Ascertain time of day when bed occupancy peaks (ensure analysis based on highest occupancy scenario)



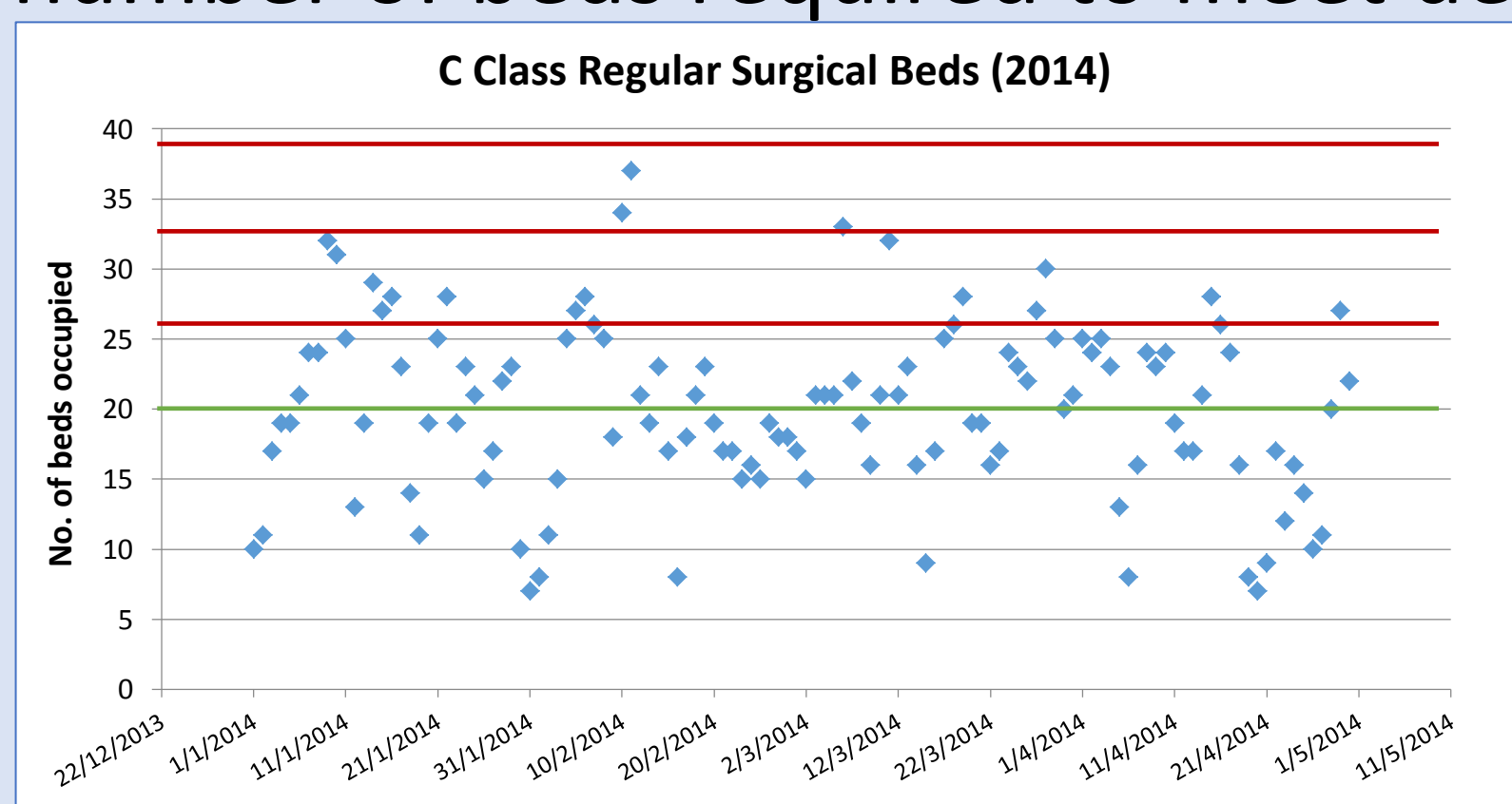
Peak Bed Occupancy Timing: 11am

- 3) Identify data period for analysis



Significant increase in the first 4 months of 2014 as compared to the preceding 24 months. As such, only historical data from January to April 2014 is used for analysis.

- 4) Establish spread of day-to-day bed occupancy using scatter plot and use mean, standard deviations and other intervals to identify number of beds required to meet demand at different percentiles



	Mean	Standard Deviation (SD)	Mean + 1SD	Mean + 2SD	Mean + 3SD
Percentile Value	20	6.2	26.2	32.4	38.7
	50%	--	84.1%	97.7%	99.8%

- 5) Set up matrix for patient mix based on existing ward/cubicle layout/infrastructure and different combinations of patient profile and number of bed classes, eg.

Ward no.	Ward Type	Beds in Svc	Bed Class				No. of each Bed type
			A1	B1	B2 +	C	
31	Medical	30				30	C: 30 Cots
51	Medical	16	16				A1: 16 Cots
56	Medical	32				32	C: 20 Bassinets, 12 Cots
62	Medical	30			25	5	B2+: 15 beds (4 years and above), 10 Cots C: 5 Beds (4years and above)
66	Medical	30				30	C: 30 beds (4years and above)
75	Medical	24	8	8		8	A1: 8 Cots B1: 8 Cots C: 8 Beds (4years and above)
85	Medical	28	12	8		8	A1: 12 Beds B1: 8 Beds (4years and above) C: 8 Beds (4years and above)
55	Surgical	30				30	C: 6 Cots, 12 beds (4-10 years), 6 beds (11years and above Male), 6 beds (11years and above Female)
86	Surgical	33	12	17		4	A1: 10 beds, 6 cots, 1 bassinet, B1: 4 Cots, 4 beds (4-10 years), 2 beds (11years and above Male), 2 beds (11years and above Female), B1 and C: 4 Bassinets

With Full Bed Classes

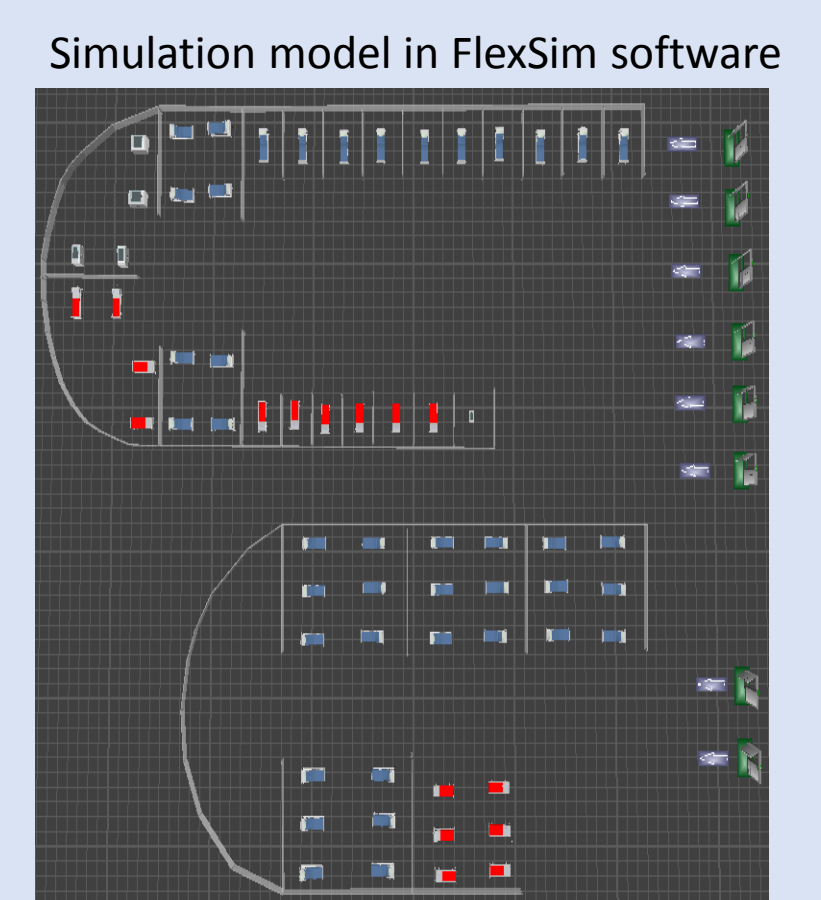
Fully Classless

Ward no.	Ward Type	Beds in Svc	No. of each Bed type
31	Medical	30	12 Cots, 18 Beds (11 years old and above Female)
51	Medical	16	16 Cots
56	Medical	32	20 Bassinets, 12 Cots
62	Medical	30	30 Beds (4-10 years old)
66	Medical	30	30 Cots
75	Medical	24	3 Cots, 21 Beds (4-10 years old)
85	Medical	28	7 Cots, 5 Beds (11 years old and above Female), 16 Beds (11 years old and above Male)
55	Surgical	30	12 Cots, 18 Beds (4-10 years old)
86	Surgical	33	4 Bassinets, 5 Cots, 4 Beds (4-10 years old), 11 Beds (11 years old and above Male), 9 Beds (11 years old and above Female)

NB: Configurations with limited bed classes also done but not shown here

- 6) Simulate all matrix combinations to show :

- patients able/unable to get required bed type in chosen bed class
- time required before required bed type in chosen bed class becomes available to ascertain impact and feasibility of each individual cohorting scenario



RESULT

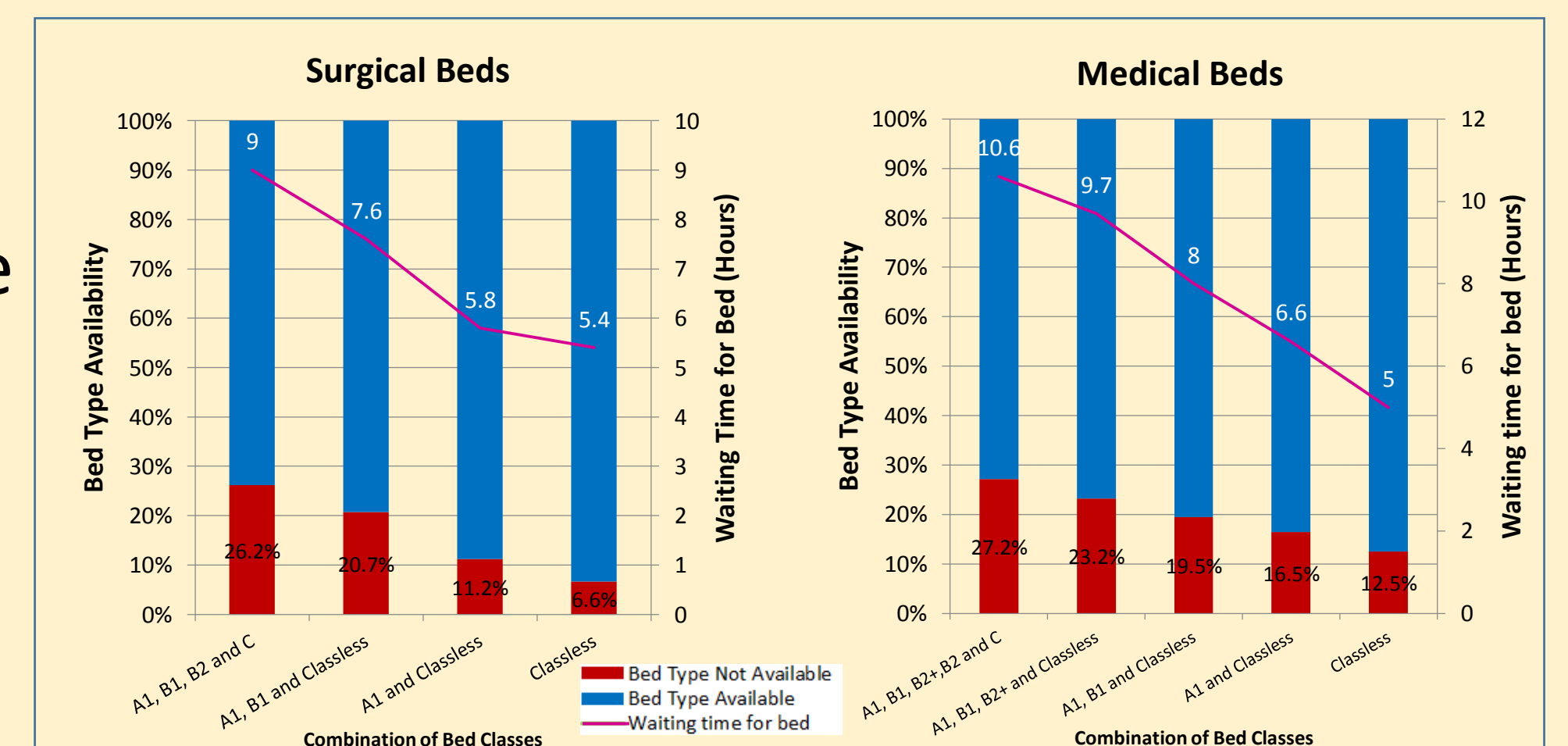
- 1) Able to determine duration that a patient (ie, those unable to get a bed) needs to wait before a bed becomes available in EVERY cohorting scenario. (See surgical example given)

Class	Age Group	Bed Type	Bed Type not Available (Freq)	Bed Type not Available (%)	Bed Utilization Rate (%)	Percentile (Hr)				Average waiting time (hr)	Max waiting time(hr)
						50th	75th	90th	95th		
A1	0-2mths	Bassinet	6/27	22.2	26.6	0.0	0.9	12.3	17.8	0.9	23.4
A1	3mths to 3 years old	Cot	40/314	12.7	48.6	1.4	4.1	12.8	16.1	0.5	19.9
A1	4 years old and above	Bed	18/455	4.0	55.6	1.0	8.0	13.6	14.8	0.2	18.0
B1	3mths to 3 years old	Cot	0/133	0	30.2	0	0	0	0	0	0
B1	4 & above (Male)	Bed	18/167	10.8	41.21	6.6	13.0	20.4	20.9	0.9	21.3
B1	4 & above (Female)	Bed	4/132	3.0	35.1	0.7	6.9	16.7	20.0	0.2	23.2
B1&C	0-2mths	Bassinet	18/163	11.0	40.94	2.5	16.3	20.1	20.9	0.8	24.1
C	4 years old & above (Male)	Bed	267/888	30.1	74.3	3.4	11.1	17.6	18.7	1.9	24.5
C	4 years old & above (Female)	Bed	44/601	7.3	56.2	2.1	4.4	9.9	10.9	0.2	14.0
C	3mths to 3 years old	Cot	262/494	53.0	81.8	5.0	14.1	19.1	21.4	4.2	38.1
Overall			677/3374	20.1	N.A	3.5	11.8	18.3	20.0	1.3	38.1

- 2) Established required no. for each bed type when cohorting by specialty, bed class, age group and gender at various percentile levels

MEDICAL			85th Percentile (approx. mean + 1 SD)	90th Percentile	95th Percentile (approx. mean + 2 SD)	100th Percentile
Patient Class	Bed Class	Bed Type				
Private	A1	Bassinets	3	4	4	7
		Cots	25	26	28	31
		Beds (4 to 10 years)	14	16	18	21
		Beds (11 years & above - Male)				
	Beds (11 years & above - Female)					
	B1	Bassinets	2	3	3	4
		Cots	12	13	14	15
		Beds (4 to 10 years)	7	8	9	14
		Beds (11 years & above - Male)	2	3	3	4
	Beds (11 years & above - Female)	3	3	3	4	
B2+	Bassinets	2	2	2	3	
	Cots	18	18	19	21	
	Beds (4 to 10 years)	12	12	14	17	
	Beds (11 years & above - Male)	4	4	5	5	
	Beds (11 years & above - Female)	5	5	6	9	
Subsidised	C (B2 & C combined)	Bassinets	18	20	22	27
		Cots	48	49	52	57
		Beds (4 to 10 years)	33	35	37	41
		Beds (11 years & above - Male)	15	16	17	21
		Beds (11 years & above - Female)	15	17	18	22
	C (B2+, B2 & C combined)	Bassinets	19	21	22	30
Cots		63	64	67	74	
Beds (4 to 10 years)		42	44	47	51	
Beds (11 years & above - Male)		17	18	19	25	
Beds (11 years & above - Female)		19	20	22	28	
C (B1, B2+, B2, C combined)	Bassinets	21	21	22	32	
C (A1, B1, B2+, B2, C combined)	Bassinets	22	23	28	33	

- 3) As the number of bed classes are reduced, the potential outcome improves significantly



Conclusion

1. Current physical infrastructure of KKH cannot support cohorting by bed class, age group, gender and specialty.
2. For a children hospital to improve efficiency and enhance housing arrangements, there is a need to consider doing away with multiple ward classes.