Online Supplement B. Data Supplement for paper "Managing advance admission requests for obstetric care"

In the paper, we compare different control policies for small-size base case and real application. Each policy is evaluated nearly exactly with a sufficiently long simulation of 10^6 days.

In the following, we will provide all the data used in the experiments, including number of beds, overcapacity penalty, request arrival rates, the probability distribution of ELT, the probability distribution of the deviation from EAT, time window for TWQ and MTWQ, and the data for sensitivity analysis. Specially, Online Supplement B-I includes the data for small-size base case, and Online Supplement B-II includes the data for real application. In addition, Online Supplement B-III shows quotas for small cases.

In the simulation, the pregnancy day and delivery day of each arriving pregnant woman are randomly generated. Since the simulation time is sufficiently long, i.e., 10^6 days, these randomly generated data have little effect on the rewards. Therefore, this part of data is ignored here.

Online Supplement B-I. Data for small-size simple base case

Number of beds: B=32

Overcapacity penalty: b=2.5

Request arrival rates: $\lambda_t = \lambda_\tau^{EAT} = 40$

The probability distribution of ELT: $p_i^{ELT} = \{0.1,0.1,0.8\}$ for i = {3,4,5}

The probability distribution of the deviation from EAT: $p_j^{\delta} = \{0.15.07.0.15\}$ for j = {-1, 0, 1}

Time window for TWQ and MTWQ: 3 days

Data for sensitivity analysis:

1) Effect of the overcapacity cost b with b = {1.5, 2, 2.5, 3, 3.5};

2) Effect of the arrival rate λ with λ_t^{EAT} = {20, 30, 40, 50, 60};

3) Effect of the probability distribution of ELT, $p_i^{ELT} = \{0.3,0.3,0.4\}$ for i= {3,4,5} (denoted as ELT1), and $p_i^{ELT} = \{0.2,0.2,0.2,0.2,0.2\}$ for i = {2,3,4,5,6} (denoted as ELT2);

4) The effect of the probability distribution of the deviation from EAT, as follows:

EAT1: $p_j^{\delta} = \{0.25, 0.5, 0.25\}$ for j= {-1, 0, 1}

EAT2: $p_j^{\delta} = \{0.33, 0.34, 0.33\}$ for j = {-1, 0, 1}

EAT3: $p_j^{\delta} = \{0.43, 0.34, 0.23\}$ for j = {-1, 0, 1}

EAT4: $p_j^{\delta} = \{0.2, 0.2, 0.2,0.2,0.2\}$ for j = {-3, -2, -1, 0, 1}

EAT5: $p_j^{\delta} = \{0.1,0.1, 0.1,0.1,0.2,0.1, 0.1,0.1,0.1\}$ for j = {-4, -3, -2, -1, 0, 1, 2, 3, 4};

5) Effect of the arrival patterns, as follows:

AP1: Seasonal demand in 3 days with $\lambda_t^{EAT} =$ {20, 40, 60}

AP2: Seasonal demand in 3 days with arrival rate λ_t^{EAT} ={40, 60, 40}

AP3: Seasonal demand in 5 days with arrival rate λ_t^{EAT} ={20, 30, 40, 50, 60}

AP4: Seasonal demand in 5 days with arrival rate λ_t^{EAT} ={40, 50, 60, 50, 40}

AP5: Seasonal demand in 5 days with arrival rate λ_t^{EAT} ={30, 60, 60, 60, 30}

6) Effect of service duration, as follows:

SD1: Service duration is 1, 2, or 3 days with respective probabilities of 0.15, 0.7, 0.15

SD2: Service duration is 1, 2, or 3 days with respective probabilities of 0.33, 0.34, 0.33

SD3: Service duration is 1, 2, or 3 days with respective probabilities of 0.25, 0.5, 0.25

SD4: Service duration is 1, 2, 3, or 4 days, each with probability 0.25

SD5: Service duration is 1, 2, 3, 4, or 5 days, each with probability 0.2

Online Supplement B-II. Data for the real-size obstetrics unit

Number of beds: B=100

Overcapacity penalty: b=2.5

Request arrival rates: $\lambda_t = \lambda_\tau^{EAT} = 35$

Expected length of stay: E[L] = 3.5

L is assumed to be uniformly distributed and equal to 2, 3, 4, or 5 with a probability of 0.25.

ELT is bounded by [140, 224].

The probability distribution of ELT:

i	$196 \le i \le 223$	$140 \le i \le 195$	$84 \le i \le 139$
p_i^{ELT}	0.0078	0.0126	0.0014

The probability distribution of the deviation from EAT:

j	p_j^δ									
j=-35~-26	0.0022	0.0011	0.0011	0.0024	0.0029	0.0026	0.0012	0.0051	0.003	0.0038
j=-25~-16	0.003	0.0034	0.0037	0.0053	0.0111	0.0077	0.0087	0.0074	0.0085	0.0086
j=-15~-6	0.0102	0.0164	0.015	0.0156	0.0156	0.0189	0.0183	0.0252	0.0373	0.0334
j=-5~4	0.0275	0.0362	0.0324	0.0315	0.0333	0.0527	0.0378	0.0365	0.0351	0.0365
j=5~14	0.0334	0.0387	0.0472	0.0384	0.0303	0.0349	0.0263	0.0223	0.0189	0.02
j=15~21	0.0135	0.0073	0.0045	0.0017	0.002	0.0013	0.0014			

Time window for TWQ and MTWQ: 30 days

Data for sensitivity analysis:

1) Effect of overcapacity cost b with b = {1.5, 2, 2.5, 3, 3.5} for the real base case;

2) Effect of arrival rate λ with λ_t^{EAT} ={5, 15, 25, 35, 45, 55, 65} for the real base case;

3) Effect of the arrival patterns, as follows:

AP1: Cycle length is 6 days with $\lambda_t^{EAT} = \{5, 5, 5, 65, 65, 65\}$/day

AP2: Cycle length is 6 days with $\lambda_t^{EAT} = \{15, 15, 15, 55, 55, 55\}$/day

AP3: Cycle length is 6 days with $\lambda_t^{EAT} = \{25, 25, 25, 45, 45, 45\}$/day

AP4: Cycle length is 6 days with $\lambda_t^{EAT} = \{5, 15, 25, 35, 45, 55\}$/day

AP5: Cycle length is 6 days with $\lambda_t^{EAT} = \{15, 15, 65, 65, 15, 15\}$/day

AP6: Cycle length is 10 days with $\lambda_t^{EAT} = \{5, 5, 5, 5, 5, 65, 65, 65, 65, 65\}$/day

AP7: Cycle length is 10 days with $\lambda_t^{EAT} = \{5, 15, 25, 35, 45, 55, 65, 55, 45, 35\}$/day

Online Supplement B-III. Quotas for small cases

Table B-1 Quotas for small cases

Parameters		EATQ			TWQ	MTWQ	ADVQ	PQ
		Sim	LP	NA				
b	1.5	34	34.9	34.0	113	101	33	96
	2	32	31.9	32.0	106	96	31	96
	2.5	31	30.4	31.0	100	92	30	96
	3	30	29.4	30.2	82	90	30	96
	3.5	30	28.7	29.7	78	88	29	96
Arrival Rate	20	∞	∞	∞	∞	∞	∞	96
	30	32	∞	∞	98	93	34	96
	40	31	30.4	31.0	100	92	30	96
	50	31	30.3	30.8	86	94	31	96
	60	31	30.3	30.8	95	87	31	96
ELT	Base	31	30.4	31.0	100	92	30	96
	ELT1	31	30.4	31.0	89	92	30	96
	ELT2	31	30.4	31.0	92	92	30	96
EAT	Base	31	30.4	31.0	100	92	30	96
	EAT1	31	30.4	30.7	91	92	30	96
	EAT2	31	30.4	30.7	91	92	30	96
	EAT3	31	30.4	30.7	92	92	30	96
	EAT4	31	30.4	30.5	93	92	30	96
	EAT5	31	30.4	30.9	91	91	30	96
Arrival Pattern	AP1	{∞,31,31}	{∞,33.5, 33.1}	{∞, 31,30.8}	{∞,100,95}	{∞,92,87}	{∞,30,31}	96
	AP2	{31,31,31}	{30.4,30.3,30.4}	{31,30.8, 31}	{100,95,100}	{92,87,92}	{30,31,30}	96
	AP3	{∞,32,31,31,31}	{∞,∞,31.4,28.7,34.4}	{∞, ∞,31,30.8,30.8}	{∞,98,100,86,95}	{∞,93,92,94,87}	{∞,34,30,31,31}	96
	AP4	{31,31,31,31,31}	{30.4,30.3,30.3,30.3,30.4}	{31,30.8,30.8,30.8,30.8}	{100,86,95,86,100}	{92,94,87,94,92}	{30,31,31,31,30}	96
	AP5	{32,31,31,31,32}	{∞,30.4,30.2,30.4, ∞}	{∞,30.8,30.8, 30.8, ∞}	{98,95,95,95,98}	{93,87,87,87,93}	{34,31,31,31,34}	96
Service duration	SD1	15	13.6	/	38	44	15	48
	SD2	14	13.6	/	39	43	14	48
	SD3	15	13.6	/	38	44	15	48
	SD4	11	10.6	/	30	34	11	38
	SD5	9	8.6	/	26	28	9	32