

## Supplementary Materials

### Appendix A

Table A 1 Distance Matrix

Number	Facility points	Demand points			
		Huangpu District	Chongming District	Xuhui District	Changning District
1	Shanghai Changzheng Hospital	2.39	42.48	9.00	9.80
2	Shanghai Ninth People's Hospital	1.72	45.44	7.30	11.08
3	Renji Hospital	5.12	49.35	5.24	11.49
4	Ruijin Hospital	6.67	42.22	10.05	6.77
5	Chongming Branch of Xinhua Hospital	45.62	16.88	51.05	46.13
6	Zhongshan Hospital	6.77	38.17	13.97	14.73
7	The Central Hospital of Xuhui District	6.25	49.08	3.04	4.85
8	Shanghai Sixth People's Hospital	6.44	46.58	6.20	3.43
9	Tongren Hospital	9.06	47.78	7.37	0.93
10	Huashan Hospital	6.16	40.51	11.14	8.94
11	Huadong Hospital	3.16	44.52	6.90	6.99
12	Shanghai Tenth People's Hospital	7.41	37.48	14.60	15.12
13	The Central Hospital of Jing'an District	8.86	46.46	8.28	2.16
14	The Central Hospital of Putuo District	5.06	47.44	8.19	13.65
15	Tongji Hospital	7.29	39.88	12.01	9.15
16	Shanghai Central Hospital	4.85	39.81	11.96	12.63

17	Changhai Hospital	11.83	33.20	18.99	18.87
18	The Central Hospital of Yangpu District	9.97	36.90	17.10	18.77
19	Xinhua Hospital	8.05	37.15	15.28	16.08
20	Shanghai Fifth People's Hospital	23.74	68.36	17.15	22.25
21	The Central Hospital of Minhang District	14.81	58.31	7.61	10.63
22	Shanghai East Hospital	4.72	41.14	11.81	14.05
23	Shanghai Pudong New Area Gongli Hospital	6.66	43.12	9.36	5.87
24	Shanghai Pudong New Area People's Hospital	22.09	47.54	26.37	31.75
25	Shanghai Pudong New District Zhoupu Hospital	17.12	56.03	17.22	24.38
26	Shanghai Pudong Hospital	30.41	62.48	31.42	38.47
27	Jinshan Hospital	52.36	96.97	45.66	49.78
28	Shanghai Songjiang District Central Hospital	33.04	74.39	25.98	26.00
29	Affiliated Zhongshan Hospital of Fudan University, Qingpu Branch	32.49	64.97	27.69	22.75
30	The Central Hospital of Jing'an District	32.38	76.03	27.36	33.86

Table A 2 Distance Matrix

Number	Facilitypoints	Demand points			
		Jing'an District	Putuo District	Hongkou District	Yangpu District
1	Shanghai Changzheng Hospital	4.58	8.51	4.47	8.41

2	Shanghai Ninth People's Hospital	8.46	11.56	7.93	10.72
3	Renji Hospital	11.86	13.69	11.80	14.60
4	Ruijin Hospital	2.91	3.49	6.04	10.87
5	Chongming Branch of Xinhua Hospital	39.18	40.47	38.99	37.64
6	Zhongshan Hospital	6.40	12.04	3.19	3.43
7	The Central Hospital of Xuhui District	9.48	8.43	11.34	15.70
8	Shanghai Sixth People's Hospital	7.03	5.27	9.53	14.24
9	Tongren Hospital	8.75	5.02	11.65	16.45
10	Huashan Hospital	0.90	5.45	3.79	8.62
11	Huadong Hospital	5.18	6.80	6.66	11.08
12	Shanghai Tenth People's Hospital	6.48	12.19	3.15	2.76
13	The Central Hospital of Jing'an District	7.64	3.67	10.68	15.51
14	The Central Hospital of Putuo District	11.75	14.80	10.83	12.70
15	Tongji Hospital	0.82	4.97	4.18	8.86
16	Shanghai Central Hospital	4.97	10.30	2.60	5.37
17	Changhai Hospital	9.43	15.07	6.30	1.67
18	The Central Hospital of Yangpu District	10.53	16.22	7.20	3.91
19	Xinhua Hospital	7.50	13.21	4.15	2.39
20	Shanghai Fifth People's Hospital	29.18	27.69	30.35	33.79
21	The Central Hospital of Minhang District	18.69	16.23	20.60	24.81
22	Shanghai East Hospital	7.63	12.60	5.31	6.37
23	Shanghai Pudong New Area Gongli Hospital	3.81	3.22	6.85	11.68

24	Shanghai Pudong New Area People's Hospital	26.50	31.47	23.64	21.10
25	Shanghai Pudong New District Zhoupu Hospital	23.78	26.66	22.42	22.87
26	Shanghai Pudong Hospital	36.57	40.24	34.52	33.49
27	Jinshan Hospital	57.63	55.45	58.95	62.38
28	Shanghai Songjiang District Central Hospital	35.56	31.34	38.11	42.67
29	Affiliated Zhongshan Hospital of Fudan University, Qingpu Branch	31.29	25.62	34.60	39.39
30	The Central Hospital of Jing'an District	38.84	38.76	39.09	41.41

Table A 3 Distance Matrix

Number	Facility points	Demand points			Pudong New Area
		Minhang District	Baoshan District	Jiading District	
1	Shanghai Changzheng Hospital	17.57	18.58	25.97	30.73
2	Shanghai Ninth People's Hospital	15.17	22.46	29.40	27.40
3	Renji Hospital	11.70	26.01	31.57	26.07
4	Ruijin Hospital	18.44	15.62	21.03	35.69
5	Chongming Branch of Xinhua Hospital	59.41	25.53	33.25	67.52
6	Zhongshan Hospital	22.32	17.36	27.80	29.90
7	The Central Hospital of Xuhui District	11.23	22.77	25.65	32.74
8	Shanghai Sixth People's Hospital	14.22	19.70	22.78	34.81
9	Tongren Hospital	14.27	19.98	21.17	37.12
10	Huashan Hospital	19.74	14.95	22.14	34.62

11	Huadong Hospital	15.55	19.18	24.70	32.18
12	Shanghai Tenth People's Hospital	22.98	16.87	27.63	30.33
13	The Central Hospital of Jing'an District	15.53	18.63	20.34	37.41
14	The Central Hospital of Putuo District	14.58	25.61	32.69	24.23
15	Tongji Hospital	20.56	13.90	21.13	35.69
16	Shanghai Central Hospital	20.42	17.52	26.79	30.30
17	Changhai Hospital	27.40	15.42	28.30	32.08
18	The Central Hospital of Yangpu District	24.99	19.65	31.45	27.58
19	Xinhua Hospital	23.56	17.40	28.52	29.72
20	Shanghai Fifth People's Hospital	8.60	42.51	42.12	32.78
21	The Central Hospital of Minhang District	4.16	31.18	30.52	34.75
22	Shanghai East Hospital	19.81	20.15	29.50	27.53
23	Shanghai Pudong New Area Gongli Hospital	17.66	16.32	21.06	35.75
24	Shanghai Pudong New Area People's Hospital	30.49	36.76	48.27	12.22
25	Shanghai Pudong New District Zhoupu Hospital	17.95	37.35	44.58	13.78
26	Shanghai Pudong Hospital	31.43	49.07	58.10	2.87
27	Jinshan Hospital	37.01	70.42	67.06	53.26
28	Shanghai Songjiang District Central Hospital	19.74	45.38	38.55	50.12
29	Affiliated Zhongshan Hospital of Fudan University, Qingpu Branch	26.98	35.53	23.90	57.82
30	The Central Hospital of Jing'an District	20.20	52.88	54.61	28.56

Table A 4Distance Matrix

Number	Facilitypoints	Demand points			
		Jinshan District	Songjiang District	Qingpu District	Fengxian District
1	Shanghai Changzheng Hospital	51.08	34.78	39.39	38.51
2	Shanghai Ninth People's Hospital	48.83	33.85	40.24	34.79
3	Renji Hospital	45.24	31.26	39.22	31.00
4	Ruijin Hospital	50.97	33.01	35.60	41.45
5	Chongming Branch of Xinhua Hospital	90.43	69.78	63.26	81.71
6	Zhongshan Hospital	55.96	39.99	44.17	41.47
7	The Central Hospital of Xuhui District	44.15	27.47	33.23	34.73
8	Shanghai Sixth People's Hospital	46.61	28.98	33.01	37.89
9	Tongren Hospital	45.58	27.17	30.45	38.72
10	Huashan Hospital	52.68	35.09	37.84	41.96
11	Huadong Hospital	48.78	32.01	36.57	37.75
12	Shanghai Tenth People's Hospital	56.61	40.53	44.49	42.16
13	The Central Hospital of Jing'an District	46.93	28.40	31.13	39.82
14	The Central Hospital of Putuo District	47.92	34.33	42.07	32.06
15	Tongji Hospital	53.30	35.40	37.62	43.01
16	Shanghai Central Hospital	54.01	37.86	42.13	40.34
17	Changhai Hospital	61.03	44.70	47.76	46.06
18	The Central Hospital of Yangpu District	58.59	43.53	48.30	42.03
19	Xinhua Hospital	57.21	41.36	45.48	42.24

20	Shanghai Fifth People's Hospital	26.31	18.89	34.21	18.52
21	The Central Hospital of Minhang District	34.88	19.12	28.69	29.10
22	Shanghai East Hospital	53.46	38.26	43.63	38.35
23	Shanghai Pudong New Area Gongli Hospital	50.08	32.09	34.83	40.89
24	Shanghai Pudong New Area People's Hospital	60.40	51.05	60.34	35.88
25	Shanghai Pudong New District Zhoupu Hospital	46.09	38.09	49.69	23.23
26	Shanghai Pudong Hospital	54.21	50.54	63.47	25.40
27	Jinshan Hospital	10.54	30.60	47.31	25.98
28	Shanghai Songjiang District Central Hospital	21.52	1.17	18.79	33.97
29	Affiliated Zhongshan Hospital of Fudan University, Qingpu Branch	39.18	17.41	7.13	48.98
30	The Central Hospital of Jing'an District	27.71	30.02	46.73	5.31

Table A 5 Medical Resource Information

Number	Hospitals	Number of beds	Number of medical staff
1	Shanghai Changzheng Hospital	1611	2094
2	Shanghai Ninth People's Hospital	3225	4192
3	Renji Hospital	4125	5362
4	Ruijin Hospital	3208	4171
5	Chongming Branch of Xinhua Hospital	1500	1950
6	Zhongshan Hospital	2550	3315
7	The Central Hospital of Xuhui District	1350	1755
8	Shanghai Sixth People's Hospital	2649	3443

9	Tongren Hospital	1800	2340
10	Huashan Hospital	3138	4079
11	Huadong Hospital	1800	2340
12	Shanghai Tenth People's Hospital	2790	2790
13	The Central Hospital of Jing'an District	3627	3627
14	The Central Hospital of Putuo District	942	942
15	Tongji Hospital	1224	1224
16	Shanghai Central Hospital	1230	1230
17	Changhai Hospital	1599	1599
18	The Central Hospital of Yangpu District	1950	1950
19	Xinhua Hospital	2535	2535
20	Shanghai Fifth People's Hospital	2730	2730
21	The Central Hospital of Minhang District	3549	3549
22	Shanghai East Hospital	4050	4050
23	Shanghai Pudong New Area Gongli Hospital	5265	5265
24	Shanghai Pudong New Area People's Hospital	1518	1518
25	Shanghai Pudong New District Zhoupu Hospital	1973	1973
26	Shanghai Pudong Hospital	3675	3675
27	Jinshan Hospital	4777	4777
28	Shanghai Songjiang District Central Hospital	1125	1125
29	Affiliated Zhongshan Hospital of Fudan University, Qingpu Branch	1462	1462
30	The Central Hospital of Jing'an District	900	900

Table A 6location results during each phase

Number	Hospitals	Phase1	Phase2	Phase3
1	Shanghai Changzheng Hospital	0	0	0
2	Shanghai Ninth People's Hospital	0	0	0
3	Renji Hospital	0	0	0
4	Ruijin Hospital	0	0	0
5	Chongming Branch of Xinhua Hospital	1	1	1
6	Zhongshan Hospital	0	0	0



7	The Central Hospital of Xuhui District	0	1	1
8	Shanghai Sixth People's Hospital	1	1	1
9	Tongren Hospital	0	0	1
10	Huashan Hospital	0	0	0
11	Huadong Hospital	0	0	0
12	Shanghai Tenth People's Hospital	1	1	1
13	The Central Hospital of Jing'an District	0	1	1
14	The Central Hospital of Putuo District	0	0	0
15	Tongji Hospital	0	0	0
16	Shanghai Central Hospital	1	1	1
17	Changhai Hospital	0	0	0
18	The Central Hospital of Yangpu District	1	1	1
19	Xinhua Hospital	1	1	1
20	Shanghai Fifth People's Hospital	0	0	0
21	The Central Hospital of Minhang District	0	0	0
22	Shanghai East Hospital	0	0	0
23	Shanghai Pudong New Area Gongli Hospital	0	0	1
24	Shanghai Pudong New Area People's Hospital	0	0	0
25	Shanghai Pudong New District Zhoupu Hospital	0	0	0
26	Shanghai Pudong Hospital	0	0	0
27	Jinshan Hospital	0	0	0
28	Shanghai Songjiang District Central Hospital	0	0	1
29	Affiliated Zhongshan Hospital of Fudan University, Qingpu Branch	0	0	0
30	The Central Hospital of Jing'an District	0	0	0

Table A 7 location results of static model

Number	Hospitals	Chosen or not
1	Shanghai Changzheng Hospital	0
2	Shanghai Ninth People's Hospital	0
3	Renji Hospital	0

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4	Ruijin Hospital	0
5	Chongming Branch of Xinhua Hospital	1
6	Zhongshan Hospital	0
7	The Central Hospital of Xuhui District	1
8	Shanghai Sixth People's Hospital	1
9	Tongren Hospital	1
10	Huashan Hospital	0
11	Huadong Hospital	1
12	Shanghai Tenth People's Hospital	0
13	The Central Hospital of Jing'an District	0
14	The Central Hospital of Putuo District	1
15	Tongji Hospital	0
16	Shanghai Central Hospital	0
17	Changhai Hospital	0
18	The Central Hospital of Yangpu District	1
19	Xinhua Hospital	0
20	Shanghai Fifth People's Hospital	1
21	The Central Hospital of Minhang District	0
22	Shanghai East Hospital	0
23	Shanghai Pudong New Area Gongli Hospital	1
24	Shanghai Pudong New Area People's Hospital	1
25	Shanghai Pudong New District Zhoupu Hospital	1
26	Shanghai Pudong Hospital	1
27	Jinshan Hospital	1
28	Shanghai Songjiang District Central Hospital	0
29	Affiliated Zhongshan Hospital of Fudan University, Qingpu Branch	1
30	The Central Hospital of Jing'an District	1

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