Analysis of Arrival Data from an Endocrinology Clinic

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Abstract

Queueing models of service systems typically assume that the arrival process is a non-homogeneous Poisson process (NHPP). Kim and Whitt [2014] previously tested that hypothesis for arrival data from a call center, and concluded that the data were indeed consistent with an NHPP within each day, but found significant over-dispersion over multiple days. Kim et al. [2014] provides data analysis of arrival data from an endrocrinology clinic where arrivals are by appointment, and apply the same statistical methods of Kim and Whitt (2014). Despite the intended deterministic pattern, the appointment-generated arrival data are also consistent with an NHPP within a single day, but now there is significant under-dispersion over multiple days. This appendix provides additional materials for the main paper.

Keywords: fitting queueing models to data, queues with scheduled arrivals, appointments, statistical tests, Poisson processes, dispersion

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Contents

1 Overview

We present supporting material in this document to the main paper [Kim et al. 2014]; the main paper has data analysis for only one doctor, and this document provides the results for all of the 16 doctors.

Here is how this document is organized: In §2 we introduce our study data from an endocrinology outpatient clinic and discuss discuss different schedules of 16 doctors. In §4, we compare each doctor's scheduled arrivals and actual arrivals, show the presence of no-shows and early and late arrivals, and conduct statistical tests that show the arrivals are consistent with a PP within shifts. We substantiate under-dispersion over multiple days in §5.

2 The Study Data

The appointment arrival data are from an endocrinology outpatient clinic of a major teaching hospital in South Korea, collected over a 13-wesek period from July 2013 to September 2013. Sixteen doctors work in this clinic and patients arrive to the clinic knowing which doctor they will meet; hence, each doctor operates as a single-server system. Each doctor works in a subset of available days and shifts. There are three shifts: morning (am) shifts, roughly from 8:30 am to 12:30 pm, afternoon (pm) shifts, roughly from 12:30 pm to 4:30 pm, and full-day shifts. During the weekdays of the 13-week study period, the 16 doctors worked for a total of 228 am shifts, 220 pm shifts, 25 full-day shifts. The shifts are not evenly distributed among the doctors; the numbers ranged from 11 to 46. Given the small number of full-day shifts, this documents will focus on am and pm shifts from now on.

Table 1: Shifts by Doctor over 13 Weeks (from July to September 2013)

	Mon			Tues			Wed			Thurs			Fri			All Weekdays		
Doc	AM	PM	Both	AM	PM	Both	AM	PM	Both	AM	PM	Both	AM	PM	Both	AM	PM	Both
1	0	12	0	0	7	4	9	0	1	1	0	0	7	0	0	17	19	5
2	0	12	0	0	6	6	11	0	0	9	0	0	1	0	0	21	18	6
3	0	10	2	11	0	0	0	1	0	1	0	1	0	0	9	12	11	12
4	0	2	0	12	0	0	11	0	0	0	10	0	11	0	0	34	12	0
5	12	0	0	0	9	2	0	10	0	10	0	0	1	0	0	23	19	2
6	6	0	0	1	4	0	4	0	0	4	0	0	2	0	0	17	4	0
7	8	0	0	0	0	0	0	1	0	0	7	0	5	0	0	13	8	0
8	1	1	0	0	0	0	0	9	0	9	0	0	0	9	0	10	19	0
9	0	11	0	12	0	0	0	2	0	0	9	0	10	0	0	22	22	0
10	1	0	0	0	0	0	1	0	0	0	0	0	0	9	0	2	9	0
11	0	0	0	0	12	0	0	0	0	10	0	0	0	0	0	10	12	0
12	0	0	0	12	0	0	0	10	0	0	0	0	0	0	0	12	10	0
13	0	13	0	0	0	0	11	0	0	0	0	0	1	0	0	12	13	0
14	0	13	0	1	0	0	0	0	0	0	10	0	0	0	0	1	23	0
15	0	0	0	0	0	0	0	11	0	0	0	0	10	0	0	10	11	0
16	12	0	0	0	0	0	0	10	0	0	0	0	0	0	0	12	10	0
All	40	74	2	49	38	12	47	54	1	44	36	1	48	18	9	228	220	25

Figure 1: Daily totals on am (top) and pm (bottom) shifts for doctors 1-6.

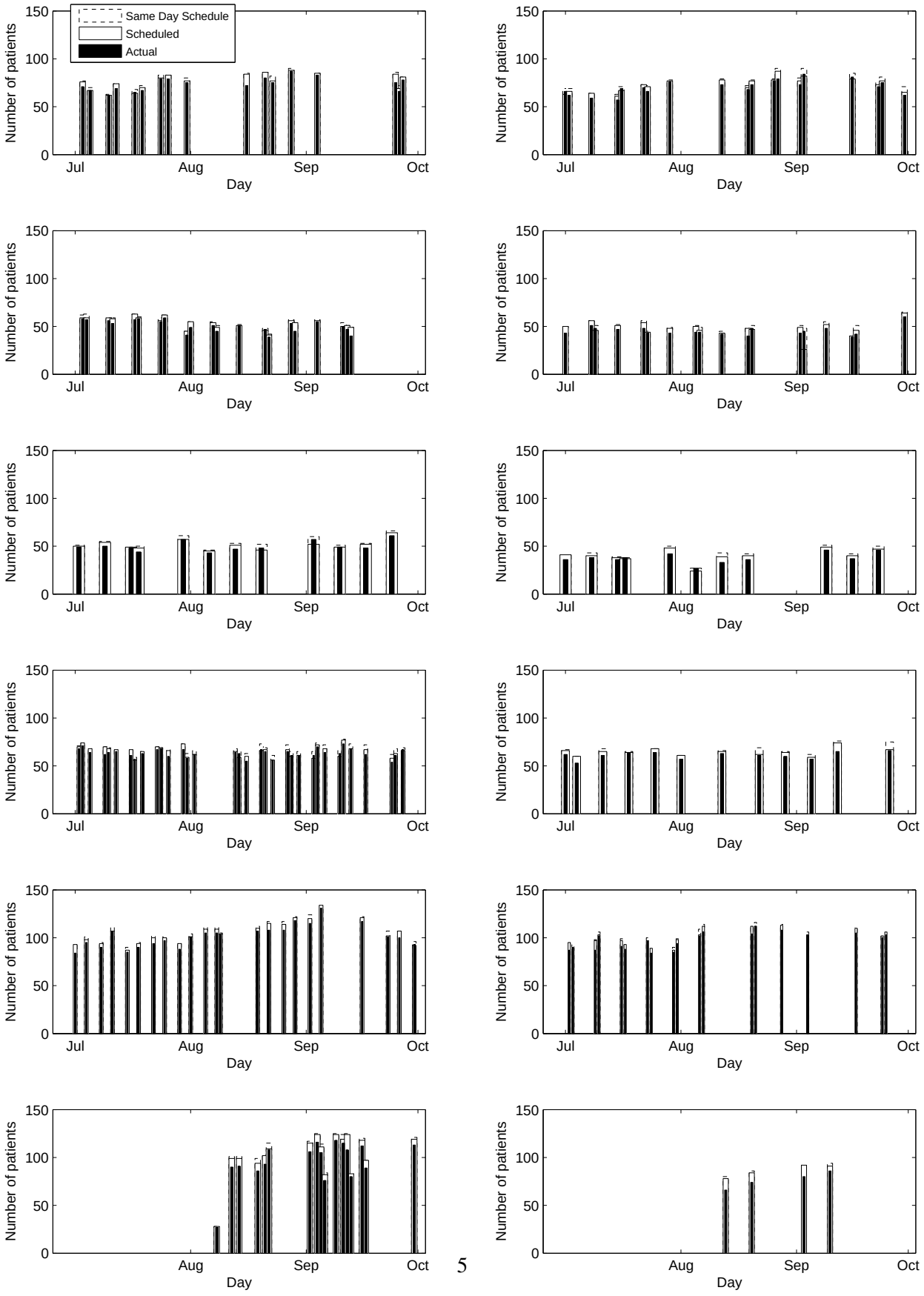


Figure 2: Daily totals on am (top) and pm (bottom) shifts for doctors 7-12.

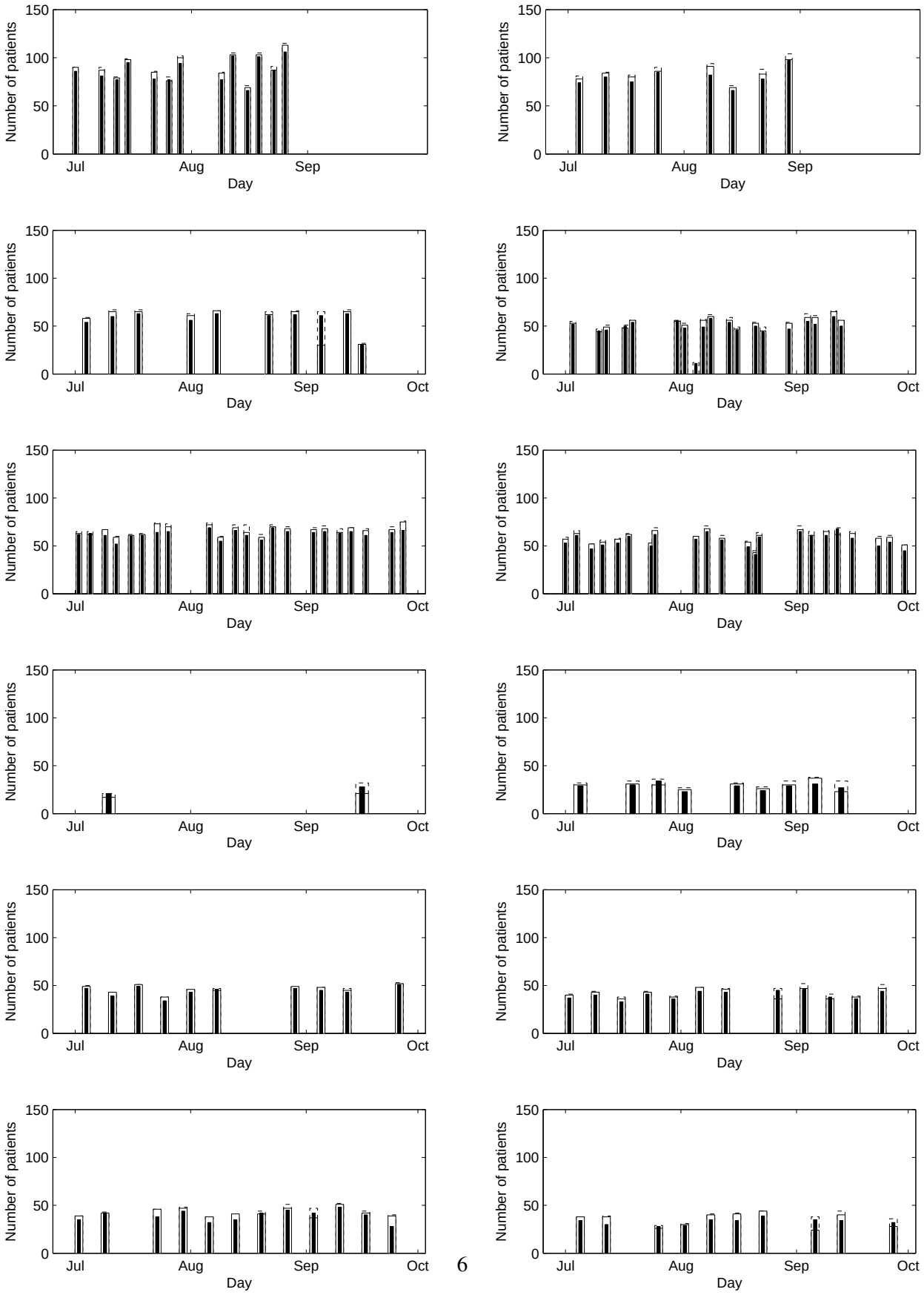
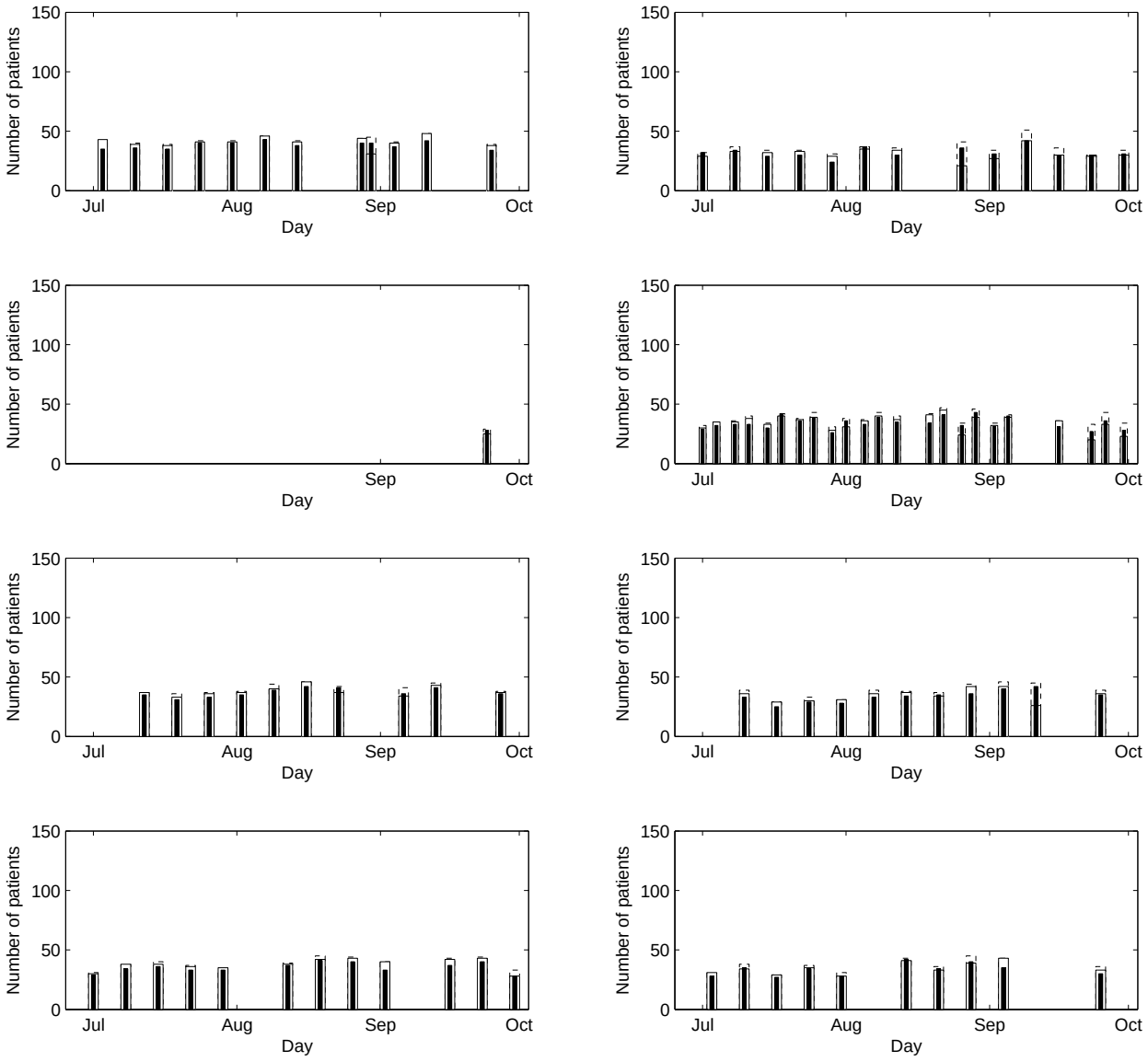


Figure 3: Daily totals on am (top) and pm (bottom) shifts for doctors 13-16.



3 Appointment Slots

Table 2: $B_{s,j}$ for Doctor 9 - am shift.

Slot	Different Days																						Avg	Var	c^2
8.00	0	0	0	0	0	0	1	1	1	0	1	0	0	0	1	0	0	0	0	0	1	1	0.32	0.23	2.24
8.17	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.05	0.05	22.00
8.33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
8.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
8.67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
8.83	3	4	5	4	4	4	4	4	4	1	3	2	1	4	2	4	4	2	4	5	4	3	3.41	1.30	0.11
9.00	3	4	2	3	3	2	3	3	3	3	3	2	2	2	2	3	4	3	2	3	4	2	2.77	0.47	0.06
9.17	3	3	3	2	2	2	4	2	2	3	2	3	2	3	3	3	2	2	3	2	3	3	2.59	0.35	0.05
9.33	2	2	4	2	3	2	3	2	2	3	3	3	2	3	2	3	3	3	3	2	3	2	2.59	0.35	0.05
9.50	3	2	3	4	3	3	4	3	3	3	3	3	1	3	2	2	2	2	3	3	3	3	2.77	0.47	0.06
9.67	3	3	3	2	2	2	2	3	3	2	2	3	2	3	2	2	2	2	3	2	2	2	2.36	0.24	0.04
9.83	3	3	3	3	2	3	3	3	3	3	3	2	2	3	3	3	3	3	2	2	3	3	2.77	0.18	0.02
10.00	3	2	3	3	2	3	2	3	2	3	3	3	3	3	3	3	4	4	3	3	3	3	2.91	0.28	0.03
10.17	3	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3	3	3	3	3	3	3	2.91	0.09	0.01
10.33	2	3	3	3	3	3	3	2	3	3	2	3	3	3	3	2	3	2	3	4	3	3	2.82	0.25	0.03
10.50	3	2	3	3	3	2	4	2	3	2	3	3	3	3	3	2	3	3	2	4	3	3	2.82	0.35	0.04
10.67	3	1	3	3	3	1	3	2	3	2	3	3	2	3	2	1	3	2	3	3	3	2	2.45	0.55	0.09
10.83	2	3	3	3	1	2	3	2	3	3	3	2	3	3	3	3	3	3	2	3	3	3	2.68	0.32	0.04
11.00	3	2	3	2	3	2	3	2	2	4	4	4	2	3	3	3	3	3	3	4	3	4	2.95	0.52	0.06
11.17	3	3	3	1	3	3	3	3	2	3	3	2	3	2	1	3	2	3	3	3	3	3	2.64	0.43	0.06
11.33	2	3	3	3	3	3	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3	4	2.91	0.18	0.02
11.50	3	3	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2	2	3	2	2.77	0.18	0.02
11.67	3	2	3	3	2	3	3	3	3	1	2	3	3	2	3	3	3	3	3	3	2	3	2.68	0.32	0.04
11.83	3	3	3	3	3	2	2	3	3	2	3	2	4	3	3	3	2	2	3	3	1	3	2.68	0.42	0.06
12.00	2	3	3	2	3	3	4	3	3	2	3	3	3	3	3	3	3	3	2	2	3	4	2.86	0.31	0.04
12.17	3	3	3	2	3	3	2	3	2	3	3	2	3	3	4	3	1	2	3	2	3	3	2.68	0.42	0.06
12.33	2	4	3	2	3	3	3	3	4	3	3	3	3	2	2	3	1	3	1	4	3	3	2.77	0.66	0.09
12.50	2	1	0	0	0	3	3	3	3	2	2	2	2	3	3	3	2	4	3	1	2	3	2.14	1.27	0.28
12.67	0	0	0	0	0	2	2	4	3	0	3	2	1	2	3	3	4	2	3	0	0	3	1.68	2.13	0.75
12.83	0	0	0	0	0	0	0	1	4	0	0	0	0	3	3	0	2	0	4	0	0	4	0.95	2.43	2.66
13.00	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.09	0.09	10.48
Daily Total	63	62	67	59	61	62	73	70	72	59	69	64	59	70	67	67	68	64	69	66	67	75	66.05	21.19	0.005
$[9, 12)$ Total	50	47	53	49	47	44	54	47	48	48	51	50	46	50	46	48	51	48	49	52	51	51	49.09	6.09	0.003
All slot avg	2.0	2.0	2.2	1.9	2.0	2.0	2.4	2.3	2.3	1.9	2.2	2.1	1.9	2.3	2.2	2.2	2.2	2.1	2.2	2.1	2.2	2.4	2.13	1.64	0.36
All slot var	1.5	1.9	2.2	1.9	1.8	1.5	1.8	1.3	1.5	1.7	1.5	1.5	1.6	1.5	1.3	1.7	1.8	1.6	1.6	2.2	1.8	1.6	(across all days)		
All slot c^2	0.4	0.5	0.5	0.5	0.5	0.4	0.3	0.3	0.3	0.5	0.3	0.4	0.4	0.3	0.3	0.4	0.4	0.4	0.3	0.5	0.4	0.3			
$[9, 12)$ avg	2.8	2.6	2.9	2.7	2.6	2.4	3.0	2.6	2.7	2.7	2.8	2.8	2.6	2.8	2.6	2.7	2.8	2.7	2.7	2.9	2.8	2.8	2.73	0.34	0.05
$[9, 12)$ var	0.2	0.5	0.2	0.4	0.4	0.4	0.4	0.3	0.2	0.5	0.3	0.3	0.5	0.2	0.4	0.4	0.4	0.4	0.2	0.5	0.4	0.4	(across all days)		
$[9, 12)$ c^2	0.02	0.07	0.02	0.06	0.05	0.06	0.04	0.04	0.03	0.07	0.03	0.04	0.08	0.02	0.06	0.05	0.05	0.05	0.03	0.05	0.05	0.05			

Table 3: $B_{u,j}$ for Doctor 9 - am shift.

Slot	Different Days																					Avg	Var	c^2
8.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0.05	0.05	22.00
8.17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
8.33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
8.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
8.67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
8.83	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	0	0.14	0.12	6.63
9.00	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0.09	0.09	10.48
9.17	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	0	0	0	0.14	0.12	6.63
9.33	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.05	0.05	22.00
9.50	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.05	0.05	22.00
9.67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0.09	0.09	10.48
9.83	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0.09	0.09	10.48
10.00	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0.05	0.05	22.00
10.17	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0.05	0.05	22.00
10.33	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	1	0	0.14	0.12	6.63
10.50	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0.09	0.09	10.48
10.67	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0.14	0.12	6.63
10.83	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.09	0.09	10.48
11.00	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0.09	0.09	10.48
11.17	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0.09	0.09	10.48
11.33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0.05	0.05	22.00
11.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
11.67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
11.83	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0.09	0.09	10.48
12.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
12.17	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	1	0	0	0.14	0.12	6.63
12.33	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.05	0.05	22.00
12.50	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0.14	0.12	6.63
12.67	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0.14	0.22	11.76
12.83	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0.09	0.09	10.48
13.00	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0.09	0.09	10.48
Daily Total	2	3	0	1	1	1	1	3	2	1	3	8	3	2	2	2	3	4	0	2	3	1	2.18	2.82	0.59
$[9, 12)$ Total	1	3	0	1	1	1	1	1	2	1	2	3	2	1	1	2	2	2	0	0	2	1	1.36	0.72	0.39

Table 4: $B_{s+u,j}$ for Doctor 9 - am shift.

Slot	Different Days																						Avg	Var	c^2
8.00	0	0	0	0	0	0	1	1	1	0	1	0	0	0	1	0	0	0	0	0	2	1	0.36	0.34	2.55
8.17	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.05	0.05	22.00
8.33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
8.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
8.67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
8.83	3	4	5	4	4	4	4	4	4	1	3	3	1	4	3	4	4	3	4	5	4	3	3.55	1.02	0.08
9.00	3	4	2	3	3	2	3	3	3	3	3	3	2	2	2	3	4	3	2	3	4	3	2.86	0.41	0.05
9.17	3	3	3	2	2	2	4	2	3	3	3	3	2	3	3	3	3	2	3	2	3	3	2.73	0.30	0.04
9.33	3	2	4	2	3	2	3	2	2	3	3	3	2	3	2	3	3	3	3	2	3	2	2.64	0.34	0.05
9.50	3	3	3	4	3	3	4	3	3	3	3	3	1	3	2	2	2	2	3	3	3	3	2.82	0.44	0.06
9.67	3	3	3	2	2	2	2	3	3	2	2	3	2	3	2	3	3	2	3	2	2	2	2.45	0.26	0.04
9.83	3	3	3	3	2	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2	3	3	2.86	0.12	0.02
10.00	3	2	3	3	2	3	2	3	3	3	3	3	3	3	3	3	3	4	4	3	3	3	2.95	0.24	0.03
10.17	3	3	3	3	3	3	3	3	2	3	3	3	3	3	3	3	3	3	3	3	3	3	2.95	0.05	0.01
10.33	2	3	3	3	3	3	3	2	3	3	3	3	3	3	3	2	3	3	3	4	4	3	2.95	0.24	0.03
10.50	3	2	3	3	3	2	4	2	3	2	3	4	3	3	3	2	3	4	2	4	3	3	2.91	0.47	0.06
10.67	3	2	3	3	3	2	3	2	3	2	3	3	2	3	2	2	3	2	3	3	3	2	2.59	0.25	0.04
10.83	2	3	3	3	2	2	3	3	3	3	3	2	3	3	3	3	3	3	2	3	3	3	2.77	0.18	0.02
11.00	3	3	3	2	3	2	3	2	2	4	4	4	3	3	3	3	3	3	3	4	3	4	3.05	0.43	0.05
11.17	3	3	3	2	3	3	3	3	2	3	3	2	3	3	1	3	2	3	3	3	3	3	2.73	0.30	0.04
11.33	2	3	3	3	3	3	3	3	3	3	3	3	3	2	3	3	3	3	3	3	3	4	2.95	0.14	0.02
11.50	3	3	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2	2	3	2	2.77	0.18	0.02
11.67	3	2	3	3	2	3	3	3	3	1	2	3	3	2	3	3	3	3	3	3	2	3	2.68	0.32	0.04
11.83	3	3	3	3	3	2	3	3	3	2	3	2	4	3	3	3	2	2	3	3	2	3	2.77	0.28	0.04
12.00	2	3	3	2	3	3	4	3	3	2	3	3	3	3	3	3	3	3	2	2	3	4	2.86	0.31	0.04
12.17	3	3	3	2	3	3	2	3	2	3	3	3	3	3	4	3	2	2	3	3	3	3	2.82	0.25	0.03
12.33	3	4	3	2	3	3	3	3	4	3	3	3	3	2	2	3	1	3	1	4	3	3	2.82	0.63	0.08
12.50	2	1	0	0	0	3	3	4	3	2	2	3	2	3	3	3	2	4	3	2	2	3	2.27	1.35	0.26
12.67	0	0	0	0	0	2	2	4	3	0	4	4	1	2	3	3	4	2	3	0	0	3	1.82	2.54	0.77
12.83	0	0	0	0	0	0	0	1	4	0	0	0	1	3	3	0	2	1	4	0	0	4	1.05	2.33	2.13
13.00	1	0	0	0	1	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0.18	0.16	4.71
Daily Total	65	65	67	60	62	63	74	73	74	60	72	72	62	72	69	69	71	68	69	68	70	76	68.23	22.28	0.00
$[9, 12)$ Total	51	50	53	50	48	45	55	48	50	49	53	53	48	51	47	50	53	50	49	52	53	52	50.45	5.88	0.00
All slot avg	2.1	2.1	2.2	1.9	2.0	2.0	2.4	2.4	2.4	1.9	2.3	2.3	2.0	2.3	2.2	2.2	2.3	2.2	2.2	2.2	2.3	2.5	2.20	1.66	0.34
All slot var	1.6	2.0	2.2	1.9	1.7	1.5	1.8	1.3	1.5	1.7	1.6	1.8	1.5	1.4	1.4	1.6	1.7	1.6	1.6	2.2	1.8	1.6	(across all days)		
All slot c^2	0.4	0.4	0.5	0.5	0.4	0.4	0.3	0.2	0.3	0.5	0.3	0.3	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.5	0.4	0.3			
$[9, 12)$ avg	2.8	2.8	2.9	2.8	2.7	2.5	3.1	2.7	2.8	2.7	2.9	2.9	2.7	2.8	2.6	2.8	2.9	2.8	2.7	2.9	2.9	2.9	2.80	0.29	0.04
$[9, 12)$ var	0.1	0.3	0.2	0.3	0.2	0.3	0.3	0.2	0.2	0.4	0.2	0.3	0.5	0.1	0.4	0.2	0.3	0.4	0.2	0.5	0.3	0.3	(across all days)		
$[9, 12)$ c^2	0.02	0.04	0.02	0.04	0.03	0.04	0.03	0.03	0.02	0.06	0.02	0.03	0.07	0.02	0.05	0.02	0.03	0.05	0.03	0.05	0.03	0.04			

Table 5: $B_{a|s,j}$ for Doctor 9 - am shift.

Slot	Different Days																						Avg	Var	c^2
8.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
8.17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
8.33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
8.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
8.67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
8.83	2	4	5	3	4	4	2	4	4	1	3	2	1	4	2	4	4	2	4	5	4	2	3.18	1.49	0.15
9.00	3	3	2	2	3	2	3	3	3	2	3	2	2	2	2	3	4	3	2	2	4	2	2.59	0.44	0.07
9.17	3	3	3	1	2	2	2	2	2	3	1	3	1	3	3	3	2	1	3	2	3	3	2.32	0.61	0.11
9.33	2	2	4	2	3	2	3	2	2	3	3	2	2	3	0	3	3	2	3	2	3	2	2.41	0.63	0.11
9.50	3	2	3	2	3	3	3	2	3	3	3	3	1	3	2	2	2	2	3	3	3	3	2.59	0.35	0.05
9.67	3	3	1	2	2	2	2	3	3	2	2	2	2	3	2	2	2	2	3	2	2	1	2.18	0.35	0.07
9.83	3	3	3	3	2	3	3	3	3	3	3	2	2	3	3	3	3	3	2	2	3	3	2.77	0.18	0.02
10.00	3	2	3	3	2	3	2	3	2	2	3	1	2	3	3	3	3	4	2	3	3	3	2.64	0.43	0.06
10.17	3	3	3	2	3	3	3	2	2	2	2	2	3	3	3	3	2	3	3	3	1	3	2.59	0.35	0.05
10.33	2	3	2	2	3	3	3	2	2	3	2	2	3	3	3	2	3	2	2	4	3	3	2.59	0.35	0.05
10.50	3	2	3	3	3	2	4	1	2	2	3	3	3	3	2	2	3	3	2	4	2	3	2.64	0.53	0.08
10.67	3	0	3	3	3	1	3	2	3	2	2	3	2	3	2	1	3	1	3	2	3	1	2.23	0.85	0.17
10.83	2	3	2	3	1	1	2	2	3	3	3	2	3	2	3	3	3	3	2	3	3	1	2.41	0.54	0.09
11.00	3	2	3	1	2	2	3	2	2	3	3	4	1	3	3	2	3	3	3	3	3	4	2.64	0.62	0.09
11.17	3	3	3	1	3	3	3	3	2	3	3	2	3	2	1	2	2	3	2	2	3	2	2.45	0.45	0.07
11.33	2	3	3	3	3	2	3	3	3	3	3	2	3	2	1	3	2	3	3	2	3	4	2.68	0.42	0.06
11.50	3	3	2	3	3	3	3	3	3	3	3	2	2	3	3	2	2	1	2	2	3	2	2.55	0.35	0.05
11.67	3	2	2	3	2	3	2	2	2	1	2	3	3	2	3	3	3	3	3	2	2	3	2.45	0.35	0.06
11.83	3	3	3	3	3	2	2	3	3	2	3	2	4	3	3	2	2	1	2	3	1	3	2.55	0.55	0.08
12.00	2	3	2	2	3	3	3	3	2	1	3	2	1	3	3	2	1	3	2	2	2	3	2.32	0.51	0.10
12.17	3	3	3	2	3	3	2	3	2	3	3	2	3	3	4	3	1	2	3	1	3	3	2.64	0.53	0.08
12.33	1	4	3	2	3	3	3	3	4	3	3	2	3	2	2	3	1	3	1	4	3	3	2.68	0.80	0.11
12.50	2	1	0	0	0	3	2	2	3	2	1	2	2	3	3	3	2	4	3	1	2	3	2.00	1.24	0.31
12.67	0	0	0	0	0	2	2	4	3	0	3	2	1	1	3	3	4	2	3	0	0	2	1.59	2.06	0.82
12.83	0	0	0	0	0	0	0	1	4	0	0	0	0	3	3	0	2	0	4	0	0	3	0.91	2.18	2.64
13.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
Daily Total	60	60	61	51	59	60	63	63	67	55	63	54	53	68	62	62	62	59	65	59	62	65	60.59	18.73	0.01
$[9, 12)$ Total	50	45	48	42	46	42	49	43	45	45	47	42	42	49	42	44	47	43	45	46	48	46	45.27	6.59	0.00
All slot avg	1.9	1.9	2.0	1.6	1.9	1.9	2.0	2.0	2.2	1.8	2.0	1.7	1.7	2.2	2.0	2.0	2.0	1.9	2.1	1.9	2.0	2.1	1.95	1.59	0.42
All slot var	1.6	1.9	2.1	1.5	1.8	1.5	1.5	1.5	1.5	1.5	1.6	1.2	1.5	1.5	1.6	1.5	1.6	1.7	1.5	2.0	1.9	1.6	(across all days)		
All slot c^2	0.4	0.5	0.5	0.6	0.5	0.4	0.4	0.4	0.3	0.5	0.4	0.4	0.5	0.3	0.4	0.4	0.4	0.5	0.3	0.6	0.5	0.4			
$[9, 12)$ avg	2.8	2.5	2.7	2.3	2.6	2.3	2.7	2.4	2.5	2.5	2.6	2.3	2.3	2.7	2.3	2.4	2.6	2.4	2.5	2.6	2.7	2.6	2.54	0.47	0.07
$[9, 12)$ var	0.2	0.6	0.5	0.6	0.4	0.5	0.3	0.4	0.3	0.4	0.4	0.5	0.7	0.2	0.8	0.4	0.4	0.8	0.3	0.5	0.6	0.8	(across all days)		
$[9, 12)$ c^2	0.02	0.10	0.07	0.11	0.06	0.09	0.04	0.06	0.04	0.06	0.05	0.09	0.13	0.03	0.15	0.06	0.05	0.15	0.04	0.08	0.08	0.13			

Table 6: $B_{a|u,j}$ for Doctor 9 - am shift.

Slot	Different Days																					Avg	Var	c^2
8.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
8.17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
8.33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
8.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
8.67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
8.83	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	0	0.14	0.12	6.63
9.00	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0.09	0.09	10.48
9.17	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	0	0	0	0.14	0.12	6.63
9.33	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.05	0.05	22.00
9.50	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.05	0.05	22.00
9.67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0.09	0.09	10.48
9.83	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0.09	0.09	10.48
10.00	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0.05	0.05	22.00
10.17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
10.33	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	1	0	0.14	0.12	6.63
10.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0.05	0.05	22.00
10.67	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0.14	0.12	6.63
10.83	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.09	0.09	10.48
11.00	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0.09	0.09	10.48
11.17	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.05	0.05	22.00
11.33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0.05	0.05	22.00
11.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
11.67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
11.83	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0.09	0.09	10.48
12.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
12.17	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	1	0	0	0.14	0.12	6.63
12.33	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.05	0.05	22.00
12.50	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0.09	0.09	10.48
12.67	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0.14	0.22	11.76
12.83	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0.09	0.09	10.48
13.00	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0.09	0.09	10.48
Daily Total	2	3	0	1	1	1	1	2	2	0	3	7	3	1	2	2	3	4	0	2	2	1	1.95	2.43	0.64
$[9, 12)$ Total	1	3	0	1	1	1	1	1	2	0	2	2	2	0	1	2	2	2	0	0	2	1	1.23	0.76	0.50

Table 7: $B_{a,j}$ for Doctor 9 - am shift.

Slot	Different Days																						Avg	Var	c^2
8.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
8.17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
8.33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
8.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
8.67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
8.83	2	4	5	3	4	4	2	4	4	1	3	3	1	4	3	4	4	3	4	5	4	2	3.32	1.27	0.12
9.00	3	3	2	2	3	2	3	3	3	2	3	3	2	2	2	3	4	3	2	2	4	3	2.68	0.42	0.06
9.17	3	3	3	1	2	2	2	2	3	3	2	3	1	3	3	3	3	1	3	2	3	3	2.45	0.55	0.09
9.33	3	2	4	2	3	2	3	2	2	3	3	2	2	3	0	3	3	2	3	2	3	2	2.45	0.64	0.11
9.50	3	3	3	2	3	3	3	2	3	3	3	3	1	3	2	2	2	2	3	3	3	3	2.64	0.34	0.05
9.67	3	3	1	2	2	2	2	3	3	2	2	2	2	3	2	3	3	2	3	2	2	1	2.27	0.40	0.08
9.83	3	3	3	3	2	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2	3	3	2.86	0.12	0.02
10.00	3	2	3	3	2	3	2	3	3	2	3	1	2	3	3	3	3	4	2	3	3	3	2.68	0.42	0.06
10.17	3	3	3	2	3	3	3	2	2	2	2	2	3	3	3	3	2	3	3	3	1	3	2.59	0.35	0.05
10.33	2	3	2	2	3	3	3	2	2	3	3	2	3	3	3	2	3	3	2	4	4	3	2.73	0.40	0.05
10.50	3	2	3	3	3	2	4	1	2	2	3	3	3	3	2	2	3	4	2	4	2	3	2.68	0.61	0.08
10.67	3	1	3	3	3	2	3	2	3	2	2	3	2	3	2	2	3	1	3	2	3	1	2.36	0.53	0.09
10.83	2	3	2	3	2	1	2	3	3	3	3	2	3	2	3	3	3	3	2	3	3	1	2.50	0.45	0.07
11.00	3	3	3	1	2	2	3	2	2	3	3	4	2	3	3	2	3	3	3	3	3	4	2.73	0.49	0.07
11.17	3	3	3	2	3	3	3	3	2	3	3	2	3	2	1	2	2	3	2	2	3	2	2.50	0.36	0.06
11.33	2	3	3	3	3	2	3	3	3	3	3	2	3	2	2	3	2	3	3	2	3	4	2.73	0.30	0.04
11.50	3	3	2	3	3	3	3	3	3	3	3	2	2	3	3	2	2	1	2	2	3	2	2.55	0.35	0.05
11.67	3	2	2	3	2	3	2	2	2	1	2	3	3	2	3	3	3	3	3	2	2	3	2.45	0.35	0.06
11.83	3	3	3	3	3	2	3	3	3	2	3	2	4	3	3	2	2	1	2	3	2	3	2.64	0.43	0.06
12.00	2	3	2	2	3	3	3	3	2	1	3	2	1	3	3	2	1	3	2	2	2	3	2.32	0.51	0.10
12.17	3	3	3	2	3	3	2	3	2	3	3	3	3	3	4	3	2	2	3	2	3	3	2.77	0.28	0.04
12.33	2	4	3	2	3	3	3	3	4	3	3	2	3	2	2	3	1	3	1	4	3	3	2.73	0.68	0.09
12.50	2	1	0	0	0	3	2	2	3	2	1	3	2	3	3	3	2	4	3	2	2	3	2.09	1.23	0.28
12.67	0	0	0	0	0	2	2	4	3	0	4	4	1	1	3	3	4	2	3	0	0	2	1.73	2.49	0.84
12.83	0	0	0	0	0	0	0	1	4	0	0	0	1	3	3	0	2	1	4	0	0	3	1.00	2.10	2.10
13.00	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0.09	0.09	10.48
Daily Total	62	63	61	52	60	61	64	65	69	55	66	61	56	69	64	64	65	63	65	61	64	66	62.55	17.21	0.00
$[9, 12)$ Total	51	48	48	43	47	43	50	44	47	45	49	44	44	49	43	46	49	45	45	46	50	47	46.50	6.26	0.00
All slot avg	2.0	2.0	2.0	1.7	1.9	2.0	2.1	2.1	2.2	1.8	2.1	2.0	1.8	2.2	2.1	2.1	2.1	2.0	2.1	2.0	2.1	2.1	2.02	1.6	0.39
All slot var	1.6	1.9	2.1	1.5	1.8	1.5	1.5	1.4	1.6	1.5	1.6	1.6	1.4	1.4	1.6	1.5	1.6	1.8	1.5	2.0	1.9	1.6	(across all days)		
All slot c^2	0.4	0.5	0.5	0.5	0.5	0.4	0.4	0.3	0.3	0.5	0.4	0.4	0.4	0.3	0.4	0.4	0.4	0.4	0.3	0.5	0.5	0.4			
$[9, 12)$ avg	2.8	2.7	2.7	2.4	2.6	2.4	2.8	2.4	2.6	2.5	2.7	2.4	2.4	2.7	2.4	2.6	2.7	2.5	2.5	2.6	2.8	2.6	2.58	0.42	0.06
$[9, 12)$ var	0.1	0.4	0.5	0.5	0.3	0.4	0.3	0.4	0.3	0.4	0.2	0.5	0.6	0.2	0.7	0.3	0.3	1.0	0.3	0.5	0.5	0.8	(across all days)		
$[9, 12)$ c^2	0.02	0.05	0.07	0.09	0.04	0.06	0.04	0.06	0.04	0.06	0.03	0.08	0.10	0.03	0.13	0.04	0.04	0.16	0.04	0.08	0.07	0.12			

Table 8: $B_{s,j}$ for Doctor 9 - pm shift.

Slot	Different Days																					Avg	Var	c^2
11.00	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.05	0.05	22.00
11.17	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.05	0.05	22.00
11.33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
11.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
11.67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
11.83	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
12.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
12.17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
12.33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
12.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
12.67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
12.83	6	4	3	4	4	4	0	4	3	4	4	4	0	3	4	3	3	4	5	0	2	0	3.09	2.85	0.30
13.00	3	4	2	3	3	1	0	3	3	4	2	2	0	3	3	3	3	3	3	5	3	3	2.68	1.37	0.19
13.17	3	2	3	2	2	3	0	2	3	3	2	2	0	3	3	3	3	3	2	3	3	3	2.41	0.82	0.14
13.33	2	3	3	3	3	3	0	3	2	3	2	2	0	3	3	2	2	2	3	4	2	2	2.36	0.91	0.16
13.50	3	3	4	3	3	3	3	3	2	3	2	2	2	3	3	3	3	2	3	3	3	3	2.82	0.25	0.03
13.67	3	3	2	3	3	2	3	3	2	2	3	3	3	2	3	2	3	2	3	3	3	3	2.68	0.23	0.03
13.83	3	3	3	2	3	1	3	3	3	4	2	2	3	3	3	3	2	0	2	3	3	2	2.55	0.74	0.11
14.00	2	2	2	2	3	2	3	3	3	3	3	3	3	2	3	1	2	2	2	2	3	3	2.45	0.35	0.06
14.17	3	2	2	2	2	3	3	2	3	3	2	4	3	3	2	3	3	3	2	3	3	3	2.68	0.32	0.04
14.33	2	3	3	3	3	3	2	3	3	2	3	3	3	1	2	3	3	1	3	2	3	2	2.55	0.45	0.07
14.50	1	2	2	3	3	3	3	3	3	3	3	2	4	3	3	2	2	1	3	2	3	3	2.59	0.54	0.08
14.67	3	3	2	2	2	3	3	3	3	3	2	2	2	2	3	1	2	3	2	3	3	1	2.41	0.44	0.08
14.83	2	3	3	2	1	3	3	2	2	2	2	2	3	3	3	2	3	3	3	2	3	2	2.45	0.35	0.06
15.00	1	3	2	2	3	3	2	3	3	3	3	3	1	3	2	1	3	3	3	3	2	3	2.50	0.55	0.09
15.17	3	3	0	2	1	2	3	2	1	2	3	3	3	3	4	3	2	3	3	2	2	2	2.36	0.81	0.15
15.33	3	2	3	2	3	3	3	2	3	3	2	1	3	3	3	3	3	2	3	3	3	2	2.64	0.34	0.05
15.50	2	3	3	3	3	3	2	3	3	3	3	1	3	3	3	3	3	3	3	3	3	1	2.73	0.40	0.05
15.67	3	2	3	2	3	3	3	3	3	3	3	2	2	3	3	3	3	3	2	2	3	4	2.77	0.28	0.04
15.83	3	3	3	3	3	3	3	3	3	3	3	2	3	1	3	3	3	3	3	3	2	2	2.77	0.28	0.04
16.00	3	3	2	2	3	3	3	3	2	3	2	3	2	3	2	3	2	3	3	3	1	3	2.59	0.35	0.05
16.17	3	3	2	3	3	1	3	2	3	3	2	1	0	3	2	3	3	1	2	2	3	3	2.32	0.80	0.15
16.33	0	3	0	1	0	2	3	3	3	3	2	2	0	3	2	3	3	1	2	2	3	1	1.91	1.32	0.36
16.50	0	1	0	0	0	3	2	2	1	3	2	3	0	2	2	3	2	3	2	0	0	0	1.41	1.49	0.75
16.67	0	0	0	0	0	0	0	3	0	0	1	0	0	0	3	2	3	2	1	0	0	0	0.68	1.27	2.74
16.83	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0.09	0.09	10.48
17.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0.09	0.18	22.00
17.17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0.14	0.41	22.00
Daily Total	57	63	52	54	57	60	53	66	60	68	58	54	43	61	67	61	65	62	63	58	59	51	58.73	35.45	0.01
$[13, 16)$ Total	45	49	45	44	47	47	42	49	48	52	45	41	41	47	52	44	48	42	48	51	50	44	46.41	11.40	0.01
All slot avg	1.6	1.8	1.5	1.5	1.6	1.7	1.5	1.9	1.7	1.9	1.7	1.5	1.2	1.7	1.9	1.7	1.9	1.8	1.8	1.7	1.7	1.5	1.55	1.96	0.82
All slot var	2.4	2.1	1.9	1.8	2.1	1.9	2.1	2.0	1.9	2.3	1.7	1.8	2.0	2.0	2.1	1.9	1.8	1.8	2.0	2.3	2.0	1.9	(across all days)		
All slot c^2	0.9	0.7	0.9	0.7	0.8	0.7	0.9	0.6	0.7	0.6	0.6	0.7	1.3	0.7	0.6	0.6	0.5	0.6	0.6	0.8	0.7	0.9			
$[13, 16)$ avg	2.5	2.7	2.5	2.4	2.6	2.6	2.3	2.7	2.7	2.9	2.5	2.3	2.3	2.6	2.9	2.4	2.7	2.3	2.7	2.8	2.8	2.4	2.58	0.52	0.08
$[13, 16)$ var	0.5	0.3	0.7	0.3	0.5	0.5	1.3	0.2	0.4	0.3	0.3	0.6	1.5	0.5	0.2	0.6	0.2	0.8	0.2	0.6	0.2	0.6	(across all days)		
$[13, 16)$ c^2	0.08	0.04	0.12	0.04	0.07	0.07	0.24	0.03	0.05	0.04	0.04	0.11	0.29	0.07	0.03	0.10	0.03	0.15	0.03	0.08	0.02	0.10			

Table 9: $B_{u,j}$ for Doctor 9 - pm shift.

Slot	Different Days																					Avg	Var	c^2
11.00	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0.05	0.05	22.00
11.17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
11.33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
11.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
11.67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
11.83	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
12.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
12.17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
12.33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
12.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
12.67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0.05	0.05	22.00
12.83	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0.14	0.12	6.63
13.00	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0.05	0.05	22.00
13.17	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0.09	0.09	10.48
13.33	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0.05	0.05	22.00
13.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
13.67	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0.18	0.16	4.71
13.83	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0.05	0.05	22.00
14.00	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.09	0.09	10.48
14.17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0.05	0.05	22.00
14.33	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0.09	0.09	10.48
14.50	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0.09	0.09	10.48
14.67	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0.09	0.09	10.48
14.83	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0.05	0.05	22.00
15.00	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2	0	0	0	0	0	0	0.14	0.22	11.76
15.17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
15.33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
15.50	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.05	0.05	22.00
15.67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0.05	0.05	22.00
15.83	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0.05	0.05	22.00
16.00	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	0.14	0.12	6.63
16.17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2	0	0	0	0	0.14	0.22	11.76
16.33	0	0	0	1	1	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0.18	0.16	4.71
16.50	0	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	1	1	0	0	0.23	0.18	3.56
16.67	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0.05	0.05	22.00
16.83	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
17.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
17.17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
Daily Total	2	3	0	2	1	1	0	2	0	3	3	1	2	3	4	4	1	7	2	2	2	0	2.05	2.71	0.65
$[13, 16)$ Total	2	1	0	1	0	1	0	1	0	3	3	0	1	1	1	4	1	3	1	1	0	0	1.14	1.36	1.05

Table 10: $B_{s+u,j}$ for Doctor 9 - pm shift.

Slot	Different Days																						Avg	Var	c^2
11.00	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.09	0.09	10.48
11.17	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.05	0.05	22.00
11.33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
11.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
11.67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
11.83	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
12.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
12.17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
12.33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
12.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
12.67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0.05	0.05	22.00
12.83	6	5	3	4	4	4	0	4	3	4	4	4	0	4	4	3	3	4	5	0	3	0	3.23	2.95	0.28
13.00	3	4	2	3	3	1	0	3	3	4	3	2	0	3	3	3	3	3	3	5	3	3	2.73	1.35	0.18
13.17	3	2	3	2	2	3	0	3	3	3	2	2	0	3	3	3	3	3	3	3	3	3	2.50	0.83	0.13
13.33	2	3	3	3	3	3	0	3	2	3	3	2	0	3	3	2	2	2	3	4	2	2	2.41	0.92	0.16
13.50	3	3	4	3	3	3	3	3	2	3	2	2	2	3	3	3	3	2	3	3	3	3	2.82	0.25	0.03
13.67	3	3	2	3	3	3	3	3	2	3	3	3	3	2	3	2	4	3	3	3	3	3	2.86	0.22	0.03
13.83	3	3	3	2	3	1	3	3	3	4	2	2	3	3	3	3	2	1	2	3	3	2	2.59	0.54	0.08
14.00	2	3	2	3	3	2	3	3	3	3	3	3	3	2	3	1	2	2	2	2	3	3	2.55	0.35	0.05
14.17	3	2	2	2	2	3	3	2	3	3	2	4	3	3	3	3	3	3	2	3	3	3	2.73	0.30	0.04
14.33	2	3	3	3	3	3	2	3	3	3	3	3	3	2	2	3	3	1	3	2	3	2	2.64	0.34	0.05
14.50	2	2	2	3	3	3	3	3	3	3	3	2	4	3	3	2	2	2	3	2	3	3	2.68	0.32	0.04
14.67	3	3	2	2	2	3	3	3	3	3	3	2	2	2	3	2	2	3	2	3	3	1	2.50	0.36	0.06
14.83	2	3	3	2	1	3	3	2	2	3	2	2	3	3	3	2	3	3	3	2	3	2	2.50	0.36	0.06
15.00	1	3	2	2	3	3	2	3	3	3	3	3	2	3	2	3	3	3	3	3	2	3	2.64	0.34	0.05
15.17	3	3	0	2	1	2	3	2	1	2	3	3	3	3	4	3	2	3	3	2	2	2	2.36	0.81	0.15
15.33	3	2	3	2	3	3	3	2	3	3	2	1	3	3	3	3	3	2	3	3	3	2	2.64	0.34	0.05
15.50	3	3	3	3	3	3	2	3	3	3	3	1	3	3	3	3	3	3	3	3	3	1	2.77	0.37	0.05
15.67	3	2	3	2	3	3	3	3	3	3	3	2	2	3	3	3	3	3	2	3	3	4	2.82	0.25	0.03
15.83	3	3	3	3	3	3	3	3	3	3	3	2	3	1	3	4	3	3	3	3	2	2	2.82	0.35	0.04
16.00	3	3	2	2	3	3	3	3	2	3	2	3	3	3	3	3	2	3	3	3	2	3	2.73	0.21	0.03
16.17	3	3	2	3	3	1	3	2	3	3	2	1	0	3	3	3	3	3	2	2	3	3	2.45	0.74	0.12
16.33	0	3	0	2	1	2	3	3	3	3	2	2	0	3	3	3	3	2	2	2	3	1	2.09	1.13	0.26
16.50	0	2	0	0	0	3	2	3	1	3	2	3	0	3	2	3	2	3	3	1	0	0	1.64	1.67	0.62
16.67	0	0	0	0	0	0	0	3	0	0	1	1	0	0	3	2	3	2	1	0	0	0	0.73	1.26	2.37
16.83	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0.09	0.09	10.48
17.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0.09	0.18	22.00
17.17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0.14	0.41	22.00
Daily Total	59	66	52	56	58	61	53	68	60	71	61	55	45	64	71	65	66	69	65	60	61	51	60.77	46.66	0.01
$[13, 16)$ Total	47	50	45	45	47	48	42	50	48	55	48	41	42	48	53	48	49	45	49	52	50	44	47.55	12.64	0.01
All slot avg	1.7	1.9	1.5	1.6	1.7	1.7	1.5	1.9	1.7	2.0	1.7	1.6	1.3	1.8	2.0	1.9	1.9	2.0	1.9	1.7	1.7	1.5	1.60	2.01	0.78
All slot var	2.5	2.3	1.9	1.8	2.1	2.0	2.1	2.0	1.9	2.4	1.8	1.7	2.1	2.1	2.2	2.0	1.9	1.7	2.1	2.3	2.0	1.9	(across all days)		
All slot c^2	0.9	0.6	0.9	0.7	0.8	0.6	0.9	0.5	0.7	0.6	0.6	0.7	1.3	0.6	0.5	0.6	0.5	0.4	0.6	0.8	0.7	0.9			
$[13, 16)$ avg	2.6	2.8	2.5	2.5	2.6	2.7	2.3	2.8	2.7	3.1	2.7	2.3	2.3	2.7	2.9	2.7	2.7	2.5	2.7	2.9	2.8	2.4	2.64	0.48	0.07
$[13, 16)$ var	0.4	0.3	0.7	0.3	0.5	0.5	1.3	0.2	0.4	0.2	0.2	0.6	1.4	0.4	0.2	0.5	0.3	0.5	0.2	0.6	0.2	0.6	(across all days)		
$[13, 16)$ c^2	0.05	0.04	0.12	0.04	0.07	0.07	0.24	0.02	0.05	0.02	0.03	0.11	0.26	0.05	0.02	0.07	0.04	0.08	0.03	0.07	0.02	0.10			

Table 11: $B_{a|s,j}$ for Doctor 9 - pm shift.

Slot	Different Days																						Avg	Var	c^2
11.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
11.17	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.05	0.05	22.00
11.33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
11.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
11.67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
11.83	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
12.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
12.17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
12.33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
12.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
12.67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
12.83	6	4	3	3	4	4	0	3	3	4	4	3	0	2	4	3	3	4	5	0	2	0	2.91	2.75	0.33
13.00	3	3	2	3	2	1	0	3	2	4	2	1	0	3	3	3	3	3	2	4	3	3	2.41	1.21	0.21
13.17	3	2	3	2	2	3	0	2	3	3	2	2	0	3	3	3	3	3	2	3	3	2	2.36	0.81	0.15
13.33	2	2	3	3	3	3	0	2	2	3	2	2	0	3	3	1	2	2	2	4	2	2	2.18	0.92	0.19
13.50	3	3	3	3	3	3	3	3	1	3	2	2	2	3	3	3	3	2	2	2	3	3	2.64	0.34	0.05
13.67	3	3	2	2	3	2	3	3	2	2	3	3	3	2	3	2	2	2	3	1	3	3	2.50	0.36	0.06
13.83	2	3	1	2	3	1	3	3	3	4	1	2	3	3	3	3	2	0	2	3	3	2	2.36	0.91	0.16
14.00	1	2	1	2	2	2	3	3	3	2	3	3	3	2	3	1	2	2	2	2	3	3	2.27	0.49	0.10
14.17	3	2	2	1	2	3	3	2	2	3	2	3	2	3	2	3	2	3	2	3	3	3	2.45	0.35	0.06
14.33	1	3	3	2	3	3	2	3	3	2	3	3	2	1	2	3	3	1	2	1	2	2	2.27	0.59	0.11
14.50	1	2	2	3	3	3	3	3	3	3	3	2	4	3	2	2	2	1	3	1	3	3	2.50	0.64	0.10
14.67	3	3	2	2	2	3	2	3	3	2	2	2	2	2	3	1	2	3	1	3	3	0	2.23	0.66	0.13
14.83	2	3	3	2	1	3	3	2	2	2	2	2	3	2	3	2	3	3	3	2	2	1	2.32	0.42	0.08
15.00	0	3	2	2	2	2	2	1	3	3	3	3	1	2	1	1	3	3	3	2	2	2	2.09	0.75	0.17
15.17	3	3	0	1	1	2	3	2	1	2	2	3	3	3	4	2	2	3	3	1	1	2	2.14	0.98	0.21
15.33	3	2	3	2	3	3	3	2	3	3	2	1	2	3	2	3	3	2	3	3	1	2	2.45	0.45	0.07
15.50	1	1	2	3	2	3	1	3	3	3	2	0	3	3	3	1	3	3	3	2	3	0	2.18	1.11	0.23
15.67	3	2	3	2	3	3	3	3	3	2	2	2	2	1	2	3	2	3	2	1	3	4	2.45	0.55	0.09
15.83	3	3	3	3	3	2	3	3	3	2	3	1	3	1	2	3	1	3	3	3	2	2	2.50	0.55	0.09
16.00	3	2	2	2	3	3	3	3	2	2	2	3	1	3	2	3	2	3	2	3	0	2	2.32	0.61	0.11
16.17	3	3	2	3	3	1	2	2	3	3	2	1	0	3	2	3	3	1	2	2	2	3	2.23	0.76	0.15
16.33	0	3	0	1	0	2	3	2	3	3	2	1	0	3	1	3	3	1	1	2	3	1	1.73	1.35	0.45
16.50	0	1	0	0	0	3	2	2	1	2	2	3	0	2	2	3	2	3	2	0	0	0	1.36	1.39	0.74
16.67	0	0	0	0	0	0	0	3	0	0	1	0	0	0	3	2	3	2	1	0	0	0	0.68	1.27	2.74
16.83	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0.09	0.09	10.48
17.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0.09	0.18	22.00
17.17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0.14	0.41	22.00
Daily Total	52	58	47	49	53	58	50	61	57	62	54	48	39	56	61	57	60	62	56	48	52	45	53.86	37.93	0.01
$[13, 16)$ Total	40	45	40	40	43	45	40	46	45	48	41	37	38	43	47	40	43	42	43	41	45	39	42.32	8.89	0.00
All slot avg	1.5	1.7	1.3	1.4	1.5	1.7	1.4	1.7	1.6	1.8	1.5	1.4	1.1	1.6	1.7	1.6	1.7	1.8	1.6	1.4	1.5	1.3	1.42	1.78	0.88
All slot var	2.4	1.9	1.6	1.5	1.9	1.9	2.0	1.8	1.8	2.1	1.5	1.6	1.8	1.8	1.9	1.8	1.6	1.8	1.8	1.8	1.8	1.7	(across all days)		
All slot c^2	1.1	0.7	0.9	0.8	0.8	0.7	1.0	0.6	0.7	0.7	0.6	0.8	1.4	0.7	0.6	0.7	0.5	0.6	0.7	1.0	0.8	1.0			
$[13, 16)$ avg	2.2	2.5	2.2	2.2	2.4	2.5	2.2	2.6	2.5	2.7	2.3	2.1	2.1	2.4	2.6	2.2	2.4	2.3	2.4	2.3	2.5	2.2	2.35	0.66	0.12
$[13, 16)$ var	1.0	0.4	0.8	0.4	0.5	0.5	1.4	0.4	0.5	0.5	0.3	0.8	1.4	0.6	0.5	0.8	0.4	0.8	0.4	1.0	0.5	1.1	(across all days)		
$[13, 16)$ c^2	0.20	0.06	0.16	0.08	0.09	0.08	0.28	0.06	0.08	0.07	0.06	0.18	0.31	0.11	0.07	0.16	0.06	0.15	0.06	0.20	0.08	0.23			

Table 12: $B_{a|u,j}$ for Doctor 9 - pm shift.

Slot	Different Days																					Avg	Var	c^2
11.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
11.17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
11.33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
11.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
11.67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
11.83	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
12.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
12.17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
12.33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
12.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
12.67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0.05	0.05	22.00
12.83	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0.14	0.12	6.63
13.00	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0.05	0.05	22.00
13.17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0.05	0.05	22.00
13.33	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0.05	0.05	22.00
13.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
13.67	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0.18	0.16	4.71
13.83	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0.05	0.05	22.00
14.00	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.09	0.09	10.48
14.17	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0.05	0.05	22.00
14.33	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0.09	0.09	10.48
14.50	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0.09	0.09	10.48
14.67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0.05	0.05	22.00
14.83	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0.05	0.05	22.00
15.00	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2	0	0	0	0	0	0	0.14	0.22	11.76
15.17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
15.33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
15.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
15.67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0.05	0.05	22.00
15.83	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0.05	0.05	22.00
16.00	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	0.14	0.12	6.63
16.17	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0.09	0.09	10.48
16.33	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0.14	0.12	6.63
16.50	0	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	1	1	0	0	0.23	0.18
16.67	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0.05	0.05	22.00
16.83	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
17.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
17.17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
Daily Total	1	3	0	2	0	1	0	1	0	3	2	1	2	3	4	4	1	6	2	2	2	0	1.82	2.44	0.74
$[13, 16)$ Total	1	1	0	1	0	1	0	0	0	3	2	0	1	1	1	4	1	3	1	1	0	0	1.00	1.24	1.24

Table 13: $B_{a,j}$ for Doctor 9 - pm shift.

Slot	Different Days																						Avg	Var	c^2
11.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
11.17	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.05	0.05	22.00
11.33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
11.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
11.67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
11.83	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
12.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
12.17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
12.33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
12.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00		
12.67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0.05	0.05	22.00
12.83	6	5	3	3	4	4	0	3	3	4	4	3	0	3	4	3	3	4	5	0	3	0	3.05	2.81	0.30
13.00	3	3	2	3	2	1	0	3	2	4	3	1	0	3	3	3	3	3	2	4	3	3	2.45	1.21	0.20
13.17	3	2	3	2	2	3	0	2	3	3	2	2	0	3	3	3	3	3	3	3	3	2	2.41	0.82	0.14
13.33	2	2	3	3	3	3	0	2	2	3	3	2	0	3	3	1	2	2	2	4	2	2	2.23	0.95	0.19
13.50	3	3	3	3	3	3	3	3	1	3	2	2	2	3	3	3	3	2	2	2	3	3	2.64	0.34	0.05
13.67	3	3	2	2	3	3	3	3	2	3	3	3	3	2	3	2	3	3	3	1	3	3	2.68	0.32	0.04
13.83	2	3	1	2	3	1	3	3	3	4	1	2	3	3	3	3	2	1	2	3	3	2	2.41	0.73	0.13
14.00	1	3	1	3	2	2	3	3	3	2	3	3	3	2	3	1	2	2	2	2	3	3	2.36	0.53	0.09
14.17	3	2	2	1	2	3	3	2	2	3	2	3	2	3	3	3	2	3	2	3	3	3	2.50	0.36	0.06
14.33	1	3	3	2	3	3	2	3	3	3	3	3	2	2	2	3	3	1	2	1	2	2	2.36	0.53	0.09
14.50	2	2	2	3	3	3	3	3	3	3	3	2	4	3	2	2	2	2	3	1	3	3	2.59	0.44	0.07
14.67	3	3	2	2	2	3	2	3	3	2	2	2	2	2	3	2	2	3	1	3	3	0	2.27	0.59	0.11
14.83	2	3	3	2	1	3	3	2	2	3	2	2	3	2	3	2	3	3	3	2	2	1	2.36	0.43	0.08
15.00	0	3	2	2	2	2	2	1	3	3	3	3	2	2	1	3	3	3	3	2	2	2	2.23	0.66	0.13
15.17	3	3	0	1	1	2	3	2	1	2	2	3	3	3	4	2	2	3	3	1	1	2	2.14	0.98	0.21
15.33	3	2	3	2	3	3	3	2	3	3	2	1	2	3	2	3	3	2	3	3	1	2	2.45	0.45	0.07
15.50	1	1	2	3	2	3	1	3	3	3	2	0	3	3	3	1	3	3	3	2	3	0	2.18	1.11	0.23
15.67	3	2	3	2	3	3	3	3	3	2	2	2	2	1	2	3	2	3	2	2	3	4	2.50	0.45	0.07
15.83	3	3	3	3	3	2	3	3	3	2	3	1	3	1	2	4	1	3	3	3	2	2	2.55	0.64	0.10
16.00	3	2	2	2	3	3	3	3	2	2	2	3	2	3	3	3	2	3	2	3	1	2	2.45	0.35	0.06
16.17	3	3	2	3	3	1	2	2	3	3	2	1	0	3	3	3	3	2	2	2	2	3	2.32	0.70	0.13
16.33	0	3	0	2	0	2	3	2	3	3	2	1	0	3	2	3	3	2	1	2	3	1	1.86	1.27	0.36
16.50	0	2	0	0	0	3	2	3	1	2	2	3	0	3	2	3	2	3	3	1	0	0	1.59	1.59	0.63
16.67	0	0	0	0	0	0	0	3	0	0	1	1	0	0	3	2	3	2	1	0	0	0	0.73	1.26	2.37
16.83	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0.09	0.09	10.48
17.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0.09	0.18	22.00
17.17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0.14	0.41	22.00
Daily Total	53	61	47	51	53	59	50	62	57	65	56	49	41	59	65	61	61	68	58	50	54	45	55.68	49.18	0.02
$[13, 16)$ Total	41	46	40	41	43	46	40	46	45	51	43	37	39	44	48	44	44	45	44	42	45	39	43.32	10.70	0.01
All slot avg	1.5	1.7	1.3	1.5	1.5	1.7	1.4	1.8	1.6	1.9	1.6	1.4	1.2	1.7	1.9	1.7	1.7	1.9	1.7	1.4	1.5	1.3	1.47	1.83	0.85
All slot var	2.4	2.1	1.6	1.6	1.9	1.9	2.0	1.8	1.8	2.2	1.6	1.5	1.8	1.9	2.0	1.9	1.7	1.6	1.9	1.8	1.8	1.7	(across all days)		
All slot c^2	1.0	0.7	0.9	0.7	0.8	0.7	1.0	0.6	0.7	0.6	0.6	0.8	1.3	0.7	0.6	0.6	0.5	0.4	0.7	0.9	0.8	1.0			
$[13, 16)$ avg	2.3	2.6	2.2	2.3	2.4	2.6	2.2	2.6	2.5	2.8	2.4	2.1	2.2	2.4	2.7	2.4	2.4	2.5	2.4	2.3	2.5	2.2	2.41	0.64	0.11
$[13, 16)$ var	0.9	0.4	0.8	0.4	0.5	0.5	1.4	0.4	0.5	0.4	0.4	0.8	1.3	0.5	0.5	0.7	0.4	0.5	0.4	0.9	0.5	1.1	(across all days)		
$[13, 16)$ c^2	0.18	0.06	0.16	0.09	0.09	0.08	0.28	0.06	0.08	0.05	0.06	0.18	0.28	0.08	0.07	0.12	0.06	0.08	0.06	0.17	0.08	0.23			

4 Arrivals within Each Shift

4.1 Estimated Arrival Rate Functions

Figure 4: Scheduled arrivals ($S(t)$) and actual arrivals ($A(t)$) during the morning shifts of doctors 1-4.

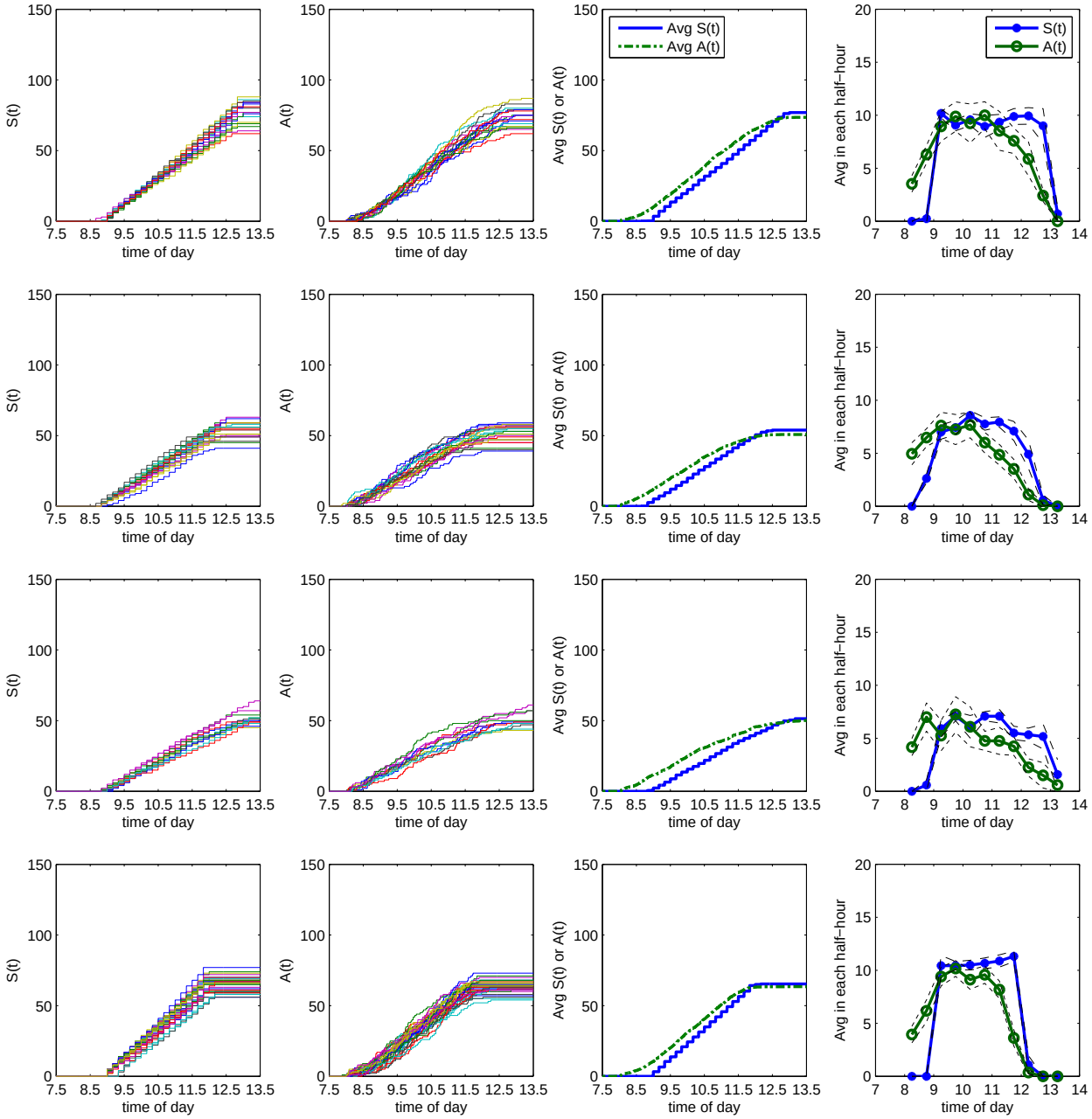


Figure 5: Scheduled arrivals ($S(t)$) and actual arrivals ($A(t)$) during the morning shifts of doctors 5-8.

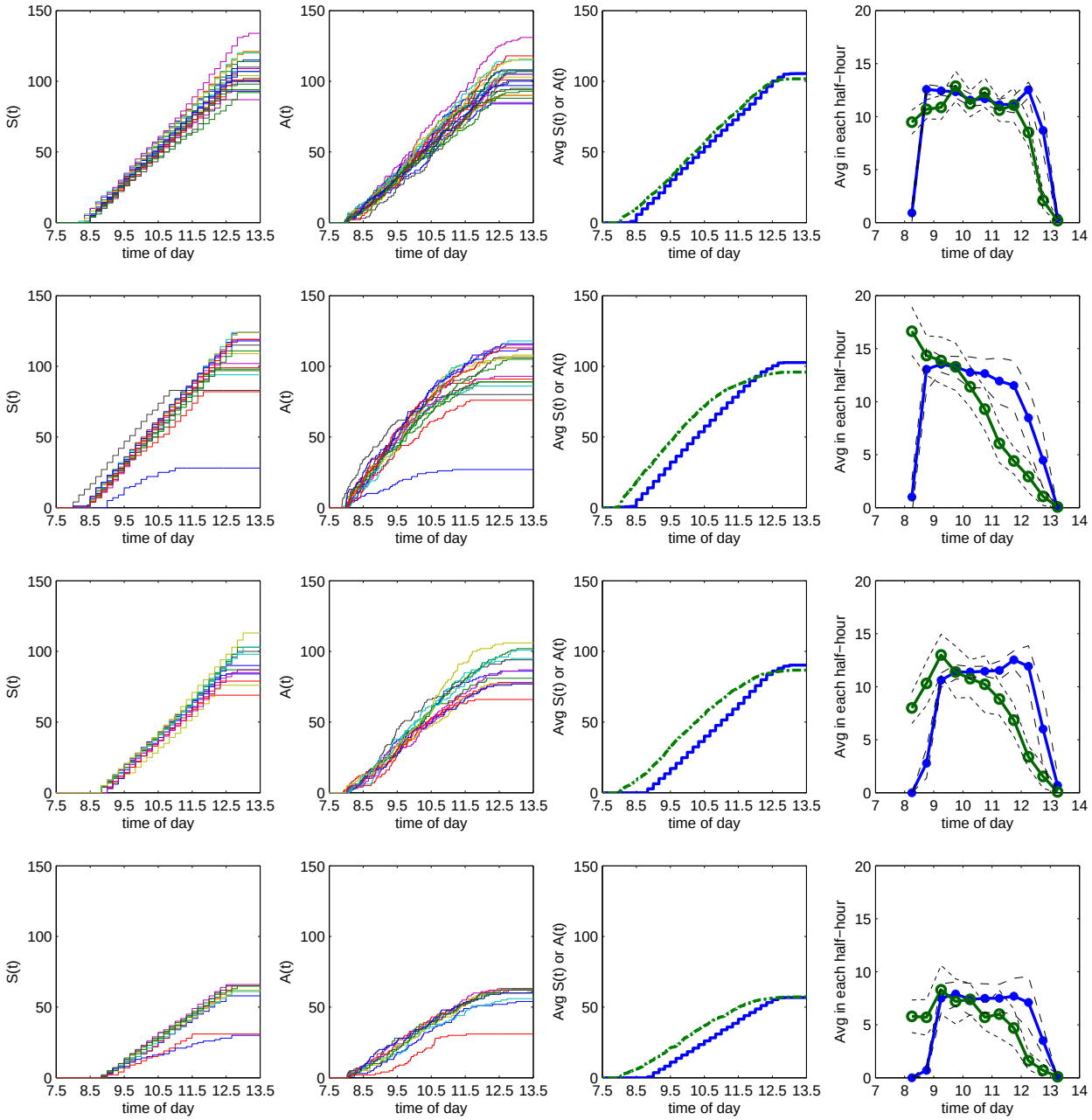


Figure 6: Scheduled arrivals ($S(t)$) and actual arrivals ($A(t)$) during the morning shifts of doctors 9-12.

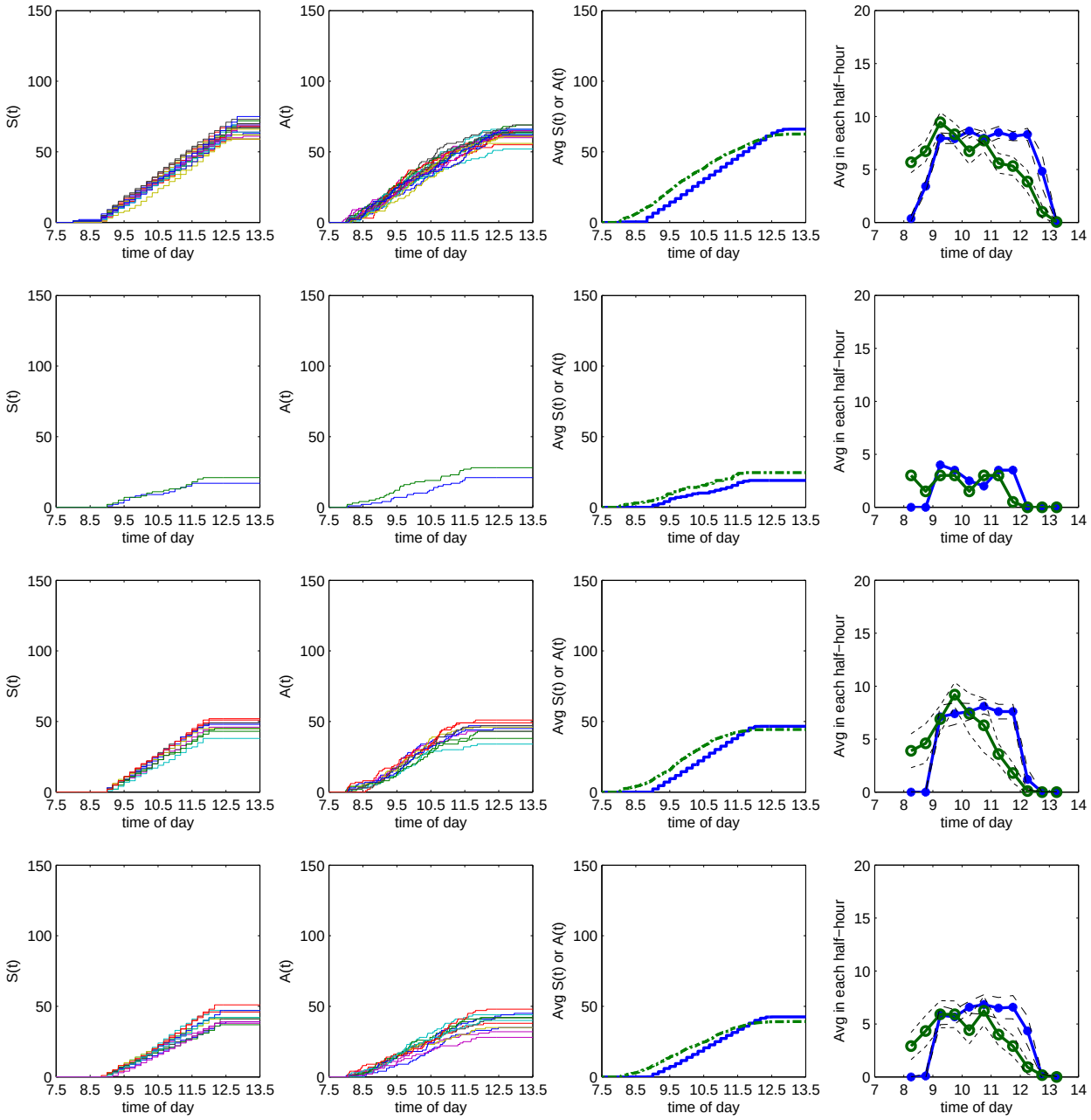


Figure 7: Scheduled arrivals ($S(t)$) and actual arrivals ($A(t)$) during the morning shifts of doctors 13-16.

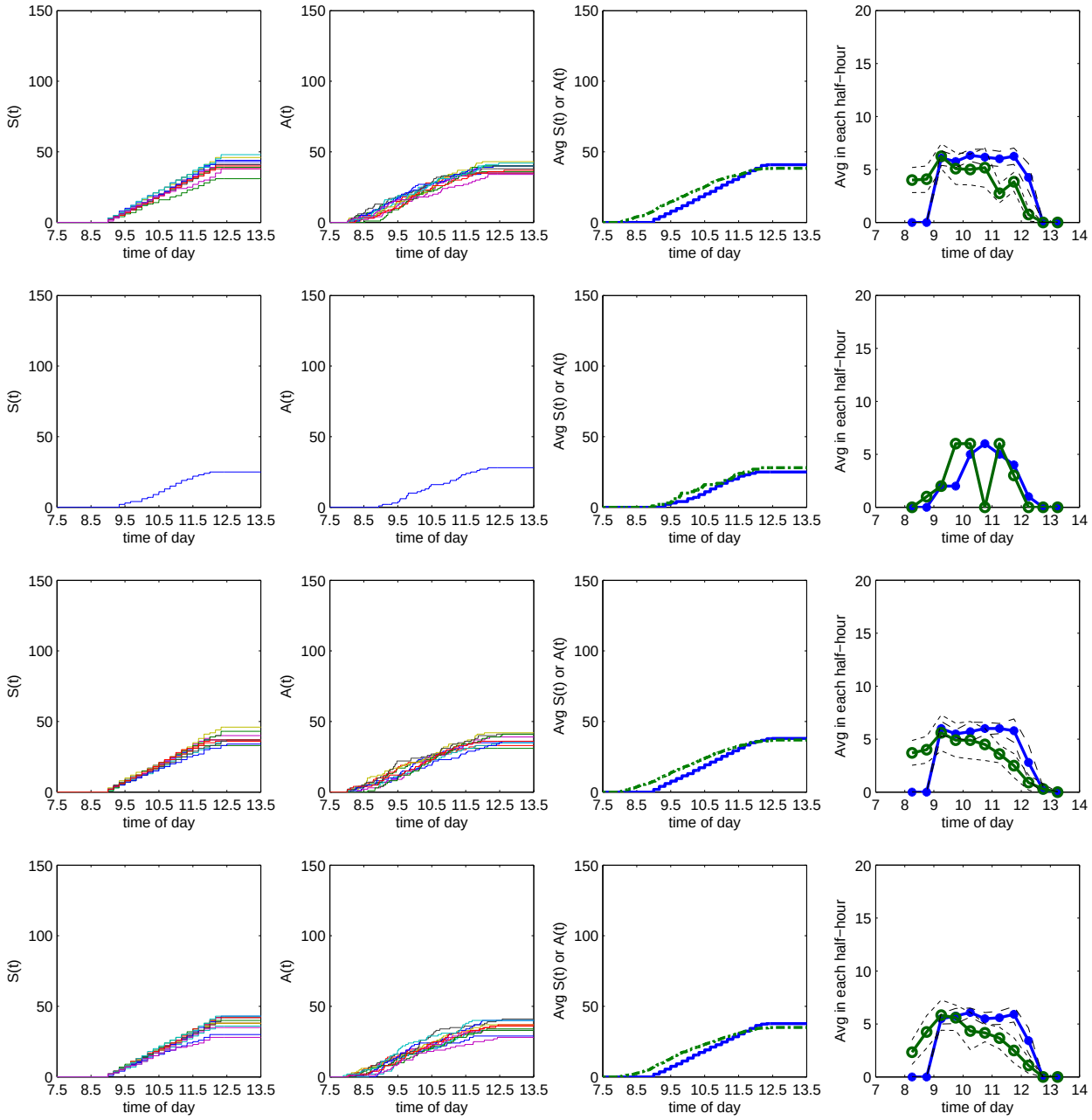


Figure 8: Scheduled arrivals ($S(t)$) and actual arrivals ($A(t)$) during the afternoon shifts of doctors 1-4.

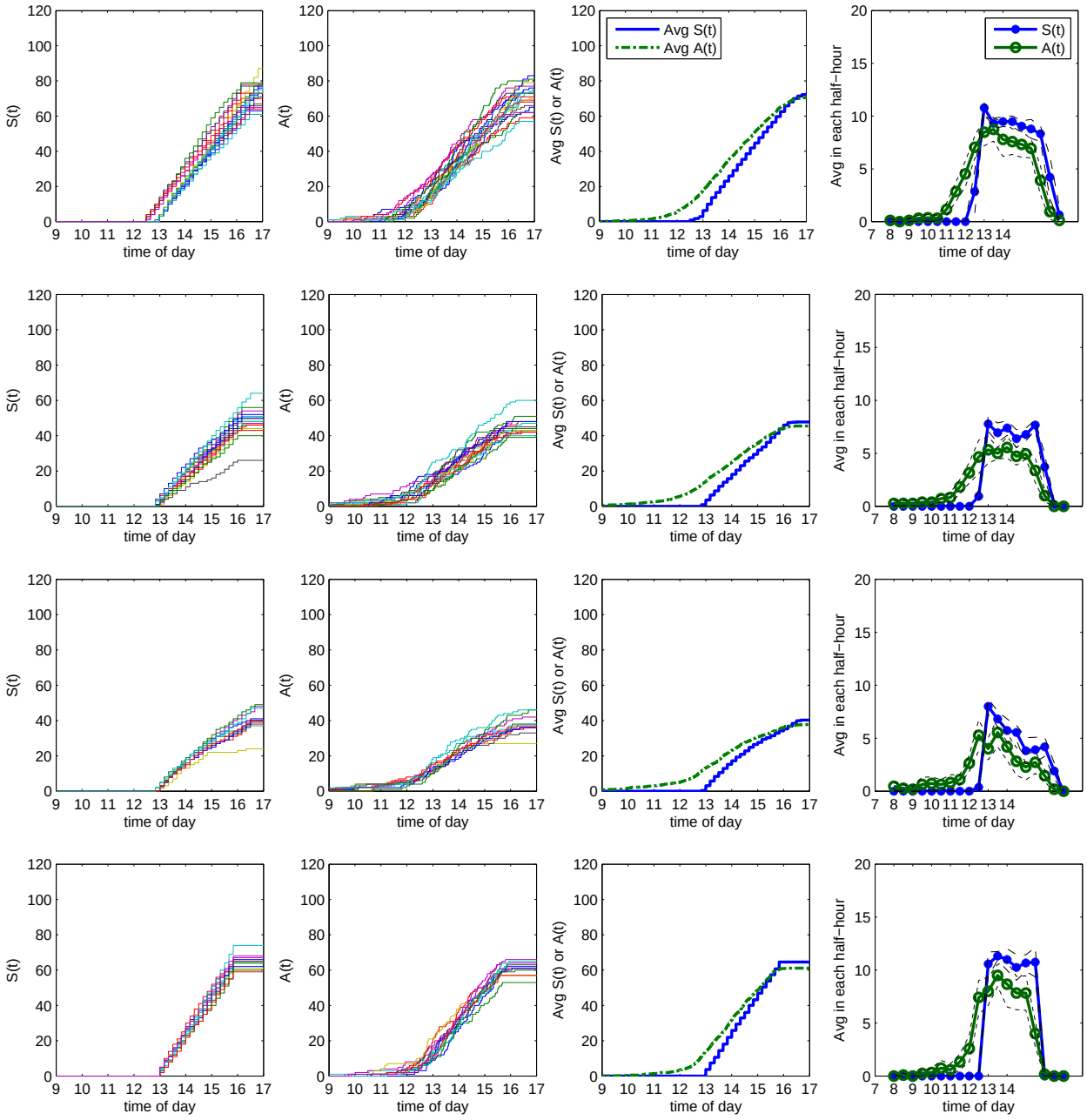


Figure 9: Scheduled arrivals ($S(t)$) and actual arrivals ($A(t)$) during the afternoon shifts of doctors 5-8.

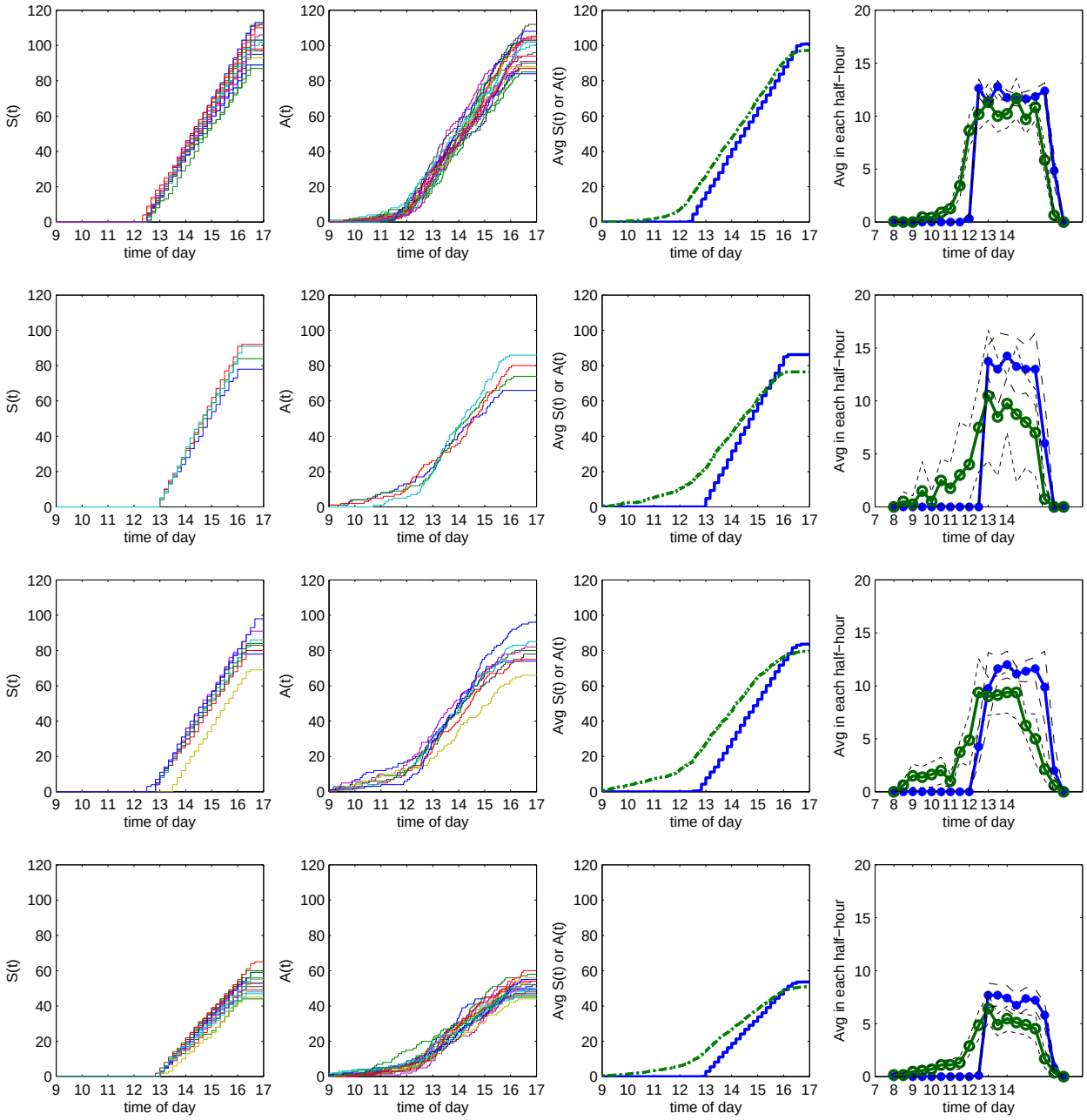


Figure 10: Scheduled arrivals ($S(t)$) and actual arrivals ($A(t)$) during the afternoon shifts of doctors 9-12.

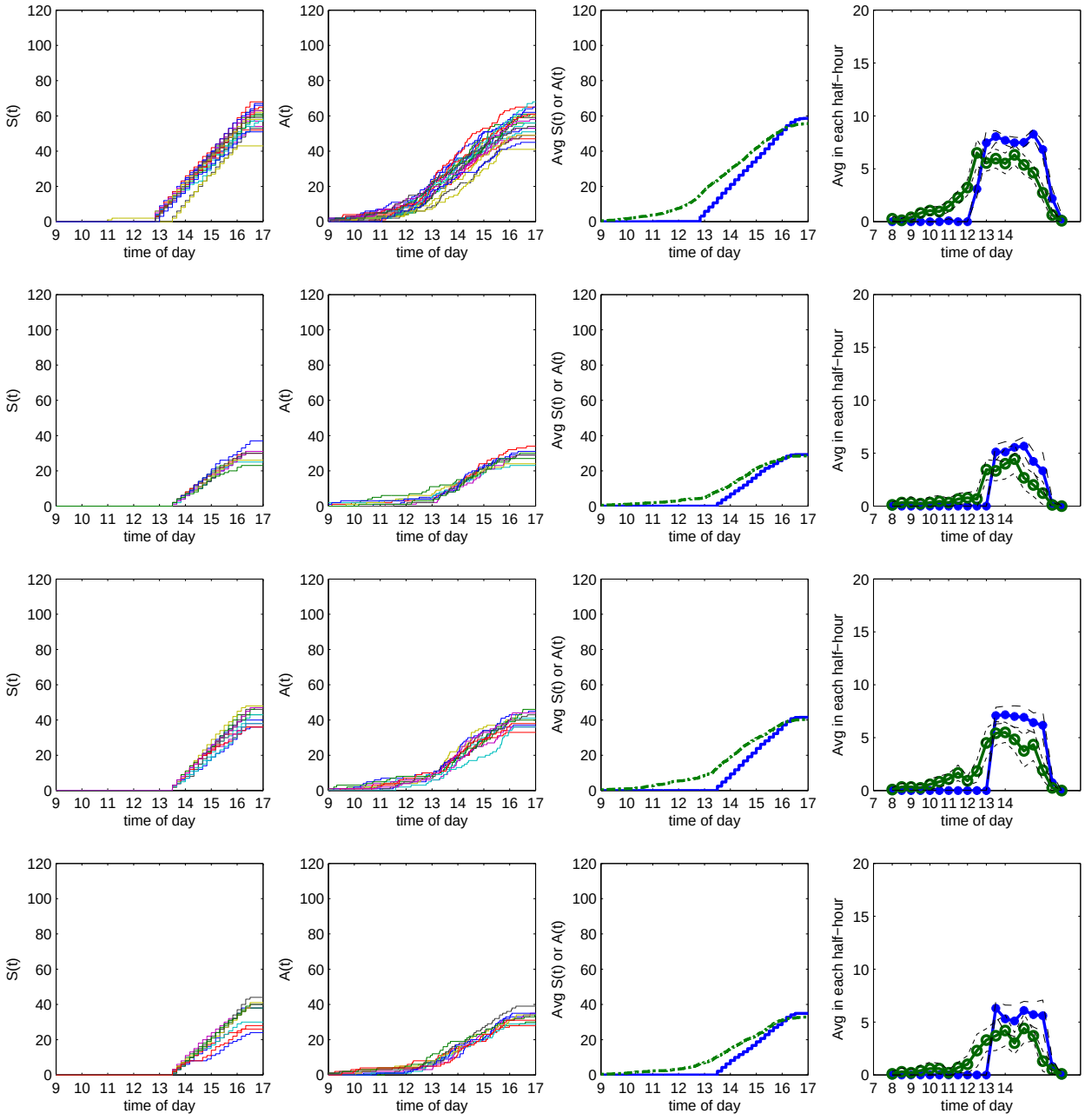
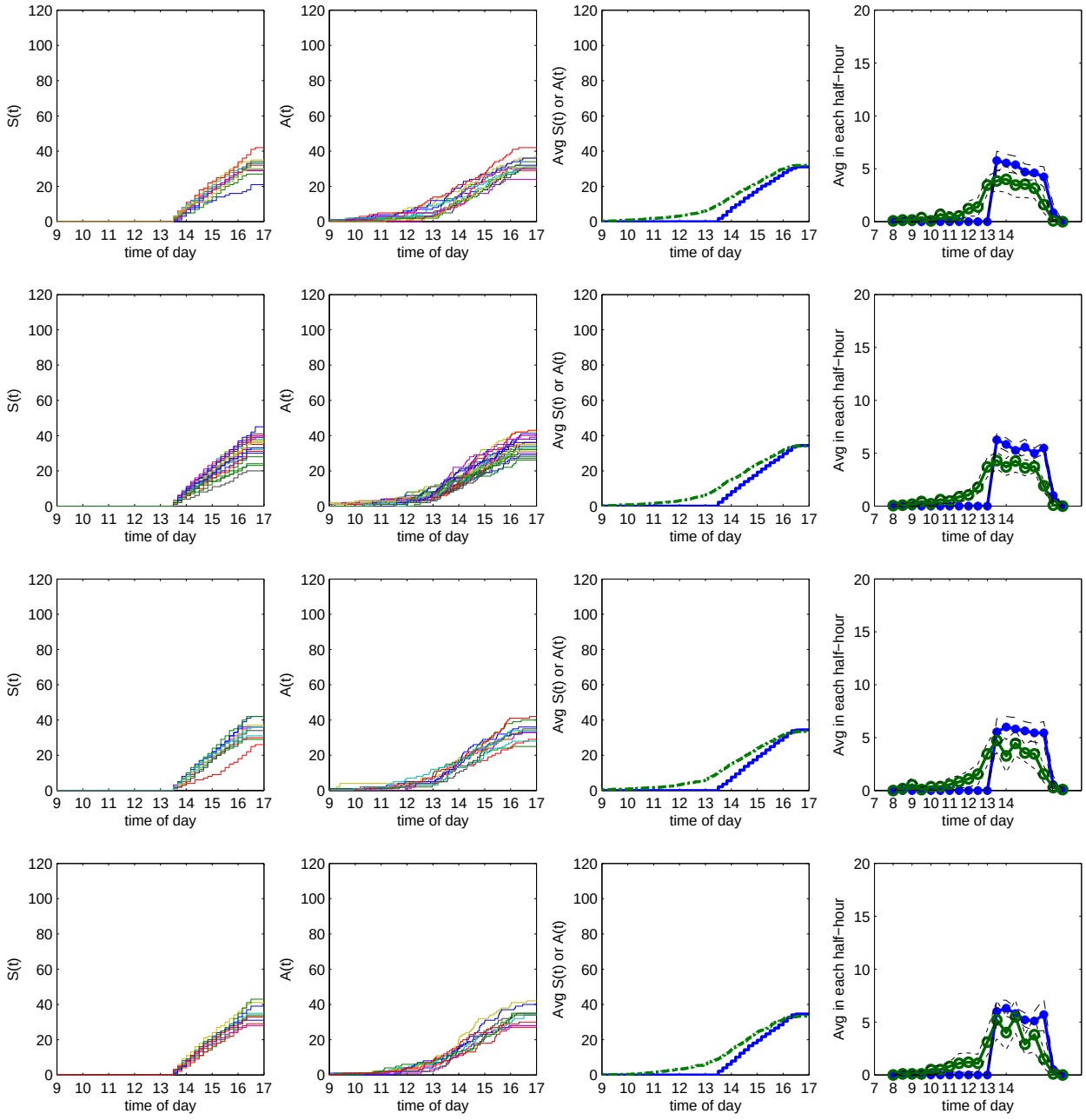


Figure 11: Scheduled arrivals ($S(t)$) and actual arrivals ($A(t)$) during the afternoon shifts of doctors 13-16.



4.2 No-Shows and Lateness

Table 14: Details of am shifts for doctors 1-8. Averages over shifts with 95% confidence intervals are shown. (X measured in minutes.)

Doc	Interval	Avg # Scheduled	% No-show	% Late	Avg(X^+)	Avg(X^-)	Avg(X)
1	$[8,9]$	0.2±0.4	0	16.7±211.8	7.7	-11.4±7.7	-8.1±34.0
	$[9,10]$	19.2±0.7	5.4±3.4	19.5±3.7	22.3±13.0	-27.8±3.9	-17.6±4.2
	$[10,11]$	18.5±1.4	6.2±3.0	20.6±5.3	16.2±4.7	-32.7±4.5	-22.3±4.1
	$[11,12]$	19.2±1.2	6.4±2.4	12.6±4.2	11.6±4.5	-40.6±6.3	-33.7±5.3
	$[12,13]$	18.9±2.1	5.5±2.3	11.2±5.0	9.4±3.1	-54.7±8.9	-47.6±8.5
	$[13,14]$	0.7±0.6	0	0		-76.3±87.9	-76.3±87.9
	$Total$	76.9±4.1	5.8±1.8	15.6±2.0	16.5±4.8	-39.5±2.9	-30.8±2.9
2	$[8,9]$	2.6±0.4	5.8±6.8	18.7±13.5	37.4±39.0	-25.5±6.4	-12.8±10.9
	$[9,10]$	14.4±1.1	7.5±4.0	14.0±6.1	24.9±13.9	-33.4±3.4	-25.5±4.5
	$[10,11]$	16.3±0.8	8.5±3.6	11.8±5.5	14.9±8.5	-43.2±4.1	-35.8±3.8
	$[11,12]$	15.0±0.9	6.6±2.8	11.8±4.4	12.7±4.1	-48.6±8.2	-42.0±9.5
	$[12,13]$	5.5±1.7	10.6±6.0	10.2±9.5	6.2±4.6	-57.0±12.8	-51.3±13.1
	$Total$	53.9±2.6	7.8±2.0	12.6±3.3	18.1±4.5	-42.5±2.9	-34.9±3.8
3	$[8,9]$	0.6±0.5	0	0		-14.6±9.8	-14.6±9.8
	$[9,10]$	13.0±0.9	4.7±3.6	10.3±4.6	20.0±17.4	-36.0±3.5	-30.4±4.7
	$[10,11]$	13.2±1.2	9.6±5.4	6.6±3.5	24.2±21.1	-48.7±6.7	-43.6±6.5
	$[11,12]$	12.6±0.9	9.0±4.4	11.1±4.8	17.7±10.8	-55.5±11.5	-48.1±12.3
	$[12,13]$	10.5±1.5	5.7±5.8	7.4±6.2	16.4±14.9	-65.2±13.9	-60.3±16.6
	$[13,14]$	1.6±1.4	0	33.0±51.1	6.9±3.1	-31.1±16.9	-19.3±23.2
	$Total$	51.4±3.3	6.9±2.4	9.2±2.3	17.2±5.7	-50.1±3.9	-43.9±4.8
4	$[9,10]$	20.9±1.1	7.1±1.9	19.9±2.5	19.4±4.3	-29.5±2.1	-19.8±2.3
	$[10,11]$	21.2±0.7	8.9±2.1	18.6±3.9	14.2±2.4	-31.4±2.4	-23.0±3.3
	$[11,12]$	22.2±0.9	6.2±1.4	11.7±2.4	9.6±1.8	-40.9±3.3	-34.7±2.8
	$[12,13]$	1.1±0.9	0	27.2±18.2	6.7±5.8	-49.8±31.1	-31.5±18.6
	$Total$	65.4±1.8	7.2±1.1	16.9±1.9	15.6±1.9	-34.7±1.7	-26.2±1.8
5	$[8,9]$	13.5±0.9	5.3±2.4	22.3±7.4	34.8±12.7	-20.5±1.6	-8.5±4.3
	$[9,10]$	24.8±0.7	5.8±2.0	22.2±3.7	19.3±6.8	-24.0±2.0	-14.3±3.3
	$[10,11]$	23.3±1.0	4.3±1.4	22.0±3.8	13.8±4.5	-22.9±1.7	-14.9±2.6
	$[11,12]$	22.3±1.1	4.7±1.7	19.4±4.6	13.0±4.3	-28.1±3.2	-20.6±3.5
	$[12,13]$	21.2±2.5	4.8±2.0	11.9±2.9	10.6±3.8	-33.1±3.4	-28.1±3.4
	$[13,14]$	0.4±0.4	0	10.0±27.8	5.1	-44.8±67.7	-43.4±69.2
	$Total$	105.5±5.0	5.0±0.9	19.5±2.7	16.7±3.1	-26.4±1.4	-17.9±2.2
6	$[8,9]$	14.1±2.7	7.4±2.9	21.3±3.6	49.3±22.2	-20.5±1.8	-6.1±4.8
	$[9,10]$	26.8±1.5	8.3±2.7	11.8±2.5	27.6±13.2	-35.5±3.0	-28.0±3.6
	$[10,11]$	25.4±2.6	6.6±2.4	10.2±3.8	10.4±3.4	-47.7±3.8	-41.9±4.1
	$[11,12]$	23.5±4.4	7.9±2.4	9.5±6.7	12.8±6.6	-66.5±7.6	-60.5±9.2
	$[12,13]$	12.9±5.2	11.4±7.3	9.2±6.3	8.5±5.4	-76.6±13.8	-68.9±13.9
	$Total$	102.8±12.1	7.9±1.4	11.2±1.8	24.0±7.9	-48.2±2.9	-40.1±2.4
7	$[8,9]$	2.8±1.4	0	18.8±14.3	30.3±26.8	-23.8±7.6	-14.3±10.7
	$[9,10]$	22.0±1.0	8.6±3.4	13.2±5.0	37.7±21.6	-36.5±4.1	-27.7±4.8
	$[10,11]$	22.8±0.8	3.6±2.7	9.7±3.7	29.2±16.5	-48.7±3.4	-41.0±4.8
	$[11,12]$	24.1±1.4	5.5±2.9	7.5±4.2	29.6±19.2	-61.4±6.5	-55.1±7.3
	$[12,13]$	17.9±4.5	6.7±4.4	5.8±3.7	11.4±6.5	-61.4±10.8	-57.1±10.2
	$[13,14]$	0.7±1.0	0	0		-82.5±406.2	-82.5±406.2
	$Total$	90.3±7.5	5.9±1.6	9.6±2.2	27.7±8.8	-51.8±4.0	-44.5±4.4
8	$[8,9]$	0.7±0.5	16.7±42.8	0		-14.1±15.5	-14.1±15.5
	$[9,10]$	15.4±2.1	3.5±2.8	16.6±9.1	18.5±14.9	-36.0±4.5	-27.3±6.7
	$[10,11]$	14.9±2.7	7.4±4.6	13.7±8.3	18.6±9.2	-49.5±10.1	-41.2±12.1
	$[11,12]$	15.2±2.8	5.7±3.8	8.7±3.7	16.4±8.7	-52.3±5.1	-46.2±3.7
	$[12,13]$	10.6±3.4	7.0±4.5	8.3±7.3	21.4±14.0	-62.8±8.8	-55.5±8.3
	$Total$	56.8±10.1	5.9±2.2	12.4±5.0	16.2±5.7	-48.2±4.0	-40.4±5.9

Table 15: Details of am shifts for doctors 9, 11, 12, 13, 15, and 16. Averages over shifts with 95% confidence intervals are shown. (X measured in minutes.)

Doc	Interval	Avg # Scheduled	% No-show	% Late	Avg(X^+)	Avg(X^-)	Avg(X)
9	$[8, 9]$	3.8±0.6	13.6±8.3	25.3±10.9	31.8±22.5	-23.3±4.5	-11.0±6.8
	$[9, 10]$	15.9±0.8	6.3±3.0	16.4±2.8	30.4±16.7	-32.6±3.2	-22.1±3.5
	$[10, 11]$	16.6±0.8	8.9±2.6	16.4±3.1	13.9±5.2	-43.6±4.6	-34.0±4.7
	$[11, 12]$	16.6±0.5	7.8±2.7	12.5±3.7	16.5±7.9	-57.8±6.2	-48.3±6.1
	$[12, 13]$	13.1±1.7	7.3±2.7	7.7±2.9	11.5±5.9	-56.2±8.3	-51.4±8.8
	$[13, 14]$	0.1±0.1	100.0				
	$Total$	66.1±2.0	8.2±1.6	14.1±1.6	20.8±5.5	-46.2±2.9	-36.7±3.1
11	$[9, 10]$	14.5±1.5	5.0±3.6	19.3±7.9	21.0±9.3	-30.3±4.2	-20.1±4.9
	$[10, 11]$	15.7±1.4	7.5±3.9	11.7±4.5	18.6±9.1	-41.2±8.2	-34.2±6.8
	$[11, 12]$	15.2±1.0	4.6±3.8	7.8±3.6	18.8±22.3	-60.1±8.7	-53.6±7.4
	$[12, 13]$	1.2±1.0		16.7±42.8	20.0	-63.5±60.8	-49.5±58.2
	$Total$	46.6±3.0	5.8±2.0	12.5±3.4	21.0±7.0	-45.7±4.3	-37.4±4.4
12	$[8, 9]$	0.1±0.2	0	0		-20.9±0.0	-20.9±0.0
	$[9, 10]$	11.5±1.1	10.8±5.5	20.9±7.0	32.3±37.7	-29.9±3.0	-18.6±5.8
	$[10, 11]$	13.4±1.4	11.9±7.3	14.7±6.4	24.3±9.4	-44.7±8.8	-34.9±7.7
	$[11, 12]$	13.1±1.8	9.5±5.4	13.3±7.4	16.9±7.3	-50.6±11.0	-40.4±5.2
	$[12, 13]$	4.4±1.4	11.8±9.9	15.2±19.4	10.0±15.4	-56.4±20.4	-47.1±22.7
	$Total$	42.5±2.7	11.3±4.9	15.7±3.4	18.7±6.8	-44.2±5.1	-34.1±3.6
13	$[9, 10]$	11.8±1.0	8.9±3.7	20.4±10.0	35.8±12.9	-33.2±4.4	-20.3±7.3
	$[10, 11]$	12.5±1.1	8.3±6.0	16.4±7.5	21.7±10.3	-46.3±8.4	-35.9±10.6
	$[11, 12]$	12.3±1.2	11.4±7.6	11.9±6.2	9.3±4.0	-58.8±11.6	-51.4±12.5
	$[12, 13]$	4.3±1.3	11.5±10.7	6.1±7.4	12.8±34.2	-52.4±23.2	-49.7±24.0
	$Total$	40.8±2.8	9.4±2.7	15.0±5.5	24.9±7.5	-47.6±6.3	-37.6±7.2
15	$[9, 10]$	11.5±0.8	10.1±4.9	23.2±9.6	27.7±15.0	-31.9±5.0	-16.7±9.0
	$[10, 11]$	11.7±1.0	4.0±4.1	16.6±7.7	15.6±9.4	-47.9±14.5	-37.4±12.5
	$[11, 12]$	11.8±1.5	11.3±6.3	14.8±9.5	6.6±6.4	-62.3±11.0	-51.3±10.9
	$[12, 13]$	3.0±1.8	6.3±14.8	11.9±11.3	16.9±10.4	-46.8±29.7	-38.1±23.9
	$Total$	38.0±2.8	8.1±2.9	18.2±4.6	20.2±9.2	-48.0±8.8	-35.6±7.5
16	$[9, 10]$	11.3±0.9	8.1±5.0	15.0±7.7	18.1±14.9	-28.7±5.7	-21.5±7.0
	$[10, 11]$	11.6±0.8	11.0±5.3	13.8±8.9	17.8±13.1	-43.3±9.2	-35.1±9.9
	$[11, 12]$	11.5±1.2	11.5±4.9	14.9±6.6	17.4±12.8	-49.7±14.2	-40.2±13.4
	$[12, 13]$	3.4±1.2	4.2±4.9	29.9±23.4	7.9±9.0	-42.8±18.2	-28.2±17.1
	$Total$	37.8±3.1	10.0±2.2	15.2±3.8	16.6±6.2	-40.9±4.5	-32.3±5.4

Table 16: Details of pm shifts for doctors 1-9. Averages over shifts with 95% confidence intervals are shown. (X measured in minutes.)

Doc	Interval	Avg # Scheduled	% No-show	% Late	Avg(X^+)	Avg(X^-)	Avg(X)
1	[12, 13]	2.8±2.0	1.4±3.5	20.2±34.1	95.0±164.3	-45.1±23.6	-25.8±32.8
	[13, 14]	20.1±0.7	4.9±2.7	12.8±4.0	36.4±25.6	-45.5±4.6	-36.2±5.0
	[14, 15]	18.9±0.9	8.2±3.5	10.6±3.3	26.2±15.5	-43.7±6.8	-36.9±7.3
	[15, 16]	17.8±1.1	7.9±3.9	10.8±4.3	11.1±5.1	-47.9±6.5	-41.0±6.0
	[16, 17]	12.5±2.5	2.9±2.2	7.2±4.1	12.1±5.6	-43.5±8.2	-40.2±8.5
	[17, 18]	0.6±0.8	0	0		-47.0±28.5	-47.0±28.5
	$Total$	72.9±3.4	6.0±1.4	10.4±1.9	23.2±7.2	-45.7±3.1	-38.6±3.3
2	[12, 13]	0.9±0.6	10.0±22.6	11.1±25.6	23.6±NaN	-53.0±33.8	-44.5±35.1
	[13, 14]	14.7±1.3	9.3±4.2	9.1±3.9	17.6±9.0	-60.6±8.9	-53.6±8.6
	[14, 15]	13.8±1.3	12.3±5.7	12.3±5.3	16.9±11.3	-55.8±8.2	-47.2±8.3
	[15, 16]	14.4±0.9	9.4±3.9	13.5±4.8	11.9±5.9	-59.0±12.9	-49.4±11.7
	[16, 17]	3.9±1.4	4.4±4.8	12.0±10.0	8.2±9.3	-61.1±31.6	-52.9±31.7
	$Total$	47.8±3.8	10.2±2.1	11.6±2.2	14.8±4.4	-57.9±5.8	-49.5±5.2
3	[12, 13]	0.4±0.5		50.0	13.0±29.2	-60.6±698.2	-23.8±334.5
	[13, 14]	14.8±0.8	10.2±6.5	11.9±6.3	15.5±12.2	-66.4±10.6	-57.6±13.2
	[14, 15]	11.3±1.3	10.6±7.2	9.5±6.4	30.9±16.6	-63.8±16.4	-53.7±12.8
	[15, 16]	7.7±2.3	11.7±6.8	5.4±9.3	23.2±143.1	-76.5±26.0	-69.1±22.0
	[16, 17]	6.1±1.5	9.7±6.6	4.2±4.8	7.1±28.4	-81.9±56.8	-77.9±54.7
	$Total$	40.3±4.6	10.4±4.1	9.1±4.0	19.2±7.0	-69.2±10.0	-61.1±9.3
4	[13, 14]	21.9±1.4	7.6±3.8	17.0±5.3	24.1±8.6	-44.5±7.7	-33.0±8.8
	[14, 15]	21.3±1.5	12.5±4.0	13.3±4.5	20.2±9.5	-37.4±6.3	-29.6±7.1
	[15, 16]	21.4±1.8	4.7±2.2	13.2±7.7	8.0±3.2	-40.0±7.6	-33.0±6.5
	$Total$	64.6±2.6	8.1±2.2	14.4±4.3	18.0±5.7	-40.6±5.5	-32.1±6.3
5	[12, 13]	12.9±1.1	5.2±3.3	14.5±4.9	11.5±6.1	-38.3±5.8	-31.3±6.9
	[13, 14]	24.1±0.8	4.1±2.1	13.2±4.1	24.2±12.7	-37.8±4.9	-29.5±5.3
	[14, 15]	23.3±1.0	5.8±2.5	16.9±3.2	18.3±5.2	-34.5±4.2	-25.7±4.0
	[15, 16]	23.5±1.3	4.9±2.0	18.9±3.9	14.0±3.3	-34.6±4.6	-25.7±4.7
	[16, 17]	17.2±1.8	7.6±2.9	12.1±3.9	9.1±3.5	-45.8±7.7	-39.0±6.8
	$Total$	100.9±4.0	5.4±1.0	15.4±1.7	16.2±3.0	-38.0±2.3	-29.7±2.4
6	[13, 14]	26.8±3.0	13.4±12.5	7.3±5.3	11.5±11.8	-65.1±30.1	-59.3±24.8
	[14, 15]	27.5±2.1	11.9±9.2	8.1±13.6	12.3±19.9	-56.1±26.0	-50.3±27.4
	[15, 16]	26.0±3.4	16.4±3.7	14.5±11.2	17.0±9.0	-49.4±22.8	-40.5±25.4
	[16, 17]	6.0±4.1	6.3±11.8	4.2±13.3	2.0	-68.4±82.0	-67.0±84.3
	$Total$	86.3±10.4	13.5±6.0	9.5±9.2	14.0±1.9	-58.7±21.3	-51.9±22.1
7	[12, 13]	4.3±1.7	11.3±10.2	8.3±13.3	29.6±290.9	-54.5±22.8	-49.0±27.8
	[13, 14]	21.4±3.6	5.6±4.0	5.5±4.9	7.0±7.8	-65.9±11.0	-62.3±12.3
	[14, 15]	23.1±1.2	7.8±6.2	9.8±4.8	21.2±16.1	-64.4±14.4	-56.7±14.2
	[15, 16]	23.0±1.2	7.0±4.7	5.9±3.9	14.8±7.8	-82.1±21.0	-77.0±22.5
	[16, 17]	11.9±4.8	11.7±7.2	9.2±8.4	12.8±13.7	-78.6±24.6	-70.0±22.5
	$Total$	83.6±7.2	8.0±2.4	7.3±2.1	15.0±7.4	-72.4±9.1	-66.0±8.8
8	[12, 13]	0.1±0.2	0	0		-29.6	-29.6
	[13, 14]	15.4±2.1	8.0±4.0	6.4±2.3	35.6±30.5	-61.3±10.4	-55.2±10.5
	[14, 15]	14.2±1.9	8.3±3.3	12.8±5.2	20.7±9.2	-59.8±12.3	-50.0±11.2
	[15, 16]	14.6±1.9	9.2±4.0	14.3±4.9	10.5±4.1	-70.0±14.2	-57.8±11.4
	[16, 17]	6.6±1.5	3.8±4.6	13.0±6.7	19.5±9.1	-58.1±15.5	-48.0±11.9
	$Total$	50.8±6.5	8.0±2.0	11.1±2.5	22.7±10.5	-62.1±6.1	-53.0±5.4
9	[11, 12]	0.1±0.2	50.0	0		-125.2	-125.2
	[12, 13]	3.1±0.7	6.0±5.8	8.8±9.3	56.7±125.5	-67.4±18.8	-57.8±17.9
	[13, 14]	15.5±1.4	6.3±2.8	10.4±4.0	12.4±5.5	-61.4±7.1	-53.2±6.4
	[14, 15]	15.1±0.7	7.2±2.4	8.4±3.2	21.7±9.6	-65.3±9.5	-58.1±9.6
	[15, 16]	15.8±0.6	12.4±3.1	11.4±4.0	13.6±5.8	-60.7±10.0	-52.4±9.3
	[16, 17]	9.0±1.4	8.0±5.5	13.3±5.1	15.4±6.9	-59.8±13.8	-50.6±13.4
	[17, 18]	0.2±0.5	0	0		-34.6	-34.6
	$Total$	58.8±2.7	8.4±1.5	10.9±2.2	17.8±4.9	-61.9±4.6	-53.3±4.5

Table 17: Details of pm shifts for doctors 10-16. Averages over shifts with 95% confidence intervals are shown. (X measured in minutes.)

Doc	Interval	Avg # Scheduled	% No-show	% Late	Avg(X^+)	Avg(X^-)	Avg(X)
10	[13, 14]	5.1±0.7	16.9±11.3	6.9±8.1	36.5±86.9	-66.9±32.2	-59.3±31.3
	[14, 15]	10.7±0.9	15.5±10.6	12.4±10.8	16.7±11.6	-74.7±23.9	-65.3±24.8
	[15, 16]	9.9±1.4	11.3±11.5	14.0±10.1	21.1±14.4	-56.9±14.8	-45.9±15.5
	[16, 17]	3.6±2.0	6.5±11.7	9.2±12.0	14.9±52.2	-41.6±21.1	-33.8±11.4
	$Total$	29.2±3.2	12.9±3.5	11.8±6.2	18.3±8.6	-64.0±16.0	-54.6±15.5
11	[13, 14]	7.1±0.8	10.0±7.6	17.3±9.3	20.7±11.1	-78.5±24.6	-59.9±18.9
	[14, 15]	14.2±1.4	5.9±3.9	17.3±7.2	24.0±14.8	-69.5±10.5	-52.2±11.2
	[15, 16]	13.3±1.6	7.5±5.5	12.0±4.7	7.4±5.0	-71.2±13.4	-61.8±13.1
	[16, 17]	6.9±1.8	8.5±6.1	13.6±10.3	14.9±12.6	-65.7±26.1	-52.0±19.7
	$Total$	41.5±3.0	7.3±1.7	14.9±2.6	19.5±6.5	-71.2±6.8	-57.7±6.4
12	[13, 14]	6.3±0.7	12.0±8.4	13.6±9.7	11.9±9.4	-64.7±22.0	-54.0±19.4
	[14, 15]	10.4±2.6	12.3±6.8	12.6±7.5	10.5±4.9	-64.5±29.2	-55.6±26.9
	[15, 16]	11.8±1.8	10.7±9.7	13.7±5.6	17.0±17.0	-70.1±18.7	-57.2±13.1
	[16, 17]	6.4±1.9	10.9±9.8	17.9±11.1	15.2±13.4	-46.3±17.2	-35.2±16.6
	$Total$	34.9±5.1	11.2±5.6	14.6±4.1	12.8±5.0	-67.0±12.9	-55.0±10.8
13	[13, 14]	5.8±0.9	5.8±5.9	12.2±8.3	9.5±13.0	-64.9±19.4	-57.5±21.4
	[14, 15]	10.9±1.4	10.1±5.5	16.7±9.0	22.3±17.4	-56.4±17.5	-45.9±17.8
	[15, 16]	9.3±1.1	8.3±6.0	9.2±5.9	15.3±10.7	-50.0±14.8	-43.7±13.6
	[16, 17]	5.1±1.4	8.1±7.8	5.7±5.6	12.3±20.5	-38.1±10.9	-35.9±11.8
	$Total$	31.1±2.9	9.0±4.6	11.6±3.0	14.6±6.2	-54.4±10.6	-46.6±10.4
14	[13, 14]	6.3±0.6	13.1±6.6	10.1±5.8	12.0±6.0	-57.7±11.8	-50.8±11.3
	[14, 15]	11.1±1.1	10.8±3.3	11.0±5.4	11.1±7.1	-70.3±11.7	-61.4±11.1
	[15, 16]	10.6±1.0	10.5±5.0	11.0±3.7	12.6±6.7	-52.4±9.9	-45.5±9.5
	[16, 17]	6.5±0.9	4.3±3.2	8.9±5.2	5.1±4.0	-42.5±7.3	-38.2±6.7
	$Total$	34.4±2.7	9.7±2.4	10.3±2.9	11.9±4.0	-57.8±4.7	-50.8±4.8
15	[13, 14]	5.5±1.3	7.5±7.7	15.4±11.5	9.1±11.8	-67.9±33.4	-52.0±21.6
	[14, 15]	11.8±1.7	10.0±6.2	10.4±6.6	19.8±27.2	-65.4±11.7	-57.3±12.8
	[15, 16]	11.1±1.5	17.5±6.6	10.4±6.7	13.2±7.6	-47.5±19.4	-41.1±18.2
	[16, 17]	6.0±1.5	9.9±9.4	19.0±15.0	19.8±22.5	-51.9±17.8	-40.9±18.0
	$Total$	34.5±3.4	11.7±2.7	12.0±5.2	13.6±7.5	-57.9±7.8	-49.0±7.8
16	[13, 14]	6.0±1.1	12.0±6.2	5.1±5.9	4.3±9.3	-75.9±24.3	-71.3±23.4
	[14, 15]	12.1±1.0	8.5±5.5	15.6±7.3	14.8±7.0	-61.0±17.4	-49.8±16.5
	[15, 16]	10.3±1.1	7.3±5.3	12.0±7.0	10.9±4.6	-54.0±13.4	-46.0±12.1
	[16, 17]	6.2±1.9	7.6±7.5	9.0±8.0	9.0±19.6	-54.3±29.1	-49.9±29.6
	$Total$	34.6±3.6	8.6±3.6	12.1±4.3	12.9±6.0	-59.4±9.0	-50.9±8.7

Figure 12: Lateness CDFs for All Doctors (Left: AM, Right: PM)

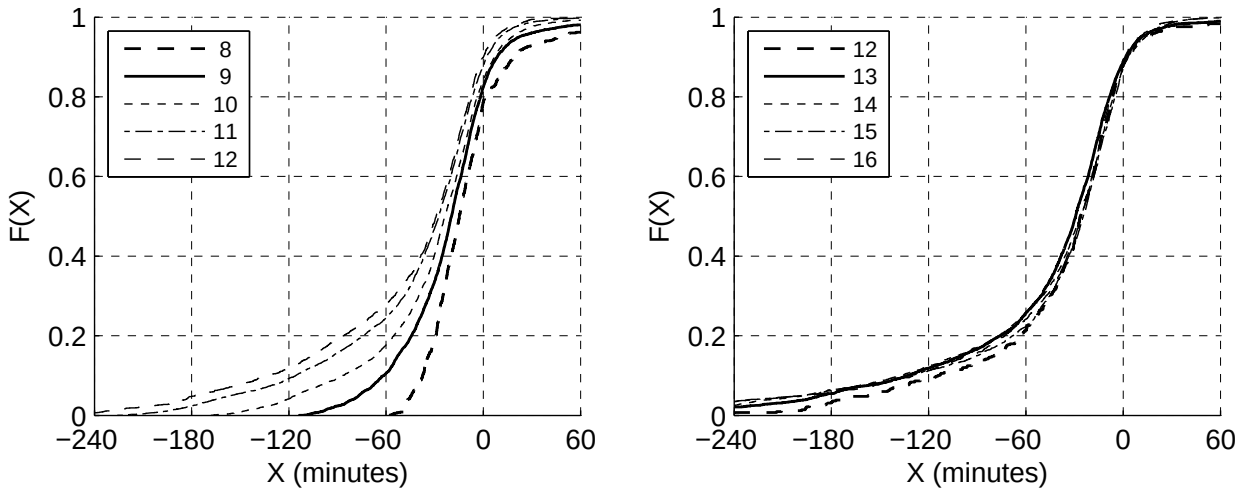


Figure 13: Lateness CDFs (From top to bottom: doctors 1, 2, 3, 4. From left to right: AM, PM)

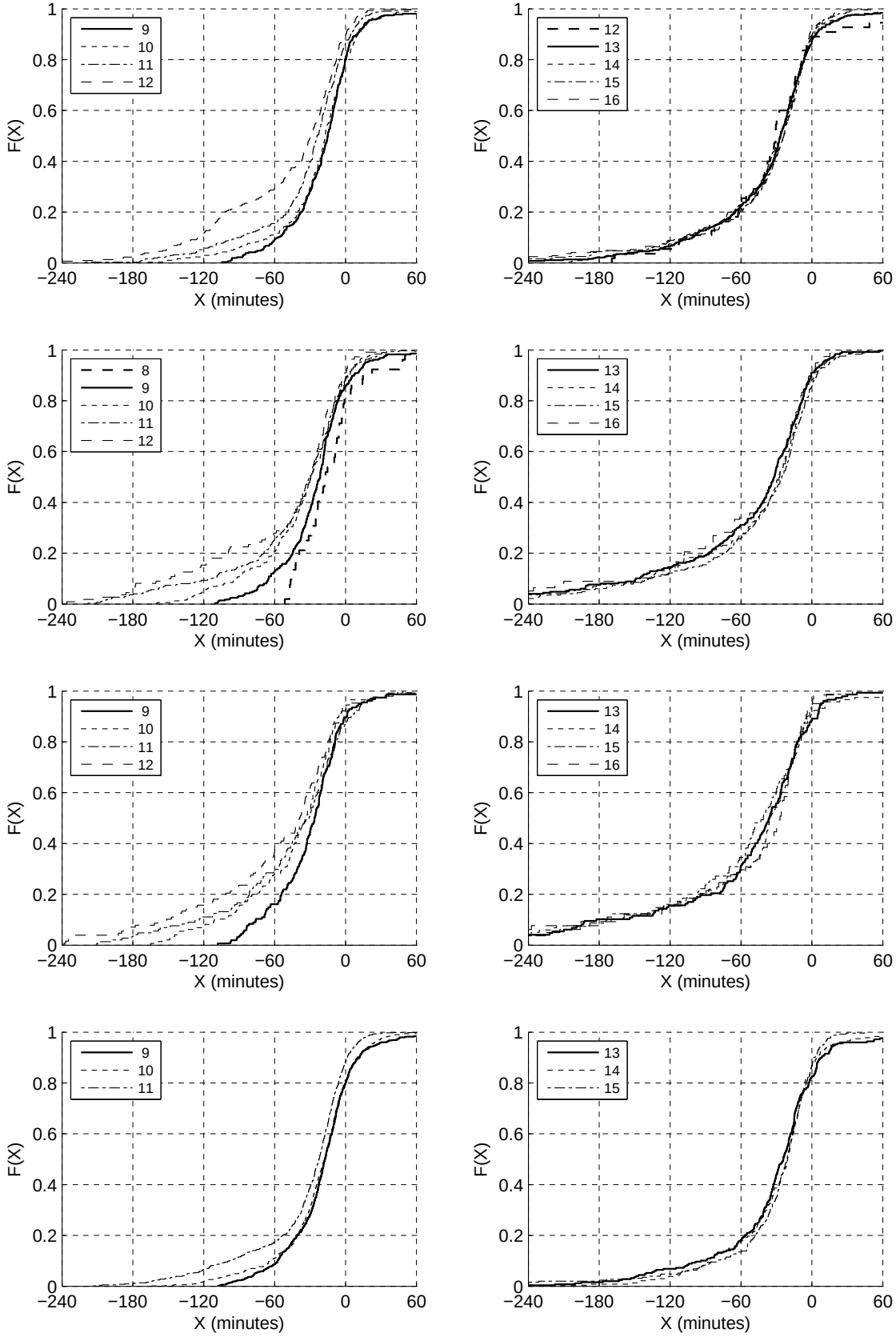


Figure 14: Lateness CDFs (From top to bottom: doctors 5, 6, 7, 8. From left to right: AM, PM)

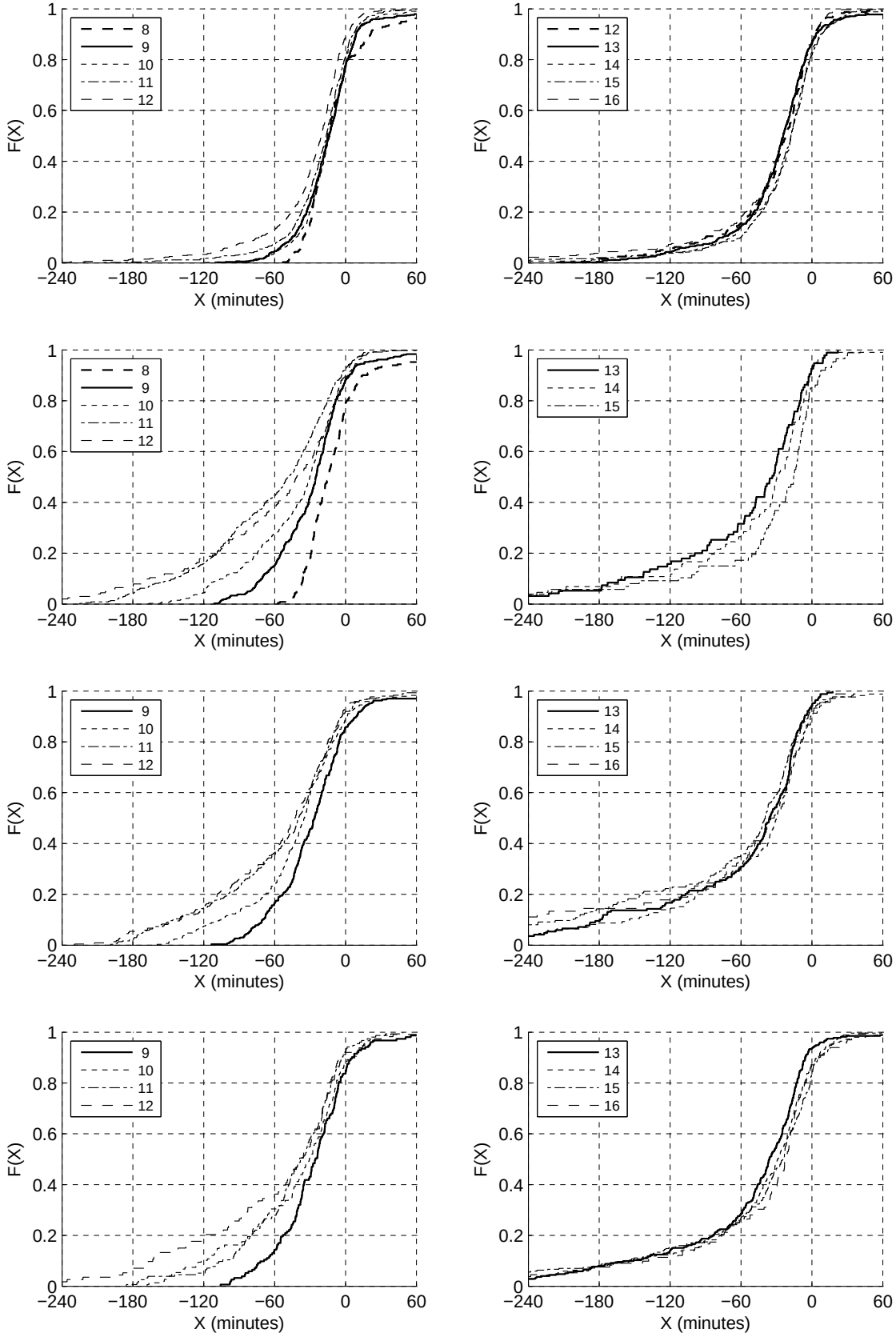


Figure 15: Lateness CDFs (From top to bottom: doctors 9, 11, 12, 13. From left to right: AM, PM)

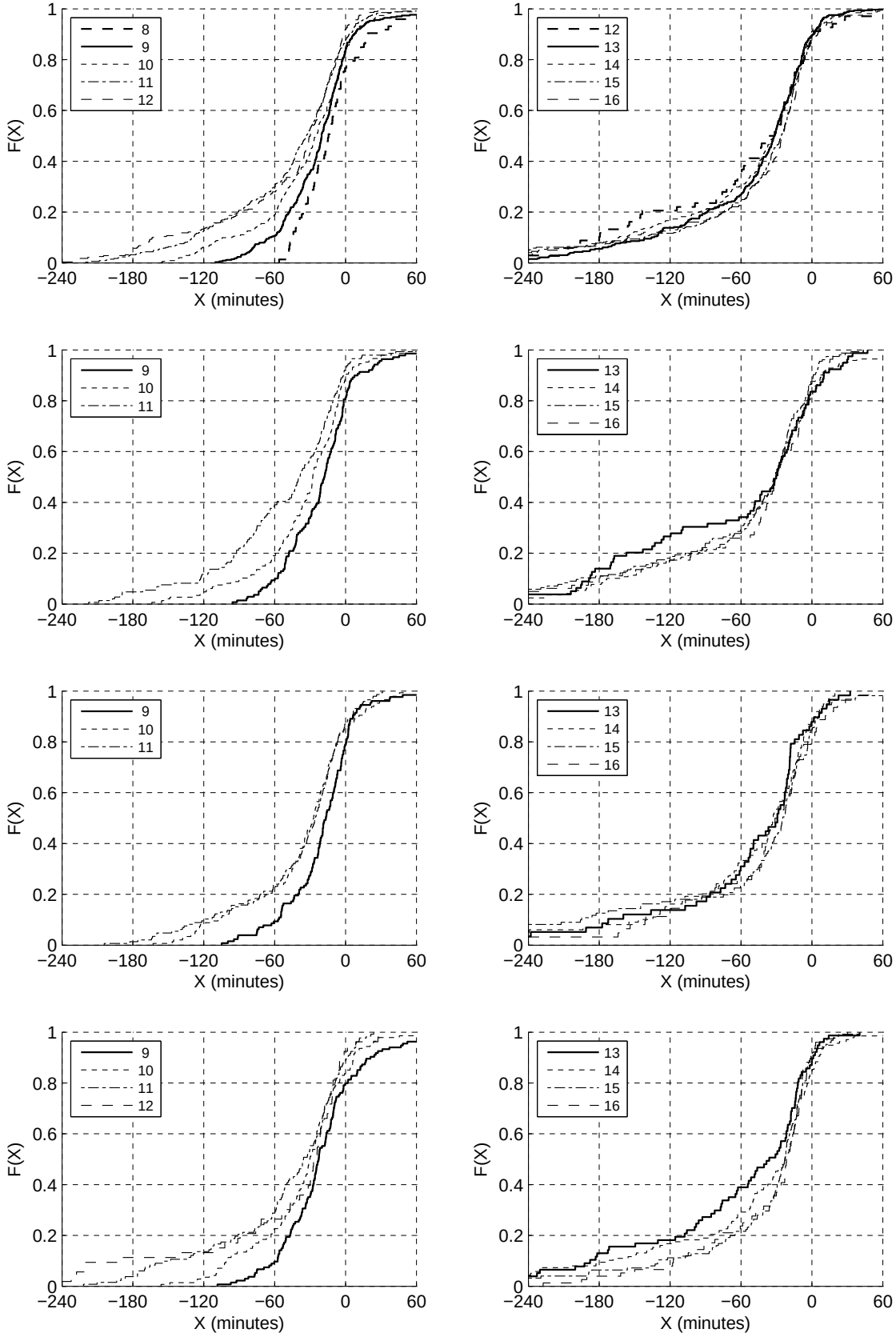


Figure 16: Lateness CDFs (From top to bottom: doctors 15, 16. From left to right: AM, PM)

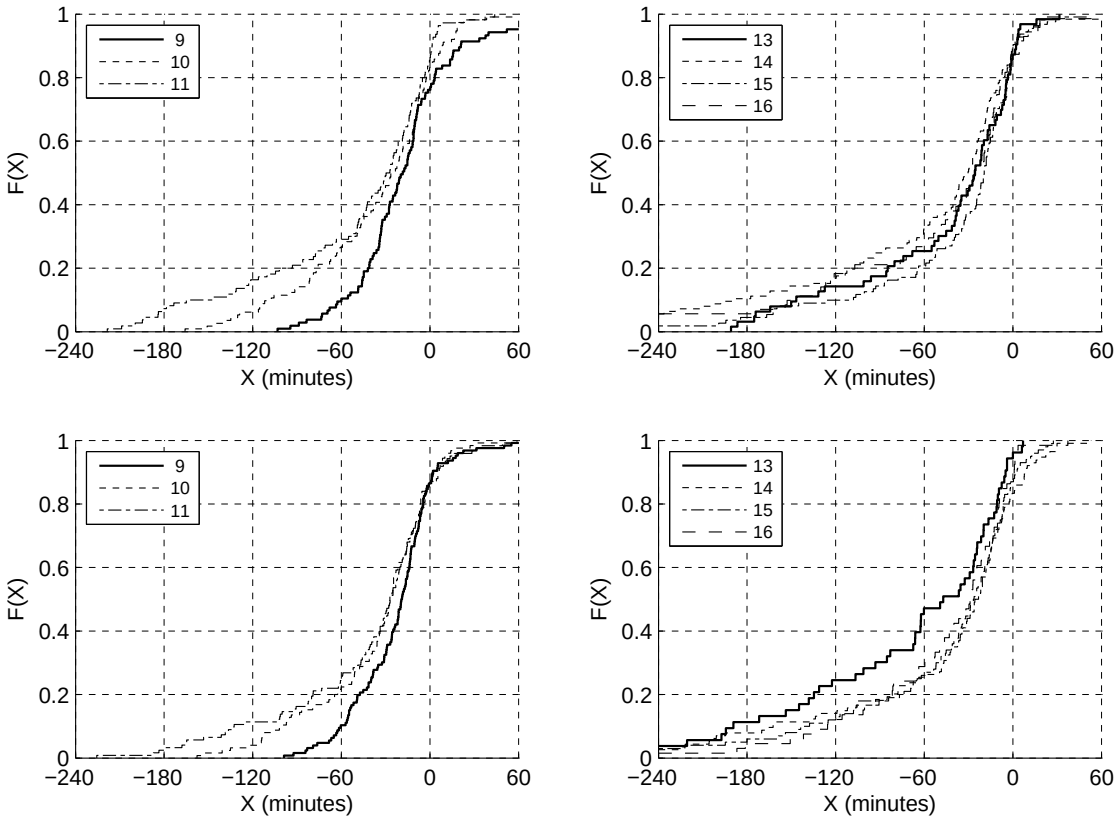
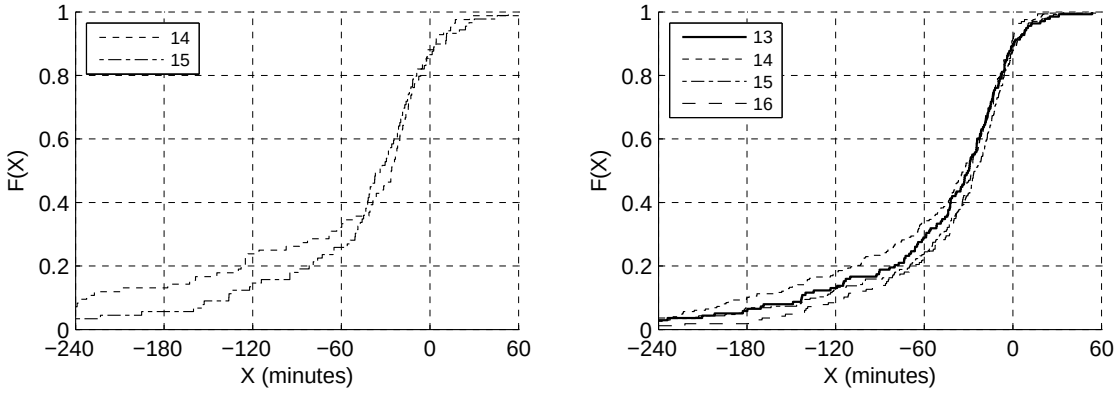


Figure 17: Lateness CDFs (From left to right: doctors 10, 14. Both PM shifts.)



4.3 Testing An NHPP Within Shifts

Table 18: P-values of the Lewis KS Test of NHPP

		Scheduled Arrivals				Actual Arrivals			
Shift	Doctor	n	$L = 1$	$L = 3$	$L = T$	n	$L = 1$	$L = 3$	$L = T$
AM	1	930	0.00	0.00	0.00	954	0.17	0.03	0.13
	2	930	0.00	0.00	0.00	809	0.20	0.09	0.71
	3	456	0.00	0.00	0.00	418	0.39	0.26	0.94
	4	2107	0.00	0.00	0.00	1822	0.00	0.00	0.00
	5	1554	0.00	0.00	0.00	1632	0.15	0.10	0.22
	6	1226	0.00	0.00	0.00	1025	0.16	0.00	0.00
	7	863	0.00	0.00	0.00	823	0.85	0.92	0.29
	8	436	0.00	0.00	0.00	430	0.52	0.25	0.48
	9	1041	0.00	0.00	0.00	997	0.12	0.60	0.41
	10	37	0.00	0.00	0.00	41	0.13	0.18	0.27
	11	442	0.00	0.00	0.00	366	0.03	0.00	0.00
	12	445	0.00	0.00	0.00	377	0.61	0.39	0.99
	13	423	0.00	0.00	0.00	363	0.27	0.19	0.83
	14	25	0.00	0.00	0.00	27	0.72	0.71	0.71
	15	341	0.00	0.00	0.00	288	0.43	0.46	0.54
	16	401	0.00	0.00	0.00	335	0.74	0.22	0.42
PM	1	1035	0.00	0.00	0.00	922	0.03	0.16	0.46
	2	744	0.00	0.00	0.00	564	0.11	0.16	0.95
	3	353	0.00	0.00	0.00	262	0.21	0.30	0.70
	4	742	0.00	0.00	0.00	576	0.20	0.53	0.27
	5	1294	0.00	0.00	0.00	1242	0.44	0.36	0.02
	6	306	0.00	0.00	0.00	220	0.27	0.50	0.40
	7	519	0.00	0.00	0.00	401	0.20	0.52	0.10
	8	805	0.00	0.00	0.00	641	0.62	0.55	0.21
	9	984	0.00	0.00	0.00	776	0.15	0.49	0.80
	10	240	0.00	0.00	0.00	207	0.06	0.07	0.49
	11	427	0.00	0.00	0.00	366	0.22	0.25	0.32
	12	295	0.00	0.00	0.00	251	0.50	0.81	0.30
	13	351	0.00	0.00	0.00	320	0.24	0.39	0.07
	14	665	0.00	0.00	0.00	607	0.01	0.01	0.13
	15	324	0.00	0.00	0.00	290	0.47	0.78	0.46
	16	294	0.00	0.00	0.00	266	0.38	0.42	0.40

Table 19: P-values of the CU KS Test of NHPP

		Scheduled Arrivals				Actual Arrivals			
Shift	Doctor	n	$L=1$	$L=3$	$L=T$	n	$L=1$	$L=3$	$L=T$
AM	1	930	0.00	0.01	0.21	954	0.09	0.01	0.07
	2	930	0.00	0.00	0.90	809	0.00	0.00	0.12
	3	456	0.00	0.01	0.50	418	0.23	0.00	0.98
	4	2107	0.00	0.00	0.53	1822	0.00	0.00	0.92
	5	1554	0.00	0.00	0.84	1632	0.31	0.05	0.06
	6	1226	0.00	0.00	0.03	1025	0.00	0.00	0.01
	7	863	0.00	0.01	1.00	823	0.02	0.00	0.73
	8	436	0.00	0.08	0.02	430	0.10	0.00	0.37
	9	1041	0.00	0.00	1.00	997	0.11	0.00	0.93
	10	37	0.03	0.51	0.96	41	0.48	0.32	0.87
	11	442	0.00	0.05	1.00	366	0.03	0.00	0.84
	12	445	0.00	0.12	0.95	377	0.51	0.00	0.69
	13	423	0.00	0.13	0.73	363	0.20	0.00	0.69
	14	25	0.15	0.72	0.72	27	0.67	0.92	0.92
	15	341	0.00	0.15	1.00	288	0.11	0.00	0.92
	16	401	0.00	0.16	0.95	335	0.23	0.00	0.93
PM	1	1035	0.00	0.00	0.56	922	0.35	0.01	0.31
	2	744	0.00	0.01	0.24	564	0.00	0.00	0.89
	3	353	0.00	0.00	0.95	262	0.56	0.00	0.66
	4	742	0.00	0.02	0.98	576	0.00	0.00	0.80
	5	1294	0.00	0.00	0.46	1242	0.41	0.26	0.26
	6	306	0.00	0.29	0.81	220	0.17	0.11	0.04
	7	519	0.00	0.07	1.00	401	0.14	0.00	0.70
	8	805	0.00	0.01	0.83	641	0.01	0.01	0.61
	9	984	0.00	0.00	1.00	776	0.05	0.05	0.81
	10	240	0.00	0.00	0.91	207	0.09	0.03	0.99
	11	427	0.00	0.00	0.74	366	0.37	0.03	0.85
	12	295	0.00	0.00	0.49	251	0.33	0.81	0.72
	13	351	0.00	0.00	0.87	320	0.15	0.65	0.99
	14	665	0.00	0.00	0.22	607	0.29	0.11	0.68
	15	324	0.00	0.00	0.55	290	0.73	0.38	0.30
	16	294	0.00	0.00	0.61	266	0.10	0.22	0.76

5 Under-Dispersion Over Multiple Days

Table 20: Under-dispersion in the number of scheduled arrivals (appointments made before the appointment day) and actual arrivals over different days

	AM Shift							PM Shift						
		Scheduled			Actual				Scheduled			Actual		
Doc	n	$\bar{\mu}$	$\bar{\sigma^2}$	$\bar{D}$	$\bar{\mu}$	$\bar{\sigma^2}$	$\bar{D}$	n	$\bar{\mu}$	$\bar{\sigma^2}$	$\bar{D}$	$\bar{\mu}$	$\bar{\sigma^2}$	$\bar{D}$
1	17	76.9	65.1	0.8	73.5	48.5	0.7	19	72.9	50.8	0.7	70.6	54.7	0.8
2	21	53.9	33.6	0.6	50.8	38.6	0.8	18	47.8	58.3	1.2	45.4	23.2	0.5
3	12	51.4	26.6	0.5	50.1	29.7	0.6	11	40.3	46.4	1.2	37.7	30.2	0.8
4	34	65.4	27.9	0.4	63.4	19.6	0.3	12	64.6	16.4	0.3	61.1	14.6	0.2
5	23	105.5	133.8	1.3	101.8	134.2	1.3	19	100.9	70.4	0.7	97.2	75.5	0.8
6	17	102.8	557.4	5.4	96.1	493.4	5.1	4	86.3	42.9	0.5	76.5	73.0	1.0
7	13	90.3	155.6	1.7	86.7	146.1	1.7	8	83.6	75.1	0.9	79.6	82.6	1.0
8	10	56.8	198.2	3.5	57.4	95.4	1.7	19	50.8	180.4	3.6	48.8	103.6	2.1
9	22	66.1	21.3	0.3	62.6	17.4	0.3	22	58.8	35.9	0.6	55.7	49.5	0.9
10	2	19.0	8.0	0.4	24.5	24.5	1.0	9	29.2	16.9	0.6	28.4	11.5	0.4
11	10	46.6	17.2	0.4	44.4	24.7	0.6	12	41.5	22.3	0.5	40.3	17.8	0.4
12	12	42.5	18.6	0.4	39.3	33.8	0.9	10	34.9	51.2	1.5	33.0	10.9	0.3
13	12	40.8	19.1	0.5	38.3	8.6	0.2	13	31.1	23.7	0.8	32.0	19.7	0.6
14	1	25.0			28.0			23	34.4	38.2	1.1	34.1	22.8	0.7
15	10	38.0	15.8	0.4	36.9	13.7	0.4	11	34.5	26.1	0.8	33.6	24.9	0.7
16	12	37.8	23.8	0.6	35.1	17.5	0.5	10	34.6	24.9	0.7	33.3	26.0	0.8

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