

WAITING IN THE ED DEPARTMENT ON A TYPICAL DAY

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PROJECT DESCRIPTION

- Purpose: Assess the process flow in the Emergency Department to determine the waiting times and the process with the highest influence
- Scope: One-day process flow
 - From patient arrival – check-in/Triage – Rooming – Exit

QUESTIONS?

How long are the waiting times for a typical day in the Emergency Department?

Do waiting times vary based on arrival type (means of patient's arrival)?

Check-in time vs Room assignment: which process step contributes more to the waiting times?

Are the resources utilized effectively and what are the possible areas of improvement?

DATA DESCRIPTION

- Data from ED on January 1, 2018 (whole day-24 hours)
- Number of Arrivals: 130 Patients
- Variables: Patient no, Arrival time, Means of Arrival, Check-in and triage time, ED Room number, time spent in the room, and departure time.
- Arrival Means: Categorized into 4 (Entities)

Category	Number of Arrivals
Car	55 (42%)
Public Transportation or Taxi	5 (4%)
Legal, Social, Health, County services (HSL)	57 (44%)
Others (Unspecified)	13 (10%)

MODELING PROCESS

- Arrival rates vary over the day, Non-stationary Poisson process with a specific rate function.

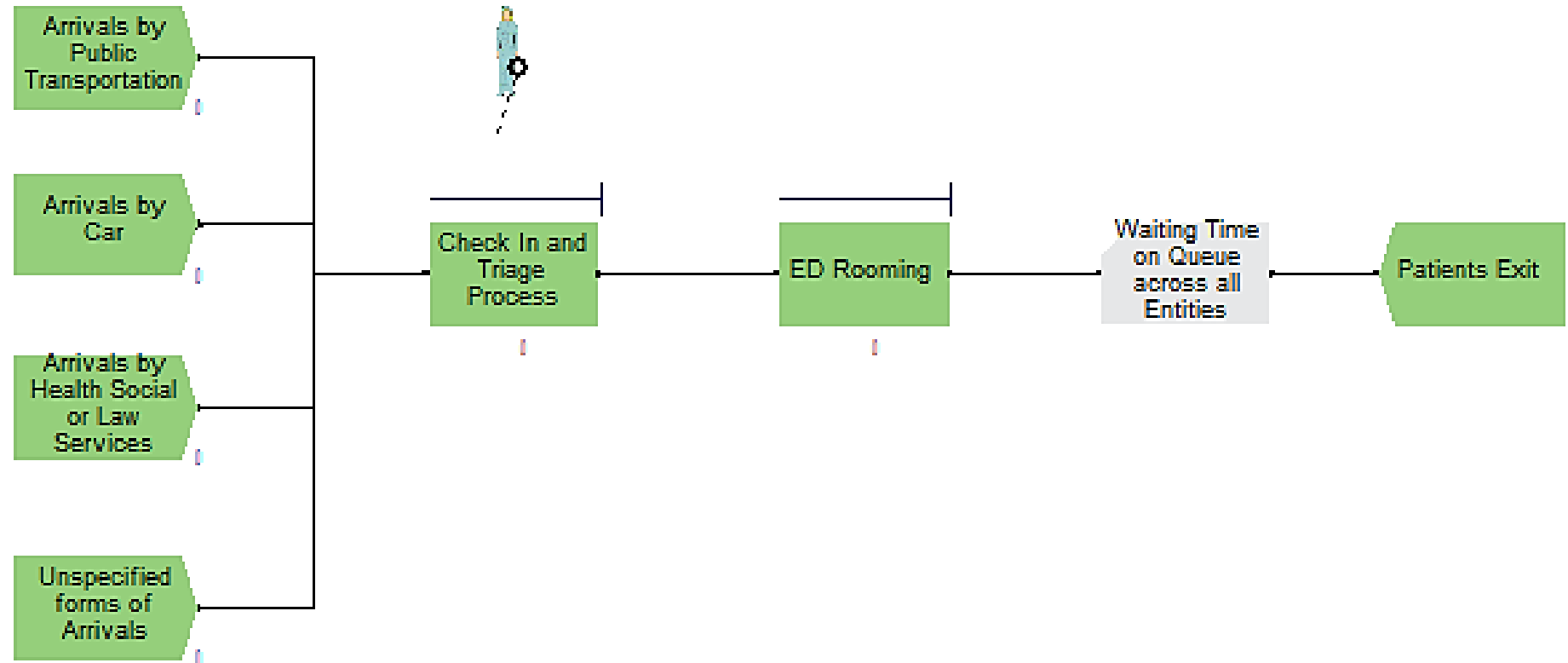
Patients Arrival rates per hour							
Time	Rate		Rate		Rate		Rate
12 am - 1 am	4	6am - 7am	1	12pm - 1pm	3	6pm - 7pm	11
1 am - 2am	2	7am - 8am	6	1pm - 2pm	5	7pm - 8pm	6
2 am - 3am	5	8am - 9am	5	2pm - 3pm	14	8pm - 9pm	5
3am - 4am	3	9am - 10am	4	3pm - 4pm	7	9pm - 10pm	8
4am - 5 am	2	10am - 11am	3	4pm - 5pm	4	10pm - 11pm	4
5am - 6am	6	11am - 12pm	10	5pm - 6pm	9	11pm - 12am	3

- Arrival Distribution: Based on schedule
- Resources:
 - 1 Receptionist/Triage Nurse - Check-in and Triage Process (Always available)
 - Service time: $103 * \text{BETA}(0.108, 1.79) == \text{MX}(0.77, 103 * \text{BETA}(0.108, 1.79))$
- ED Rooms: 55 different rooms, with different availability schedules per hour.

Mismatch between number of patients and rooms available

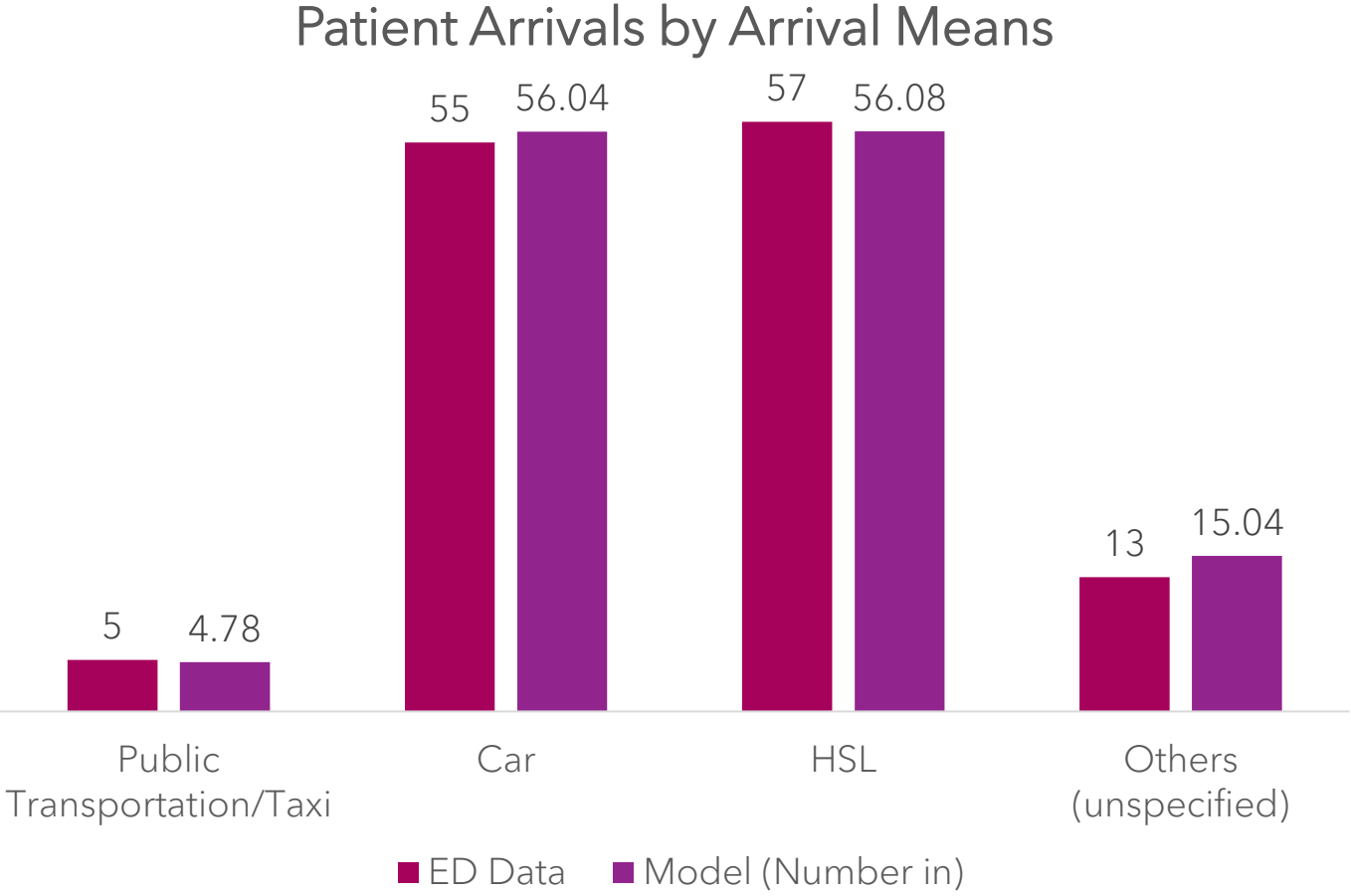
ED Room Availability per hour							
Time	No		No		No		No
12 am - 1 am	4	6am - 7am	3	12pm - 1pm	3	6pm - 7pm	7
1 am - 2am	1	7am - 8am	6	1pm - 2pm	3	7pm - 8pm	9
2 am - 3am	6	8am - 9am	5	2pm - 3pm	12	8pm - 9pm	5
3am - 4am	3	9am - 10am	4	3pm - 4pm	6	9pm - 10pm	6
4am - 5 am	2	10am - 11am	3	4pm - 5pm	7	10pm - 11pm	6
5am - 6am	4	11am - 12pm	10	5pm - 6pm	11	11pm - 12am	4

MODEL



- Steady state process : One day warm up Period
- Replication Length of 2 days and 50 replications
- Verification: Runs at it should ; Validation

MODEL VERIFICATION



Patients Arrivals by Category		
Arrival Means	ED Data	Model (Number in)
Public Transportation/Taxi	5	4.84
Car	55	56.68
HSL	57	55.28
Others (unspecified)	13	16.64

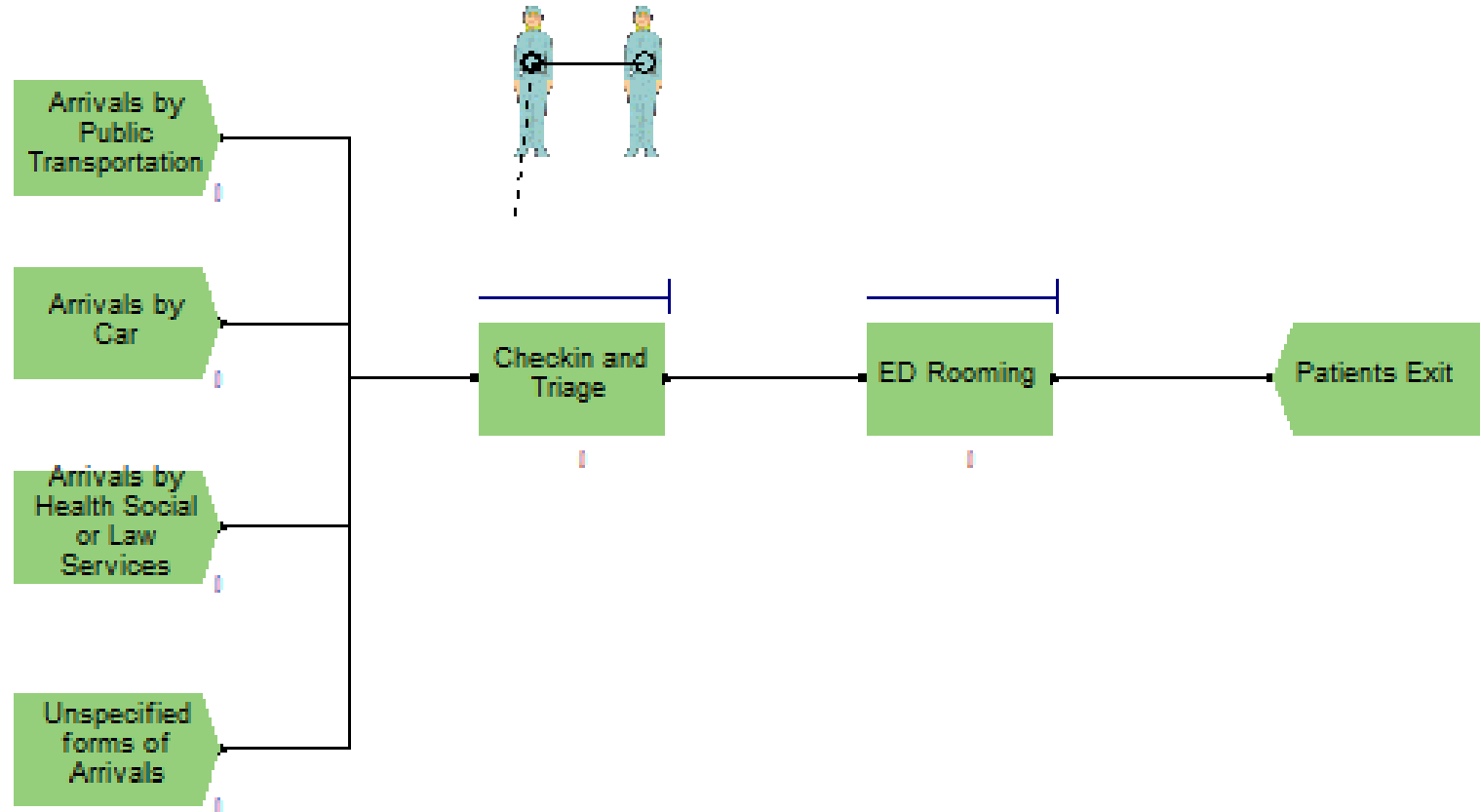
MODEL RESULTS

System Performance Measures	
Waiting Times (Minutes)	Average
Overall (in the system as a whole)	28.31
Public Transportation/Taxi	25.89
Car Arrivals	30.93
HSL Arrivals	33.42
Others (Unspecified)	41.11
Waiting Times time by Resource	
Check-in & Triage	33.21
ED Room	0.02

Utilization of Resources	
Receptionist (Check-in)	0.60 – 0.84
ED Room	0.03 - 0.04

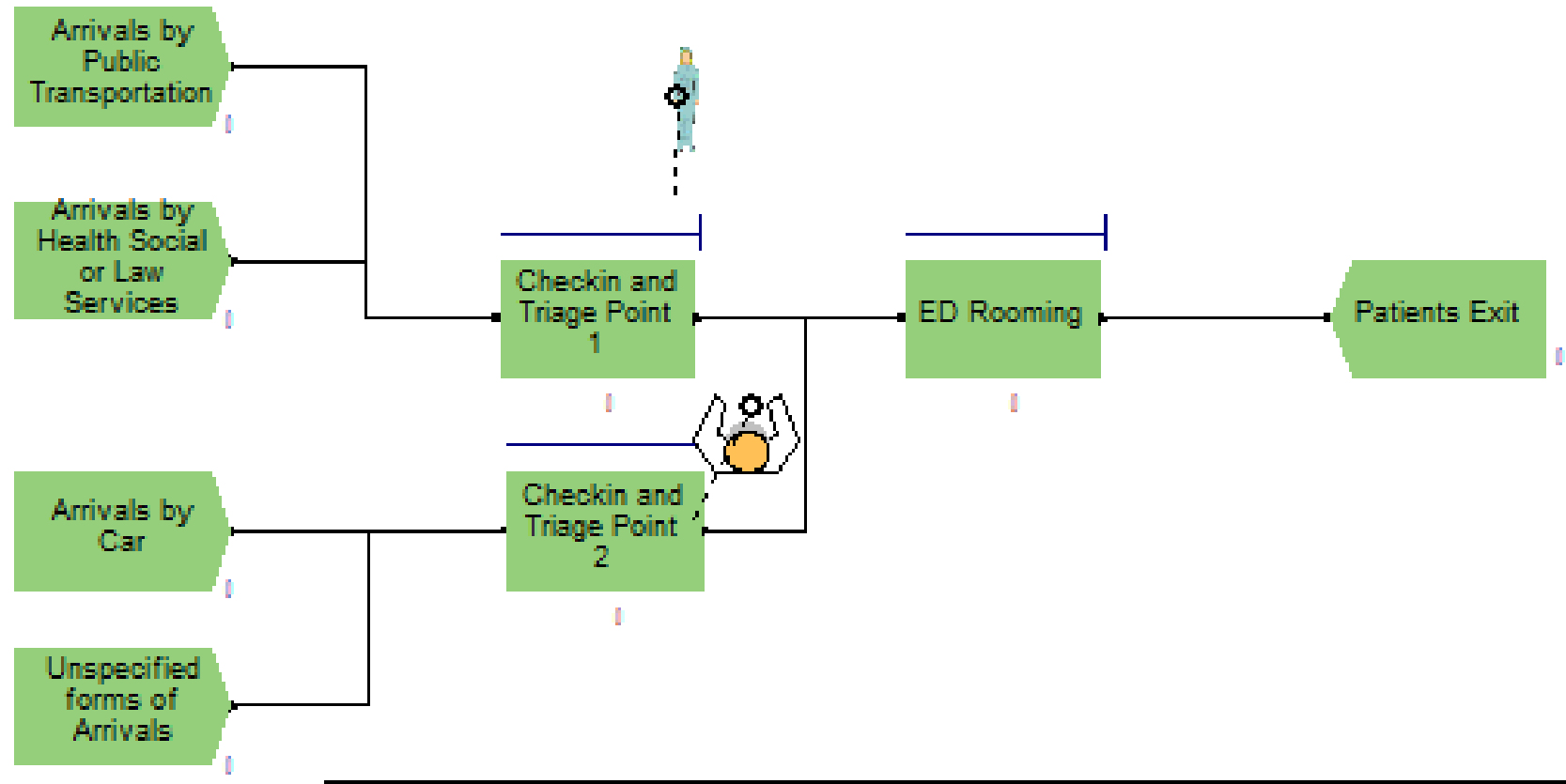
MODIFICATIONS

- MODIFICATION 1: Reduce Waiting time at Check-in by adding another Receptionist/Triage Nurse (Increase capacity; Receptionists are always available)



MODIFICATIONS

- MODIFICATION 2: Two Receptionist handling different types of arrivals



COMPARISON AND FINDINGS

	Baseline	Modification 1	Modification 2
Avg. Waiting Times by Patient Arrival Means			
Public Transportation/Taxi	25.89	1.24	5.26
Car Arrivals	30.93	1.99	12.58
HSL Arrivals	33.42	2.07	8.19
Others (Unspecified)	41.11	3.17	16.11
Avg. Waiting Times on Queue by Resource			
Check-in & Triage	33.21	2.17	Check-in Point 1 7.93 Check-in Point 2 13.25
ED Room	0.02	0.01	0.004
Utilization of Resources			
Receptionist (Check-in)	0.60 - 0.84	0.30 - 0.48	Receptionist 1 0.28 - 0.51 Receptionist 2 0.32 - 0.56
ED Room	0.03 - 0.04	0.03 - 0.04	0.03 - 0.04

CONCLUSION



The overall patients avg. waiting time is 28.31 minutes and a max. of 334.90 minutes (an extreme case)



The most wait is at the check-in and triage process.



Waiting times vary based on patients means of arrival

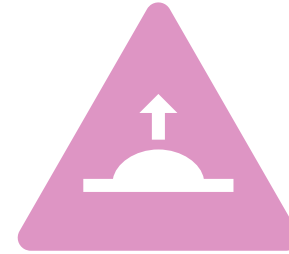
- Unspecified forms of arrivals are the highest, and then car arrivals
- Public transport or taxi are the least.

RECOMMENDATIONS AND NEXT STEPS



Optimal ways of reducing waiting time at check-in, while ensuring effective utilization.

Variable scheduling for the receptionists.



Re-assignment of rooms to ensure better utilization (trade-off may occur).

More available rooms in the later hours of the day

THANK YOU!