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# ECONOMIES OF SCALE: LARGER VACCINATION DISTRIBUTION HUBS ARE MORE RESILIENT TO SERVICE DISRUPTIONS

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A PREPRINT

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## Abstract

Abstract to be added here

**Keywords** COVID19 · vaccination

## 1 Introduction

## 2 Methods

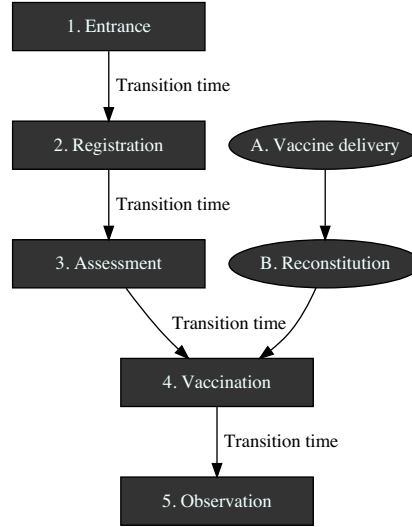


Figure 1: Queueing model for a vaccination site

Table 1: Service time parameter values and resulting distributions

Station	Staff	Base time	Rate	Percentiles					Distribution
				5%	25%	50%	75%	95%	
Reconstitution	7	1	3.0	1.0	1.1	1.2	1.5	2.0	
Entrance	8	2	1.0	2.1	2.3	2.7	3.3	5.0	
Registration	12	3	0.5	3.1	3.6	4.3	5.7	9.2	
Assessment	8	2	1.0	2.1	2.3	2.7	3.4	4.9	
Vaccination	14	2	1.0	2.1	2.3	2.7	3.4	5.2	

### 2.1 Assumed arrival times for the baseline model

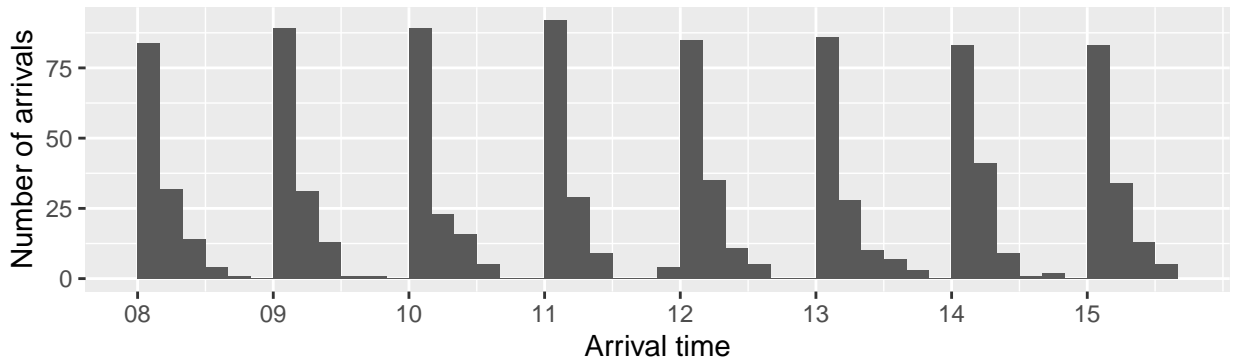


Figure 2: Example of the randomly generated arrival times, with bookings at quarter past the hour, every hour

### 3 Results

#### 3.1 Staff utilisation factor for the baseline model



Figure 3: Processing times for the baseline model

#### 3.2 Processing times for the baseline model

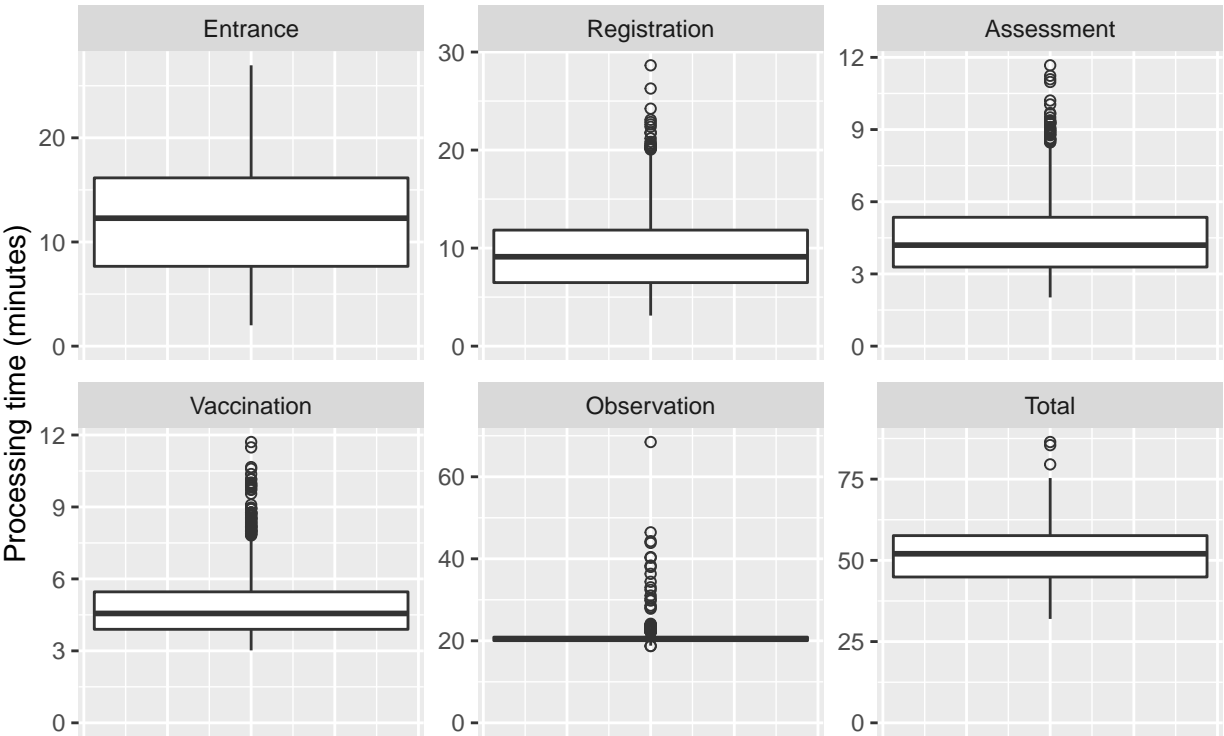


Figure 4: Processing times for the baseline model

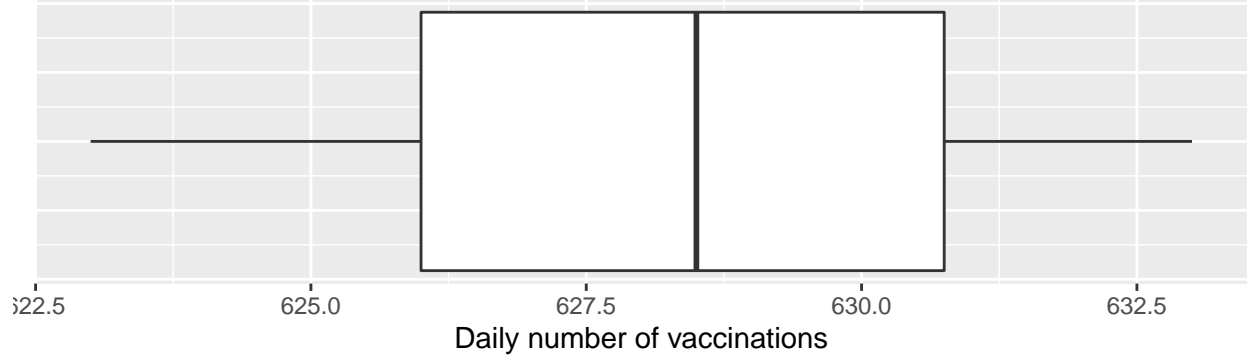


Figure 5: Daily thoroughput for the baseline model

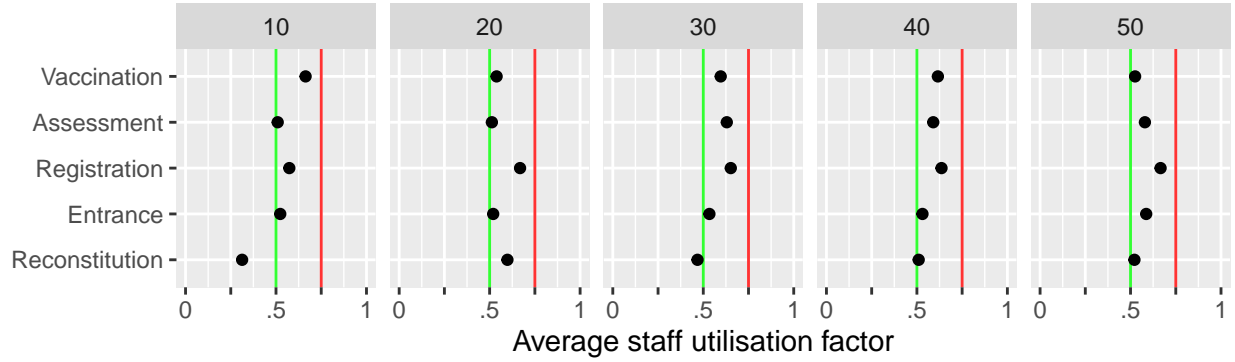


Figure 6: Baseline staff utilisation factor

### 3.3 Daily thoroughput for the baseline model

### 3.4 Baseline utilisation factor

### 3.5 Baseline processing time

### 3.6 Throughput across larger sites

### 3.7 Increase in processing time with increased arrivals by site size

### 3.8 Increase in processing time with delays to registration time

## 4 Discussion

## 5 Contributions

## 6 Acknowledgements

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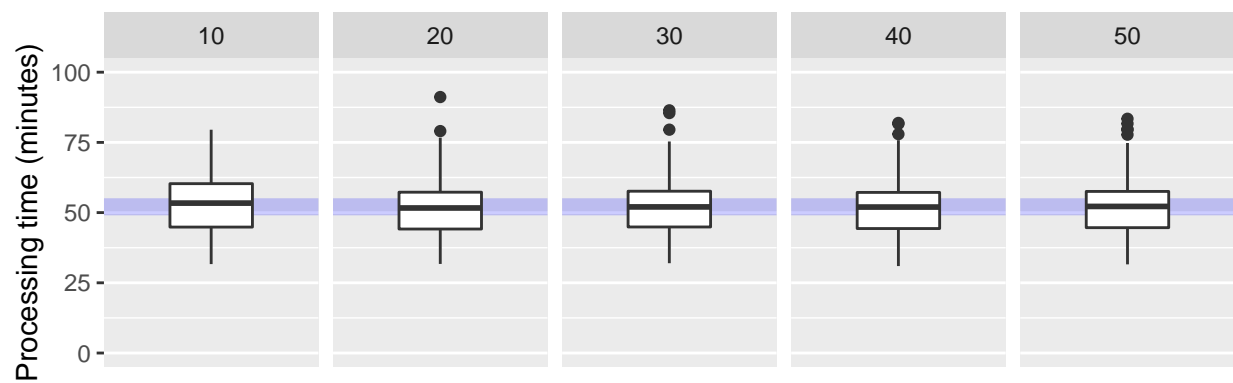


Figure 7: Baseline processing time

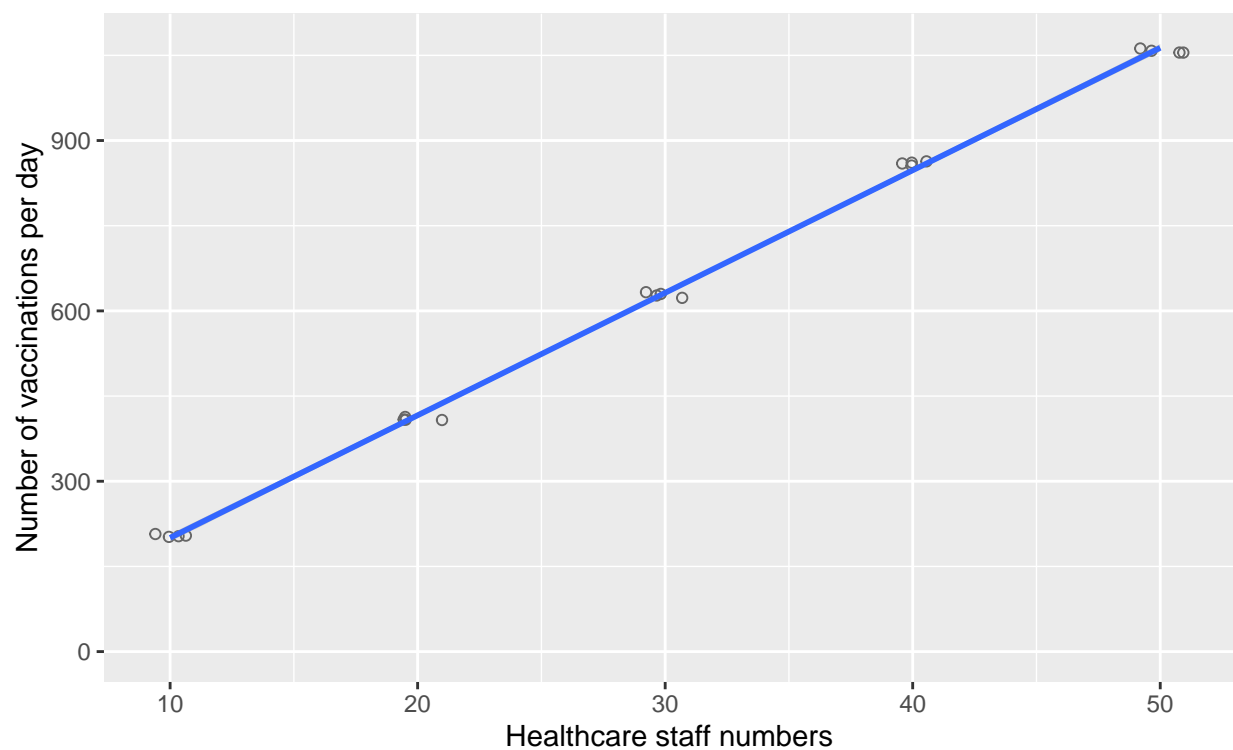


Figure 8: Baseline processing time

## 7 References

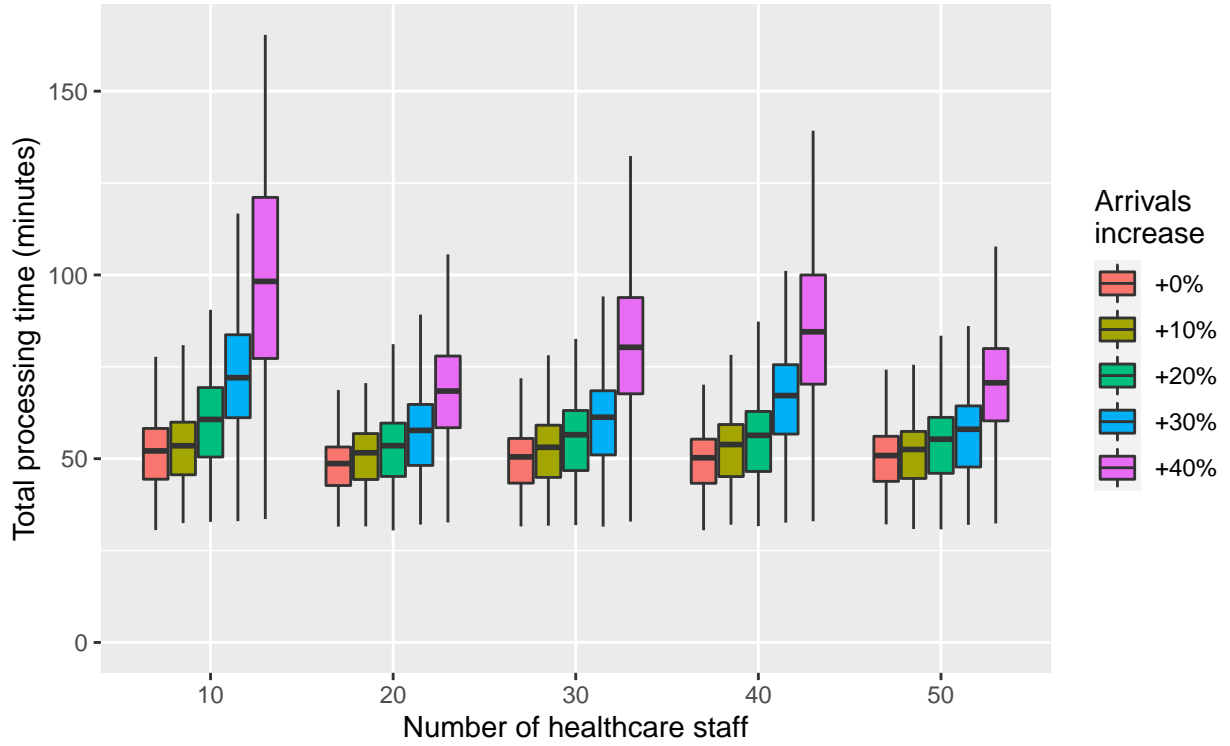


Figure 9: Increase in processing time with increased arrivals by site size

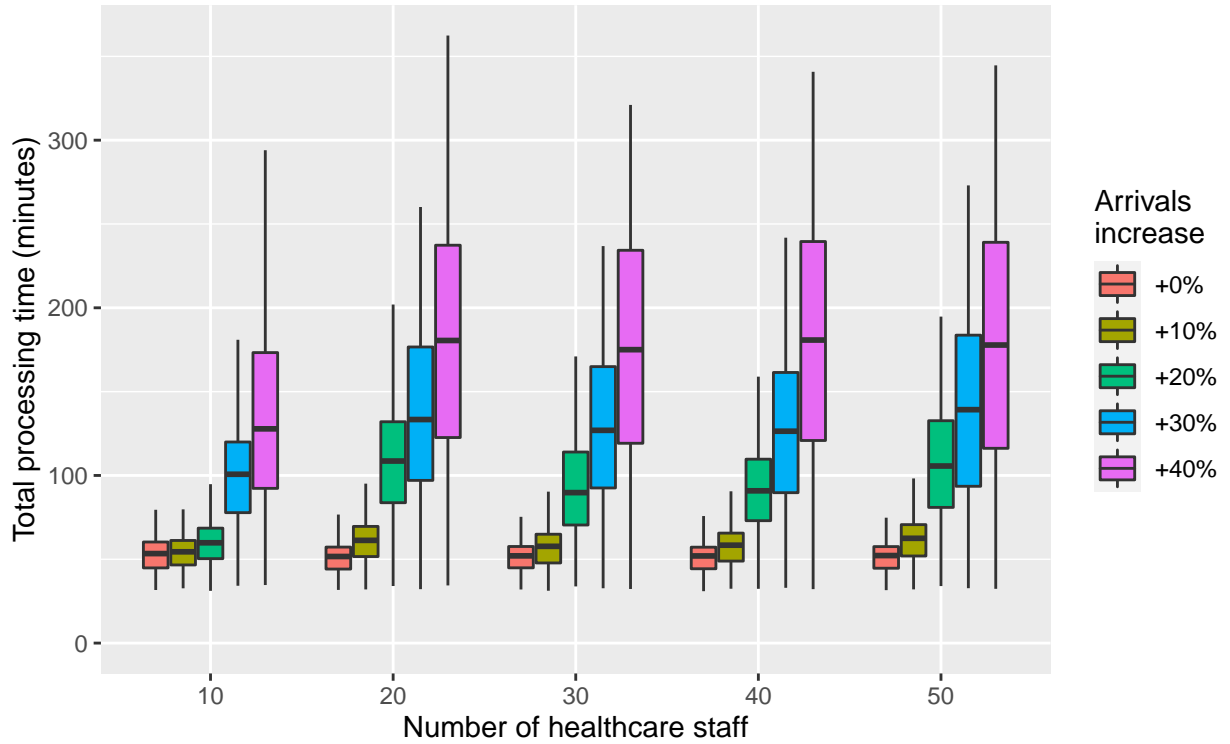


Figure 10: Increase in processing time with increased arrivals by site size