CT SB-181 Dashboard Prototype

Tom Shin

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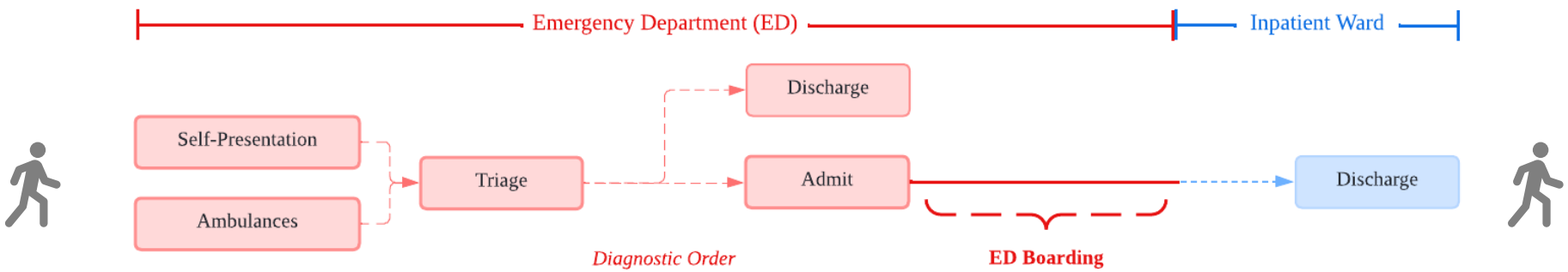
Yale SCHOOL OF MEDICINE

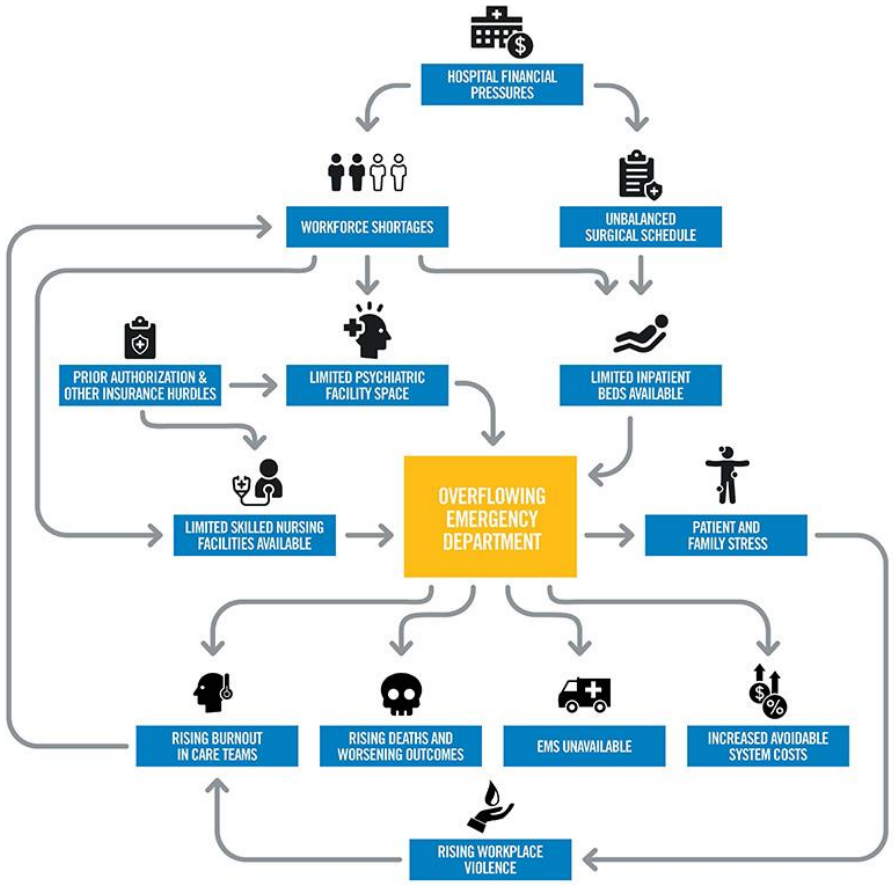
What is ED Boarding

Emergency department (ED) boarding refers to the waiting time for admitted patients in the ED until an inpatient bed is ready, acting as the primary cause of the overcrowding[1]



ED Arrival Patient Flow

Why Boarding Happens



The Systemic Boarding Crisis[2]

Why ED Boarding

The extraordinary nature of ED boarding affects all involved parties from patients to healthcare providers, highlighting the urgency of action

• Delayed Treatment	Delays in receiving necessary care, longer LOS, and increased medical complications[3]
• Substandard Care Locations	Patient evaluation in hallways due to lack of treatment spaces compromises privacy, confidentiality, and care quality[4]
• Increased Morbidity/Mortality	Higher in-hospital mortality, more frequent medication errors, missed care, and delirium[3, 5]
• Strain on ED Personnel	Lack of training for boarding patients, negatively impacting patient care and leading to increased burnout and stress[6]
• Increased Violence Against Staff	Heightened patient agitation, leading to increased violence against staff[7]
• Higher Costs/Lost Revenue	Significantly higher costs, with resource expenses per ED bed hour more than double those of non-critical care units[8-10]
• Decreased Patient Satisfaction	Lower patient satisfaction as patients often feel neglected due to high patient volumes and strained personnel[11]

Main consequences of ED boarding

Causes

A significant amount of literature has emerged regarding the crisis and the ill effects that go along with boarding

Input
Presentations with more urgent and complex care needs
Increase in presentations by the elderly
High volume of low-acuity presentations
Access to primary care
Limited access to diagnostic services in community
Throughput
ED nursing staff shortages
Presence of junior medical staff in ED
Delays in receiving test results and delayed disposition decisions
Output
Hospital occupancy
Inpatient bed shortages
Inefficient patient discharge planning

Main causes of ED overcrowding from literature[12-14]

The causal factors can be represented as input-throughput-output model

- Input: the volume of patients waiting to be seen
- Throughput: delays in assessing/treating patients in the ED
- Output: impediments to patients leaving the ED after treatment

Mitigations

A significant amount of literature has emerged regarding the crisis and the ill effects that go along with boarding

Input *Decrease Demand*
Extended GP opening hours
Decreasing ED use (increasing health literacy, access to cares)
Education campaigns, financial disincentives, redirection
Throughput / Output *Increase Capacity*
Increased ED staff
Increased ED bed
Acceleration of diagnostic pathways
Simplified admission process
Management / Operations
Early and weekend discharge
Real-time flow dashboard

Main solutions to ED overcrowding from literature[12-14]

Three general themes exist among the solutions:

- Increased resources: additional physical, personnel, and supporting resources
- Demand management: redistribute patients or encourage appropriate utilization
- Operations research: crowding measures and offline change management techniques

SB-181

Numerous entities, including ACEP, have collaborated to address this issue on a national level. Recently, Connecticut became the first state to enact such legislation by passing **SB-181**, which mandates hospital EDs to report boarding data to the state legislature from 1/1/2025 to 1/1/2029, annually[15]

The following **data** will be reported from the previous calendar year:

- Number of patients treated in the ED
- Number of ED patients admitted to the hospital
- Average time from initial presentation in the ED to hospital admission
- Percentage of admitted patients transferred to a bed outside the ED more than 4 hours after an admission order

Bringing attention to this issue can not only raise awareness and put pressure on hospitals to address it but also play a crucial role in promoting transparency. This, in turn, enhances public understanding of healthcare challenges, supporting informed decision-making and effective policy development.

The Initiative

Following the passage of SB-181, we plan to create a **publicly accessible webpage** that will present the key metrics through:

- **Interactive data visualizations** to enhance user experience and comprehension of complex data
- **Educational sections** to educate the public, patients, and healthcare providers on the causes, consequences, and potential solutions to boarding
- **Rigorous quality standards** following U.S. Department of Health and Human Services guidelines to ensure transparency, reliability, and usability of the website

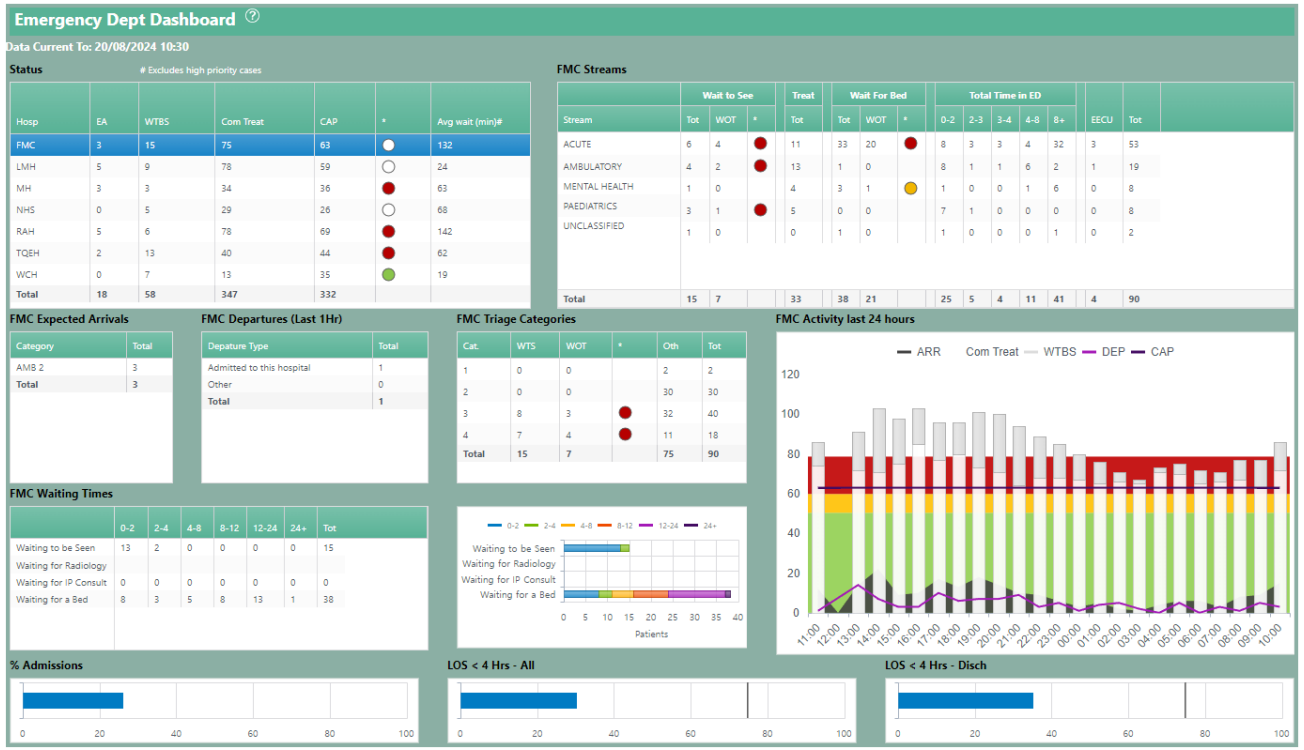
Considerations

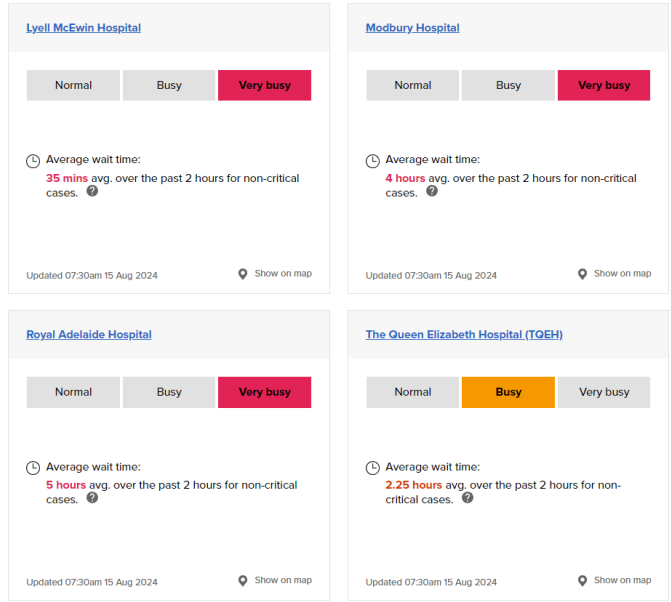
Though logistics will be refined in collaboration with the 31 ED facilities in Connecticut, the following key considerations will guide the process:

- **State Leadership** As the first state to implement this initiative, it's essential **to maintain standardization** in data and format, setting a precedent for other states and contributing to developing a universally accepted ED boarding measure[16]
- **Research Accessibility** Ensuring **easy access to data sources** and additional ED boarding measures will enhance the webpage's value for research purposes
- **Public Assurance** Including elements like regular update notices and clear maintenance indicators will reassure the public of **ongoing** efforts and care
- **Educational Content** Beyond covering the causes, consequences, and solutions to boarding, the educational section should include **information on appropriate ED visits and alternatives**, helping to reduce unnecessary ED visits and mitigate boarding issues

Example 1

Following is an active ED dashboard which could help web development process

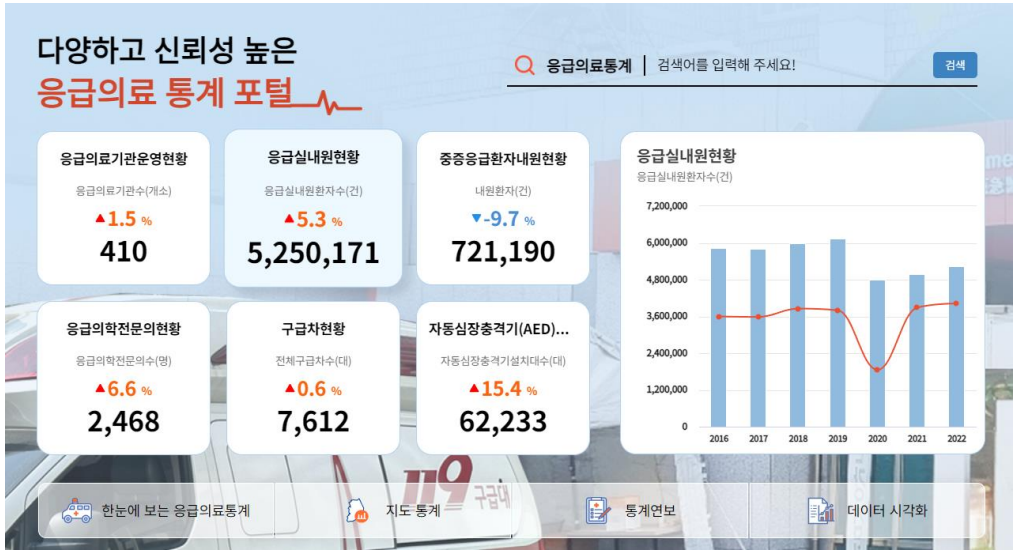


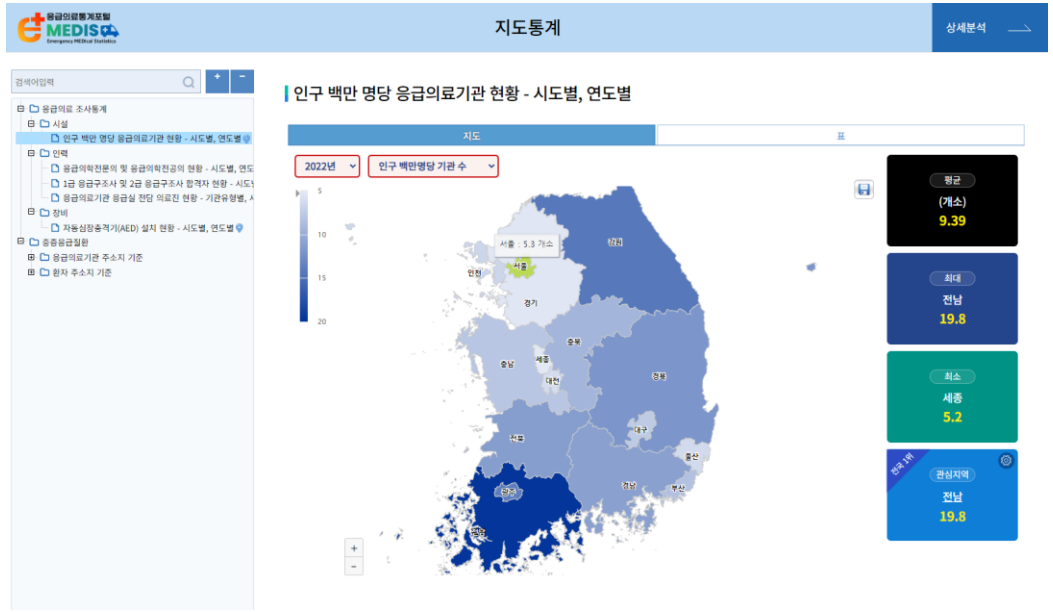


Government of South Australia ED Dashboard [Link]

Example 2

Following is an active ED dashboard which could help web development process (*translation is available on the next slide*)





Government of South Korea ED Dashboard [Link]

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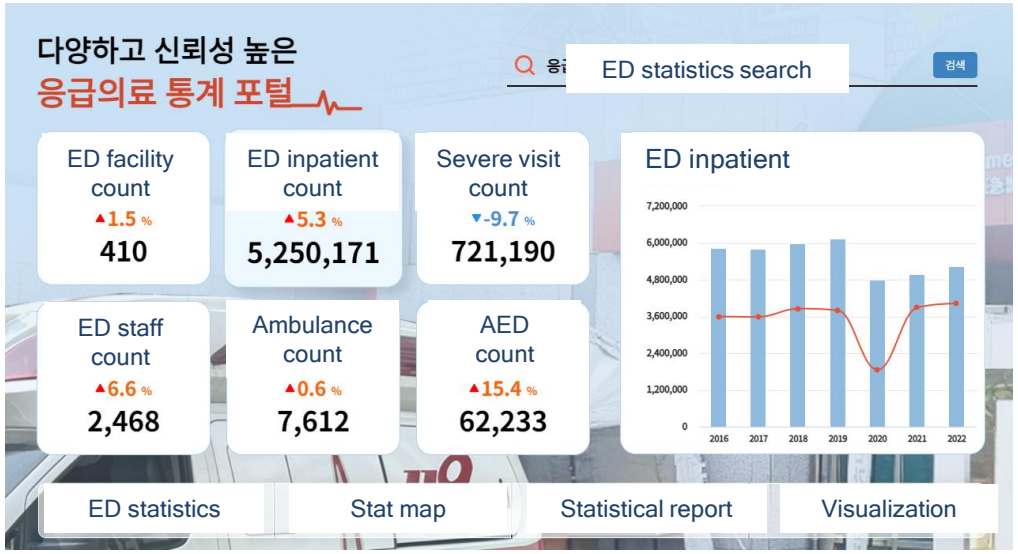

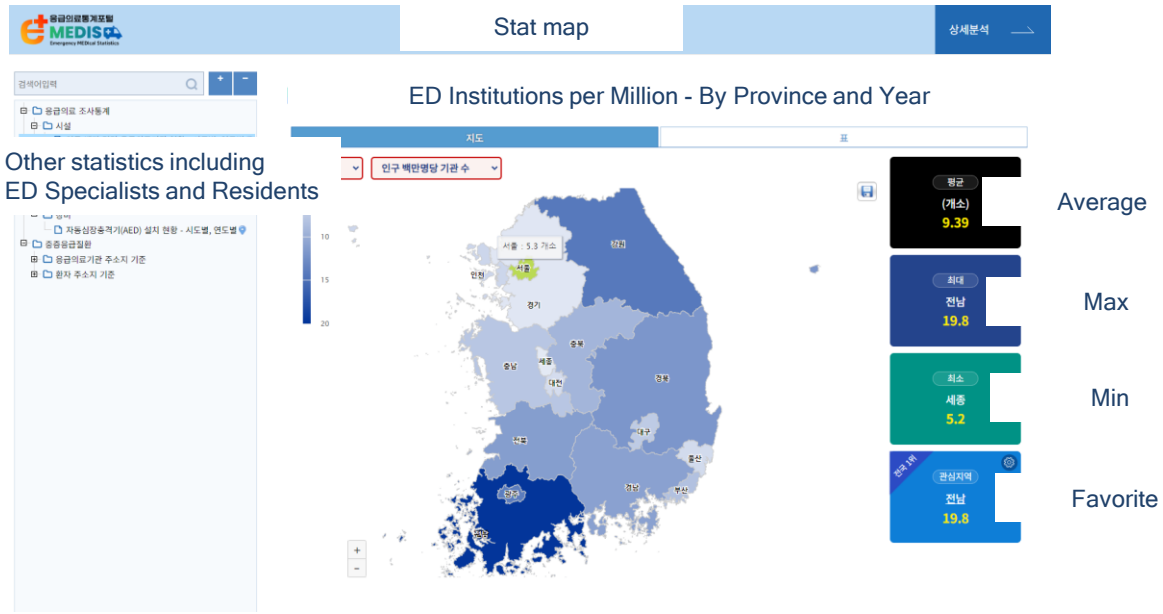

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Dashboard Prototype

• A prototype (Google Colab) has been developed using the Dash application with synthesized data representing 4 key metrics from 31 ED facilities in CT, ensuring interactive visualization despite undecided server and database hosting options (e.g., external link or embedding into the existing CCEP website)

• To maximize efficiency, the visualization format will be iteratively refined based on feedback, and components will be integrated into a single webpage with a cohesive layout, leveraging CSS for design consistency

• Given the periodic nature of data updates, lightweight storage solutions such as GitHub may be adopted initially, avoiding the complexity of relational database systems

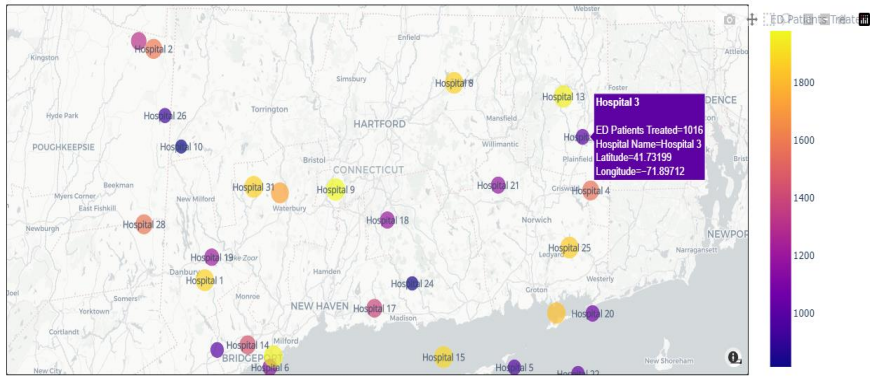
• To address potential challenges with server and hosting management, short-term or part-time consultation from experts in relevant fields is considered ideal to ensure smooth implementation

• For the **educational section**, a document-style webpage design—similar to ACEP's documentation on ED boarding and crowding—will be explored. Alternatively, a dashboard format with visually engaging diagrams and figures (like those included in this presentation) may be used, paired with a direct link to ACEP's resources for further context

Rough Overview

Total Overview

Total ED Patients Treated	Total ED Admissions	Avg Time to Admission	Transfers >4hrs After Admission Order
44,167	12,451	5.08 hrs	31.8%

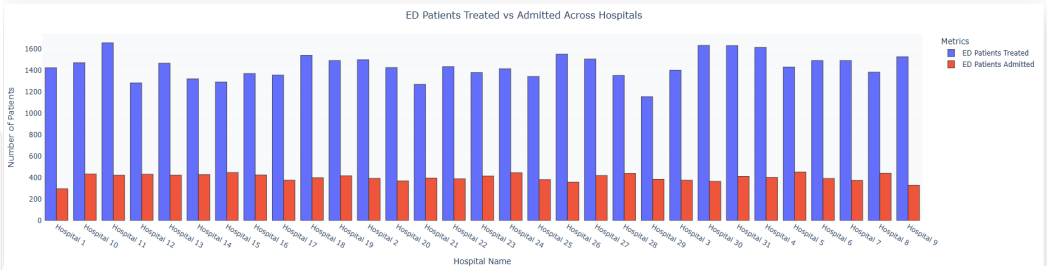


Hospital Name	Hospital 3
ED Patients Treated	1,016
Maximum Capacity	392
Available Resources	Orthopedics, Cardiology, Neurosurgery, Radiology

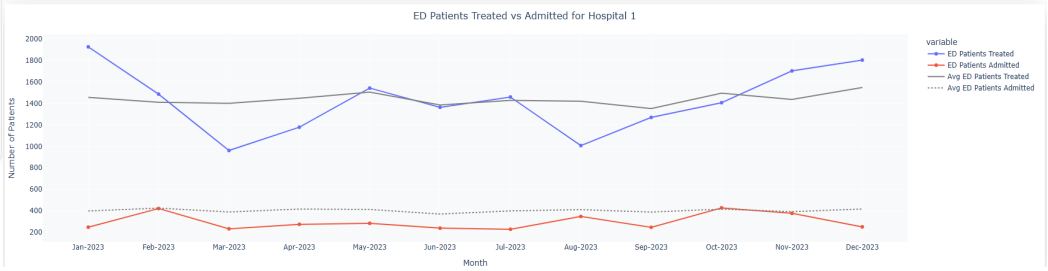
Month	ED Patients Treated	ED Patients Admitted	Avg Time to Admission (hrs)	% Admitted Patients >4hrs
January	808	488	5.43	28.9
February	846	325	5.39	16.4
March	1534	275	6.1	37.6
April	976	372	4.89	19.2
May	877	212	4.89	38.9
June	1374	552	3.58	46.9
July	1228	207	4.83	34.4
August	854	371	3.9	15.3
September	1738	461	3.67	23
October	1200	470	6.16	23.5
November	1022	224	6.04	26.4
December	918	535	6.13	44.7

Download Data

ED Patients Treated vs Admitted



Hospital 1



Select Month: January

Select Hospital A: Total Average

Select Hospital B (Comparison): Hospital 2

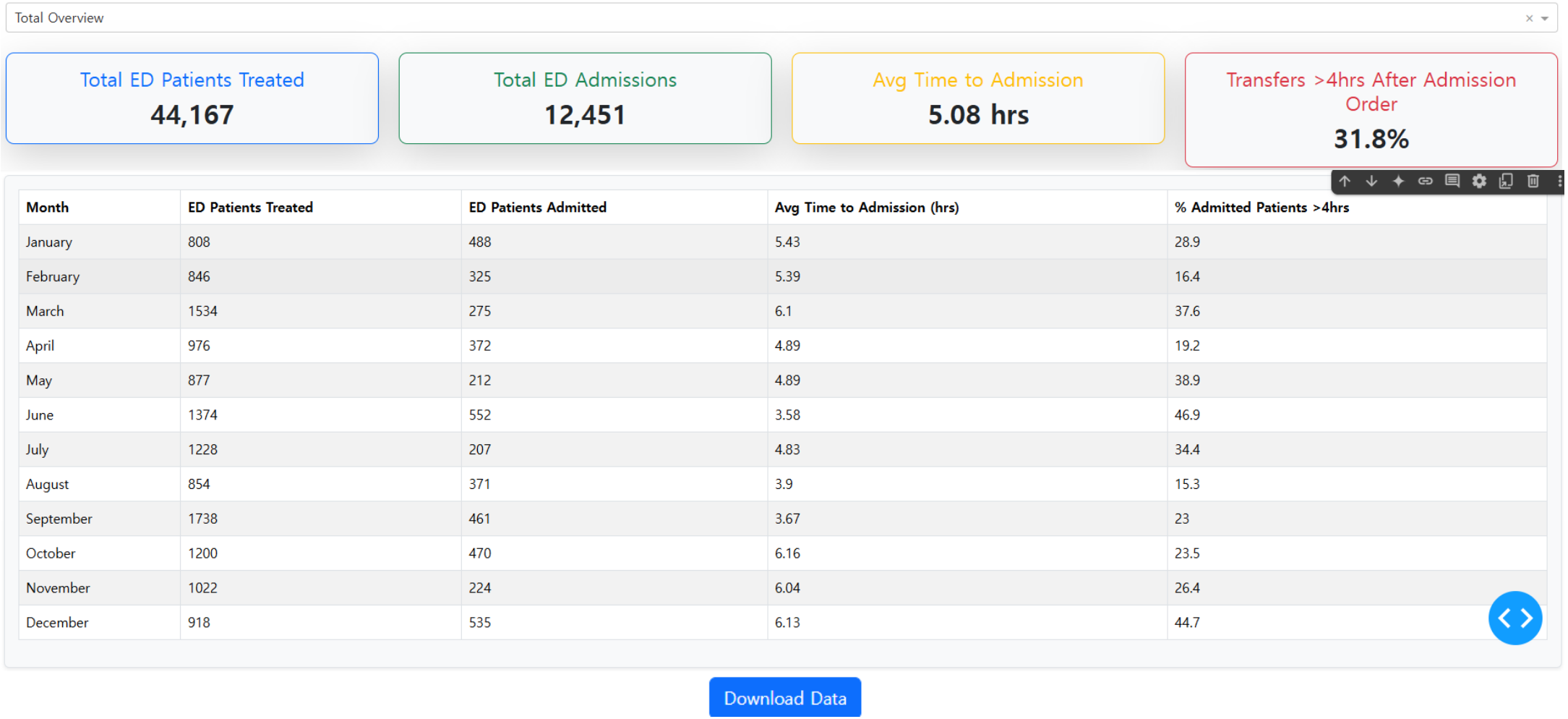
Hospital A Metrics

Hospital Name	Total Average
ED Patients Treated	1983 (avg: 1424.74)
Avg Time to Admission (hrs)	4.43 (avg: 5.33)
% Admitted Patients >4hrs	47.8 (avg: 28.80)
Capacity	420 (avg: 307.97)

Hospital B Metrics

Hospital Name	Hospital 2
ED Patients Treated	1408 (avg: 1591.00)
Avg Time to Admission (hrs)	4.69 (avg: 5.84)
% Admitted Patients >4hrs	49.1 (avg: 31.00)
Capacity	422 (avg: 212.00)

Component 1: Data Cards & Tables



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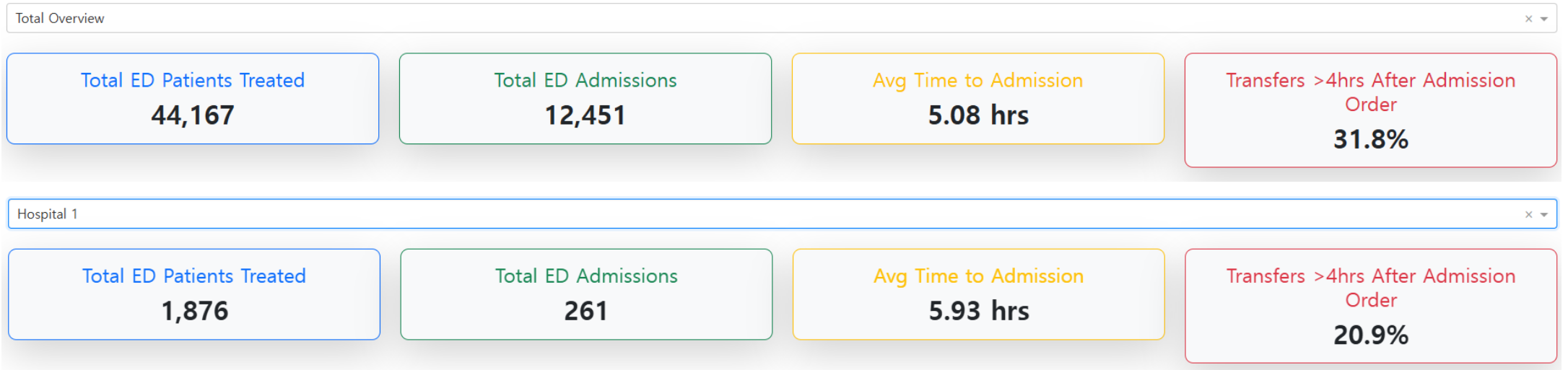
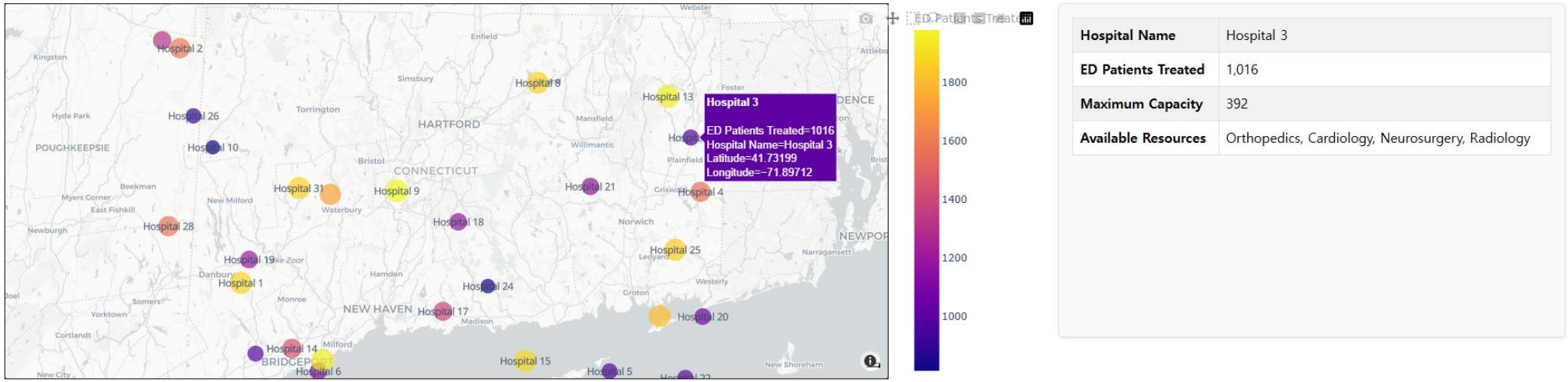


The four metrics for each ED facility, available via a drop-down list menu

Component 2: Scatter map



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Maximum Capacity	392
Available Resources	Orthopedics, Cardiology, Neurosurgery, Radiology

Each facility will be marked according to its exact location (currently randomly generated).
General information about the facility could also be included, in addition to the metrics

Component 3: Comp Tables

Select Month:

January

Select Hospital A:

Total Average

Select Hospital B (Comparison):

Hospital 2

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Select Month:

January

Select Hospital A:

Hospital 1

Select Hospital B (Comparison):

Hospital 2

Hospital A Metrics

Hospital Name	Hospital 1
ED Patients Treated	943 (avg: 1876.00)
Avg Time to Admission (hrs)	5.72 (avg: 4.80)
% Admitted Patients >4hrs	23.5 (avg: 18.70)
Capacity	157 (avg: 286.00)

Hospital B Metrics

Hospital Name	Hospital 2
ED Patients Treated	1408 (avg: 1591.00)
Avg Time to Admission (hrs)	4.69 (avg: 5.84)
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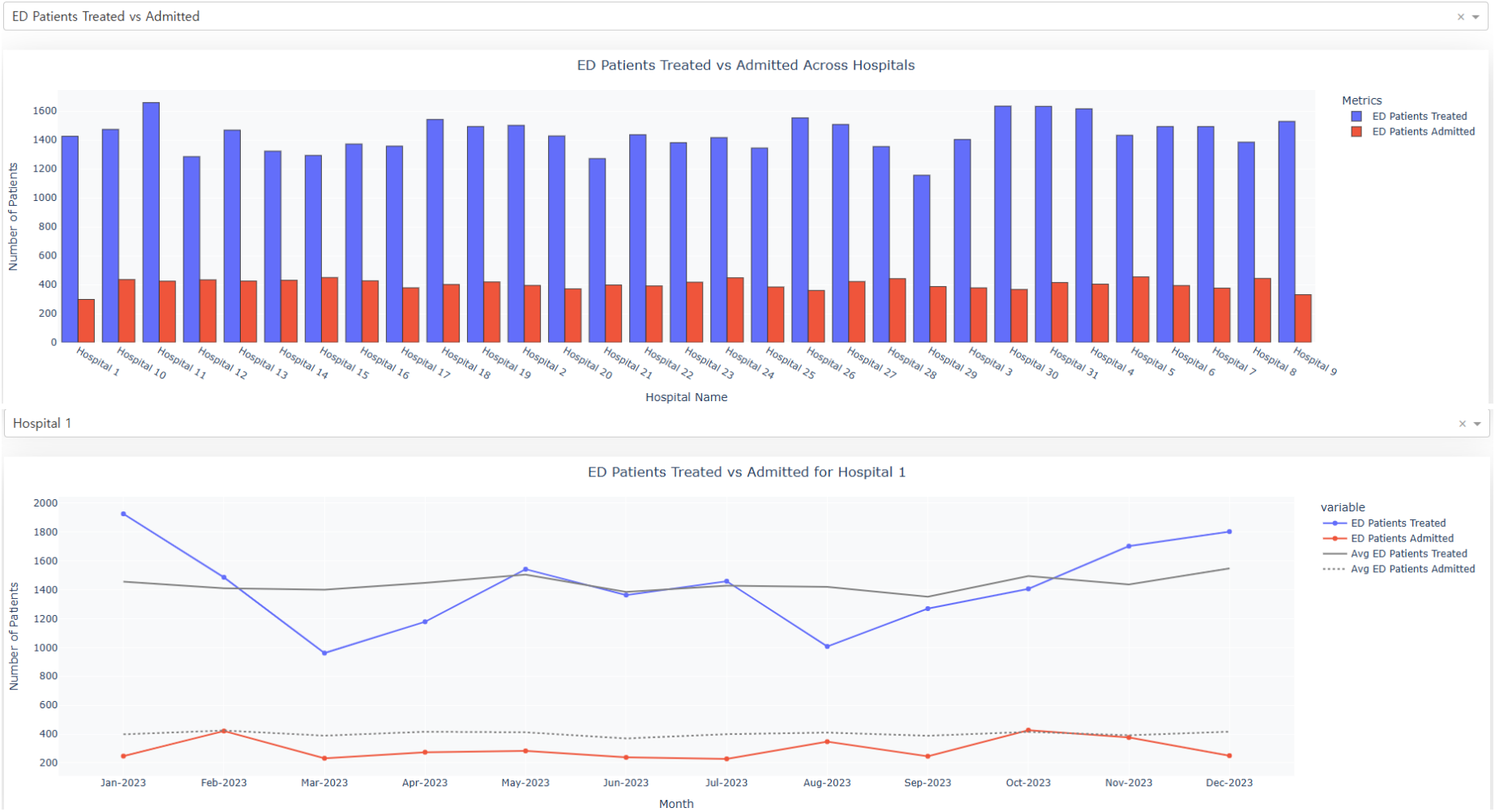
Capacity	422 (avg: 212.00)

The tables dynamically display key metrics for two selected hospitals, allowing users to compare their performance for a chosen month, with values highlighted relative to the annual averages

Component 4: Plots



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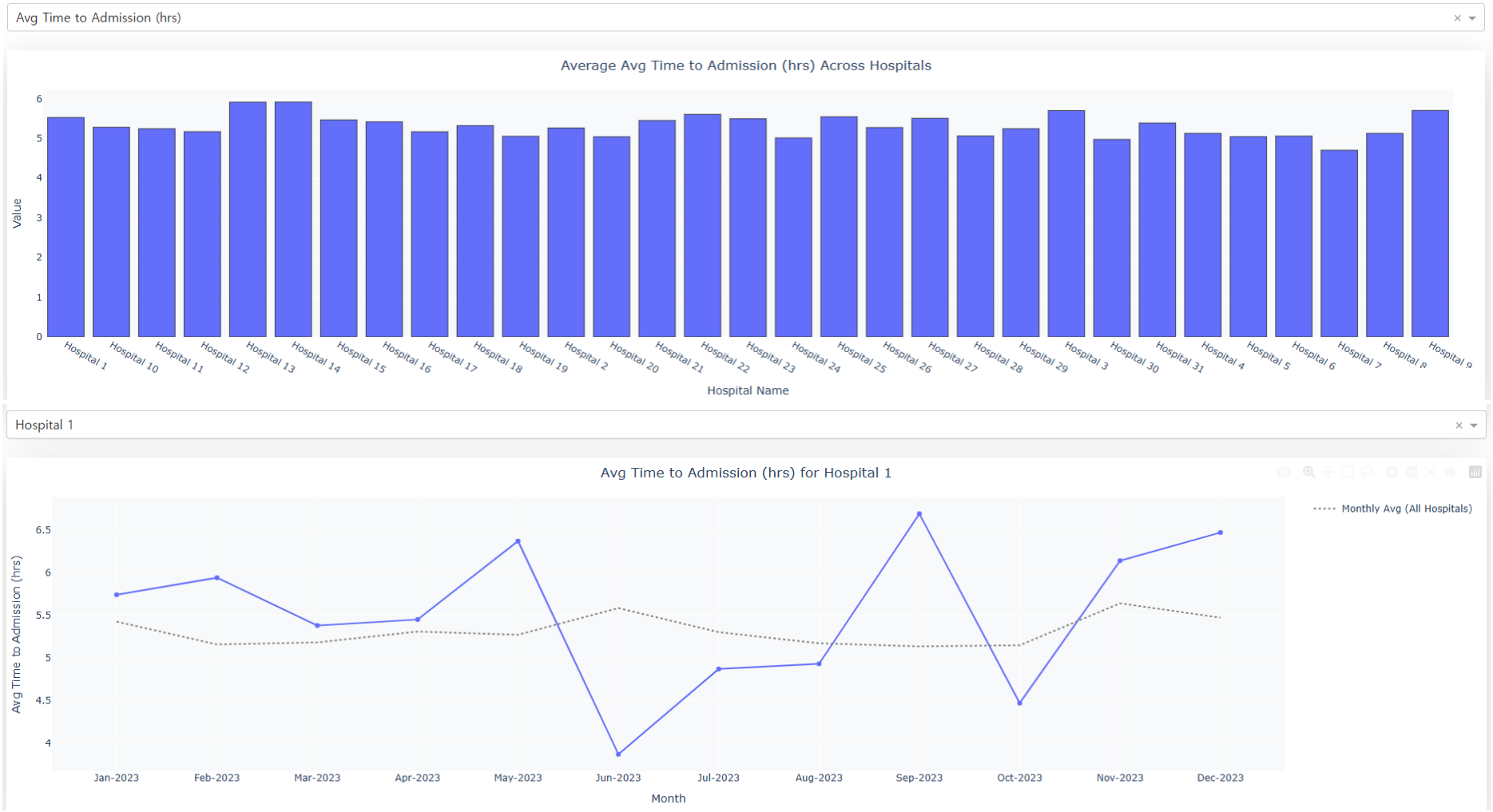

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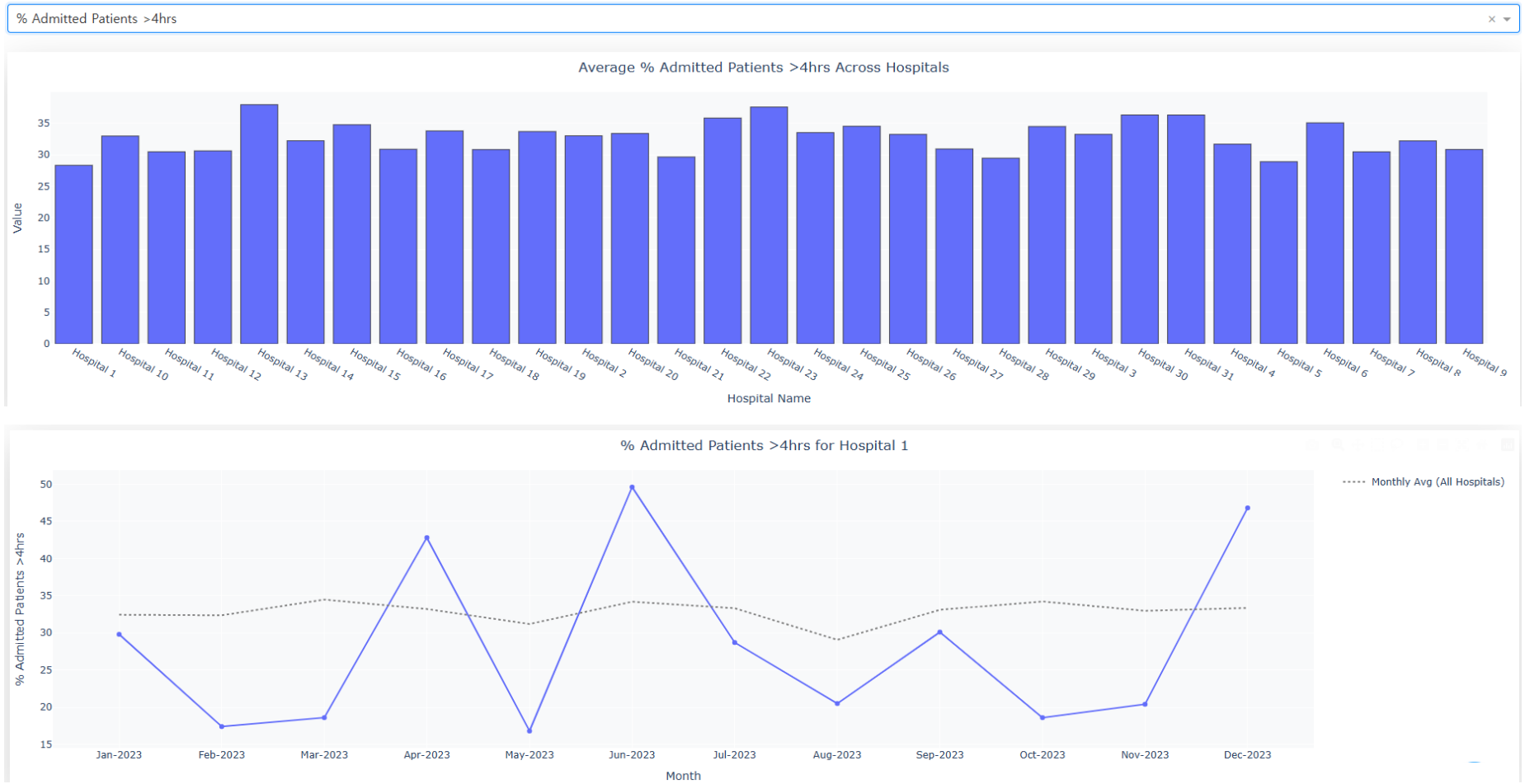

Useful Resources to consider

Unique Boarders																											
				Hour of Day																							Total
Year	Month	Day	Day of Week	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
		12	Saturday	7	8	10	14	14	14	14	14	17	17	19	18	18	18	18	18	20	17	15	16	17	18	22	24	16
		13	Sunday	27	26	29	30	31	31	31	30	32	32	32	32	30	29	29	28	30	27	28	29	31	30	26	25	29
		14	Monday	28	29	30	31	32	34	33	32	32	33	33	33	31	31	28	29	28	26	23	23	24	20	17	18	28
		15	Tuesday	21	20	19	22	22	22	22	27	28	28	26	25	22	21	19	18	16	13	11	11	14	14	13	8	19
		16	Wednesd	11	13	13	14	16	17	18	18	19	20	19	20	20	18	18	19	18	17	17	15	17	17	13	14	17
		17	Thursday	15	18	19	19	20	23	23	24	27	27	28	27	26	27	29	29	25	22	15	13	16	13	10	8	21
		18	Friday	8	10	9	10	9	8	7	8	8	10	10	11	11	12	14	14	16	17	18	17	17	19	18	18	12
		19	Saturday	21	21	22	22	23	25	26	26	26	26	27	27	27	27	30	29	26	25	24	22	22	19	20	21	24
	February	20	Sunday	21	21	23	24	25	27	28	28	28	29	27	25	24	26	24	23	25	25	27	25	27	27	30	31	26
		21	Monday	33	35	35	35	35	36	38	38	38	38	40	39	39	40	39	39	41	41	40	32	32	29	28	25	36
		22	Tuesday	26	26	28	28	29	30	32	33	34	34	34	35	36	37	40	38	36	33	30	25	26	25	25	20	31
		23	Wednesd	25	26	30	28	29	30	31	32	35	36	37	36	35	34	33	31	29	28	28	27	24	23	25	22	30
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		25	Friday	24	26	26	26	29	29	28	28	28	29	28	24	22	23	24	24	24	24	22	18	18	16	16	16	24
		26	Saturday	15	14	15	16	17	17	20	21	22	22	22	22	21	22	21	21	20	20	20	19	21	20	20	18	19
		27	Sunday	18	19	20	20	20	19	19	21	24	24	24	24	24	25	23	24	21	19	18	17	17	14	11	11	20
2023		28	Monday	10	11	12	13	14	16	16	16	15	14	15	15	15	16	16	15	14	15	19	19	20	20	20	15	15
		1	Tuesday	17	14	15	16	16	17	19	18	18	19	20	20	20	21	21	23	25	27	27	27	27	26	27	29	21
		2	Wednesd	28	27	26	29	30	30	30	31	32	33	32	32	32	29	28	27	26	29	29	27	26	23	21	19	28
		3	Thursday	18	15	16	16	17	16	16	16	17	17	17	16	17	17	17	21	23	22	21	21	23	21	22	17	18
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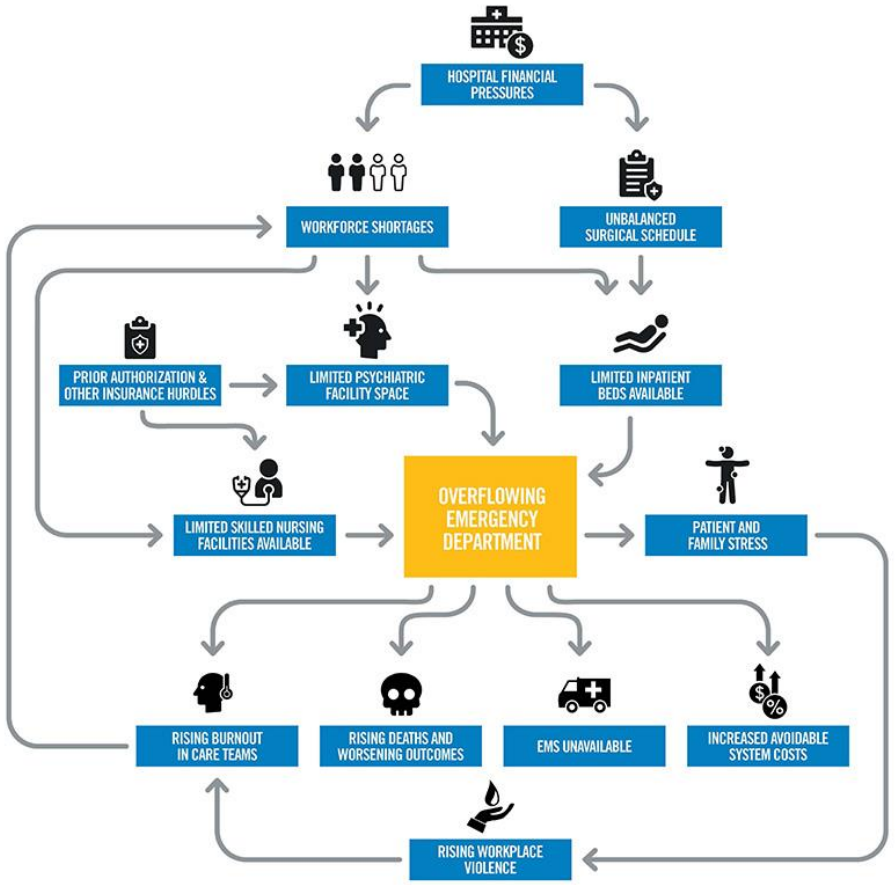
		5	Saturday	16	18	18	20	20	25	26	27	28	27	25	24	24	25	25	24	24	23	23	19	19	17	16	15	22
		6	Sunday	15	18	20	25	26	28	28	28	29	29	29	29	28	27	25	23	21	19	19	17	18	18	21	20	23
		7	Monday	14	15	17	20	24	24	26	28	29	28	29	29	27	28	28	28	29	29	29	24	23	22	20	20	25
	March	8	Tuesday	21	22	21	22	22	22	23	24	25	26	27	26	27	27	26	25	26	26	26	24	26	26	23	22	24
		9	Wednesd	25	27	27	27	32	31	31	33	34	35	36	37	37	37	38	34	29	25	25	23	23	27	26	31	30
		10	Thursday	29	29	29	29	33	33	34	34	35	35	34	33	32	29	30	28	24	24	24	24	25	22	22	19	29
		11	Friday	22	21	18	20	22	23	25	27	26	26	27	26	25	23	22	22	21	22	20	20	20	20	23	21	23
		12	Saturday	22	23	23	24	24	24	24	24	25	24	24	25	25	26	25	22	25	22	19	18	20	20	19	20	23
		13	Sunday	22	24	26	26	28	28	30	31	33	35	36	36	36	36	36	36	34	32	27	24	23	21	15	13	29
		14	Monday	14	16	16	19	21	23	26	27	29	28	30	31	32	32	33	33	32	28	30	29	29	28	25	26	27
		15	Tuesday	25	27	28	29	30	33	33	34	34	35	32	30	28	26	28	25	25	24	24	21	21	19	20	20	27
	Average			20	21	22	23	24	25	25	26	27	27	27	27	26	27	26	26	25	24	23	21	22	21	20	20	24

Mock-up of internal dashboard displaying boarding heatmap by day and hour[17]
(https://www.acepnow.com/article/an-actionable-visual-dashboard-approach-to-boarding/)

Useful Resources to consider



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1. American College of Emergency Physicians. (2018). *Definition of boarded patient*. American College of Emergency Physicians. https://www.acep.org/globalassets/new-pdfs/policy-statements/definition-of-boarded-patient.pdf
2. American College of Emergency Physicians. (n.d.). *Emergency department boarding and crowding*. Retrieved January 15, 2025, from https://www.acep.org/administration/crowding--boarding
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