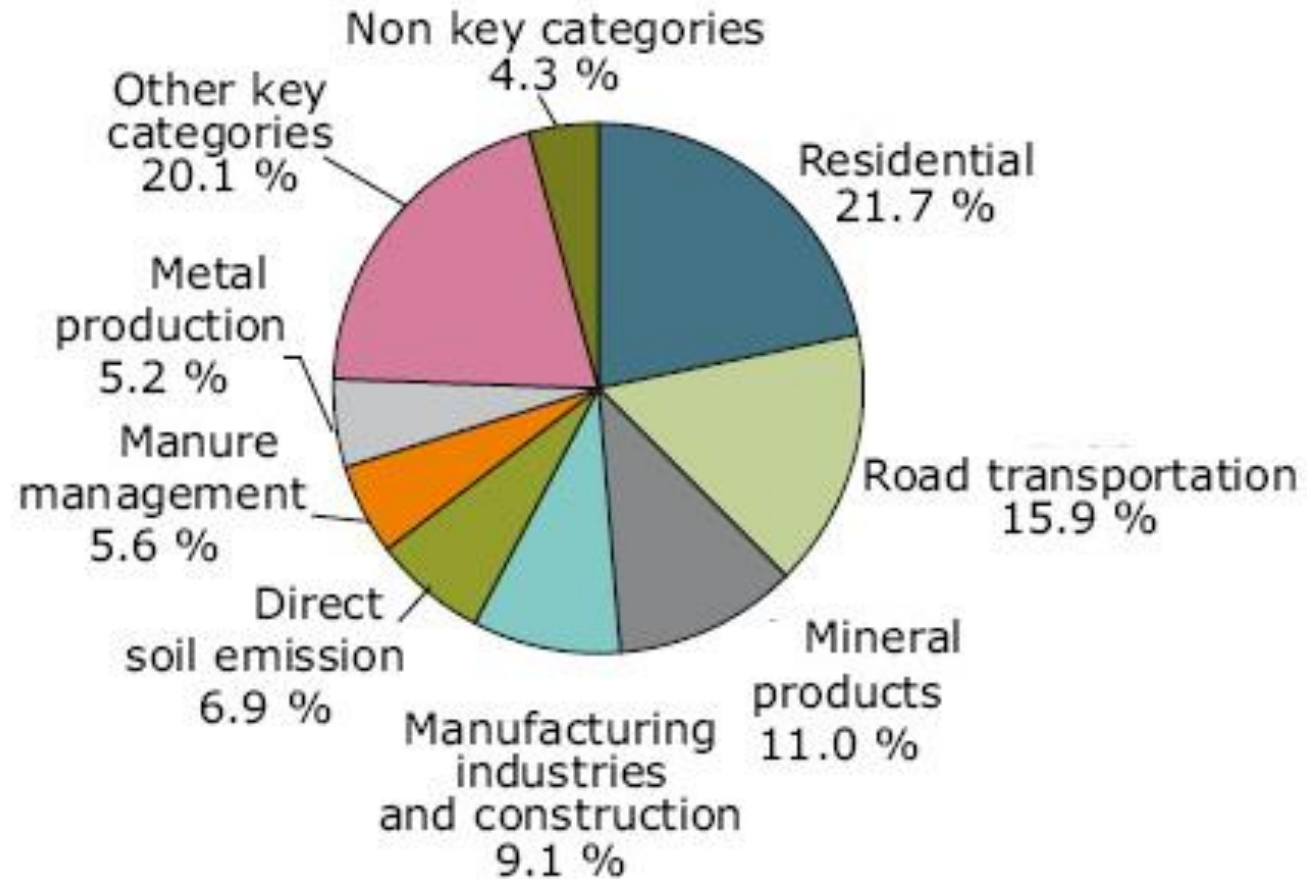# Research Objectives

▶ Herrera-Molina et al. (2021)[1] investigated whether dust exposures in El Paso (generally acute, short-term exposures from nearby source areas) were associated with significant increases in hospitalizations on the day of the exposure and up to seven days afterward. Genitourinary diseases, valley fever, respiratory diseases etc., were found to be positively associated with dust exposure.

▶ The goal of the project is to explore how the hospital admission rate for the genitourinary system is influenced by dust storm events, max PM_{10}, and max windspeed for the population of El Paso, Texas.

▶ We also aim to investigate which individual-level factors (age, sex, income, education) and other variables (temperature, humidity, season, weekend, holiday) are associated with hospital admissions for genitourinary system diseases.

What is Genitourinary System ?

▶ The genitourinary system is a collection of body organs that have either urinary or reproductive functions. Some key organs are the ureters, urethra, bladder, kidney, prostrates, and other genital organs[2].

▶ Diseases associated with the genitourinary system are responsible for about 15% of extrapulmonary cases such as tuberculosis and can affect the kidneys or genital organs[3].

Sources Of PM$_{10}$

Non key categories 4.3 %
Other key categories 20.1 %
Metal production 5.2 %
Manure management 5.6 %
Direct soil emission 6.9 %
Manufacturing industries and construction 9.1 %
Mineral products 11.0 %
Road transportation 15.9 %
Residential 21.7 %

Source: https://www.researchgate.net/figure/EU-27-emission-sources-of-PM10-2006-EEA-2008_fig10_221909194

Source: https://www.devic-earth.com/blog/what-are-pm2-5-and-pm10-how-they-affect-you-and-solutions
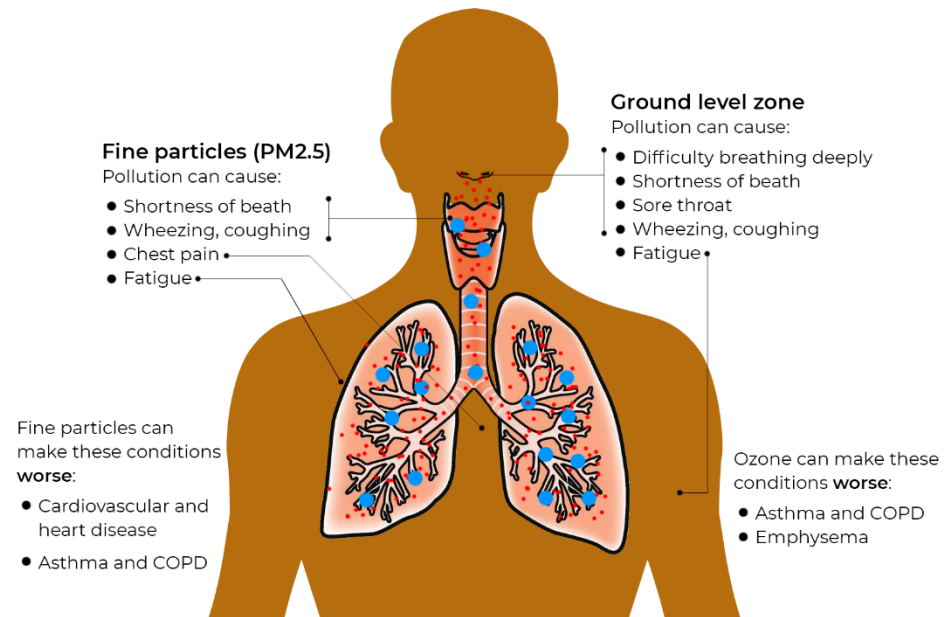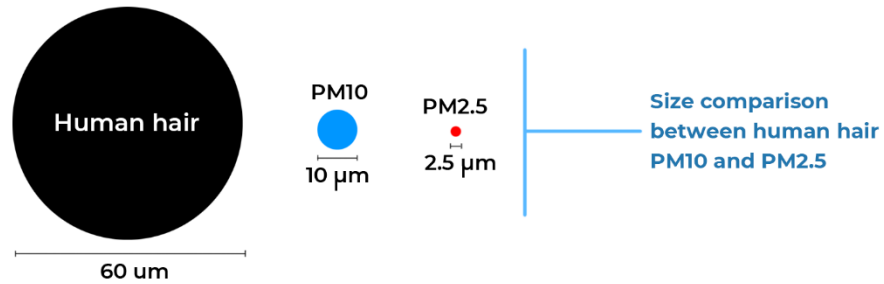
Health Effects of PM_{10}
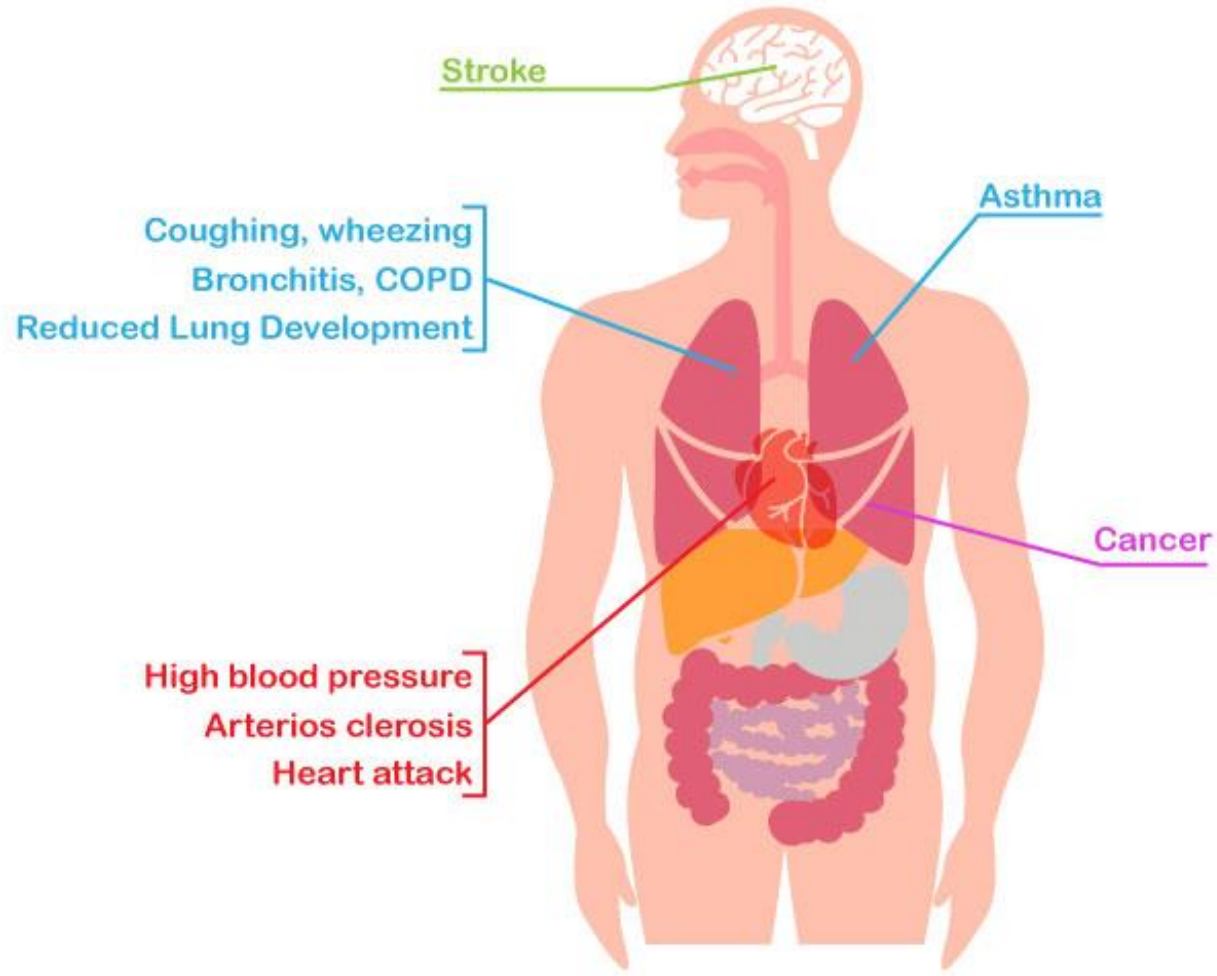
Data Description

- The hospital admission data were collected for a five-year period, 2010-2014, for El Paso County from the Texas Department of State Health Services (TDSHS), Center for Health Statistics, Austin, Texas, USA.

- 299,804 hospitalization registrations were recorded.
    - Female (58%) and male (42%).
    - We were interested in age 1 and above.
    - The age was categorized into three groups; 1-17 (7.4%), 18-64(45.8%), and 65 and above(31.3%).
    - Median Hispanic income of patient's census block group (average $36,406)
    - Education level of patient's census block group

Data Description

▶ 8,772 (2.93%) were admitted for the genitourinary related diseases. Below is the frequency of each ICD-9 code used for the Genitourinary System:

- 5849 - Acute kidney failure (2450, 27.9%)

- 5990 - Urinary tract infection (4362, 49.7%)

- 6262 - Excessive and frequent menstruation (761, 8.7%)

- 59080 -Pyelonephritis (1207, 13.7%)

▶ 16.33% of genitourinary system-related hospitalizations occurred on dust storm days.

▶ Max PM10 (95.36 ± 190.14 µg/m³)

▶ Max windspeed (12.40 ± 4.96 m/s)

Variables of interest

Primary factors
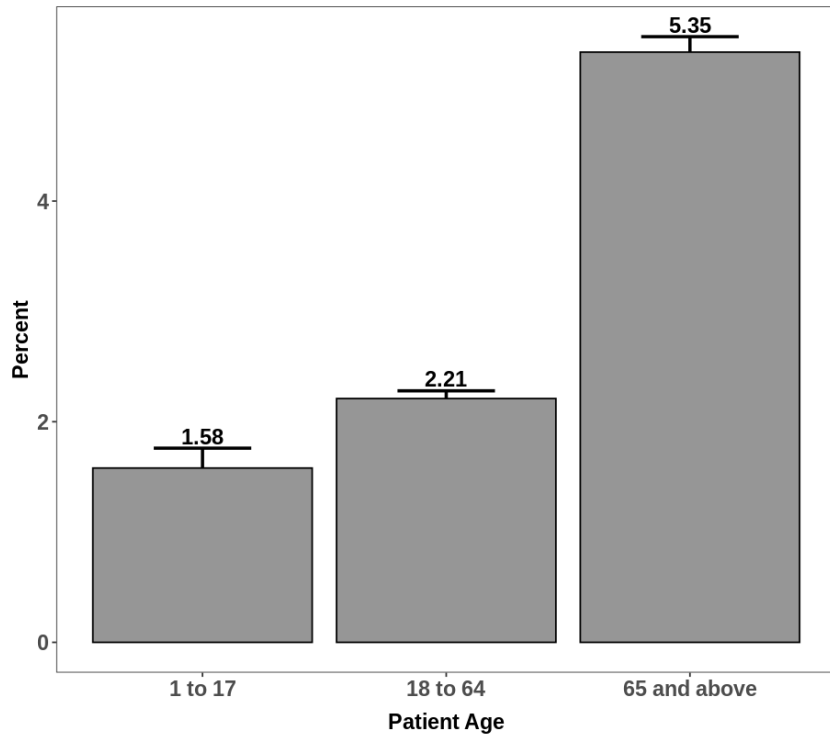
- Dust storm event
- Maximum PM10
- Maximum Windspeed

Weather Variables

- Avg. Relative humidity
- Avg Temperature
- Season

Demographic/Other variables
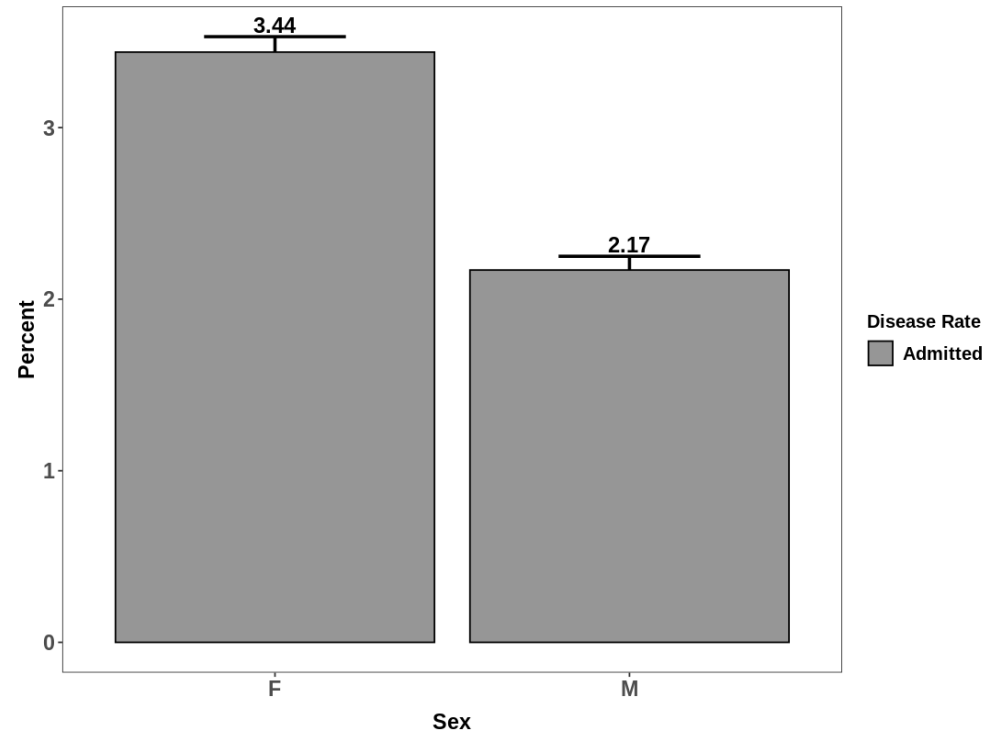
- Age
- Sex
- Income
- Education
- Holiday
- Weekend or weekday

Admittance for Genitourinary Disease by Age and Sex

P-value < 0.001

P-value < 0.001

Association between Hospital Admission and DSE
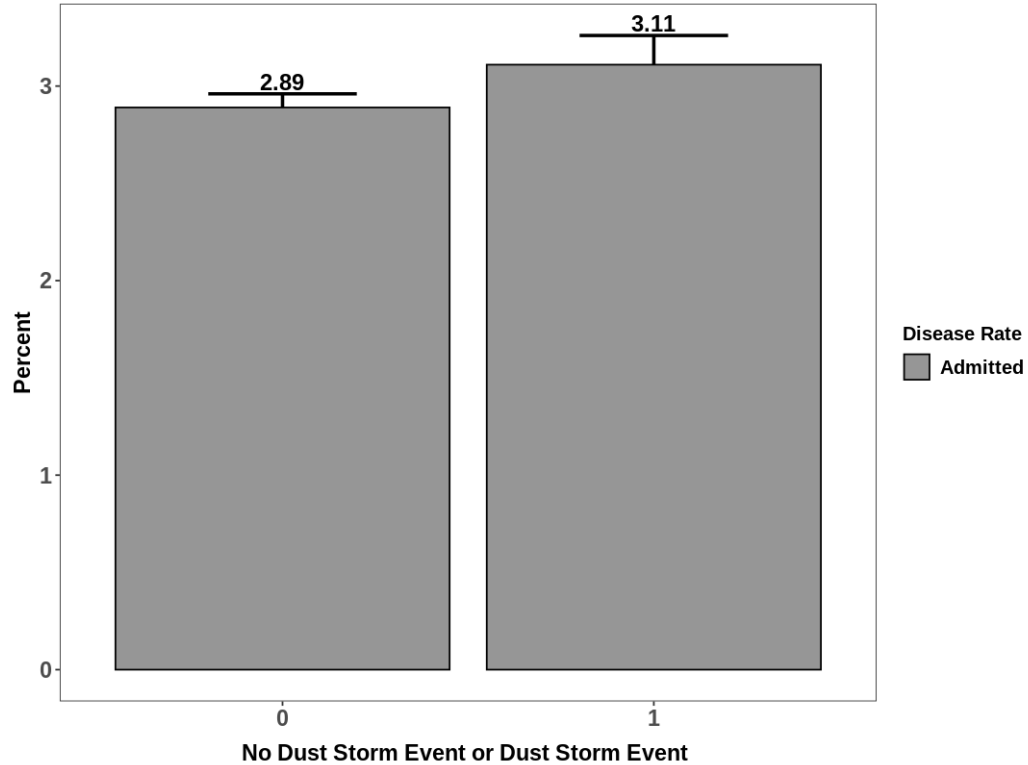
	Not Admitted	Admitted
No Dust Storm Event	246,314 (97.11%)	7,339 (2.89%)
Dust Storm Event	44,718 (96.89%)	1,433 (3.11%)

P-value=0.014

Mean difference in maximum windspeed for admitted and not admitted
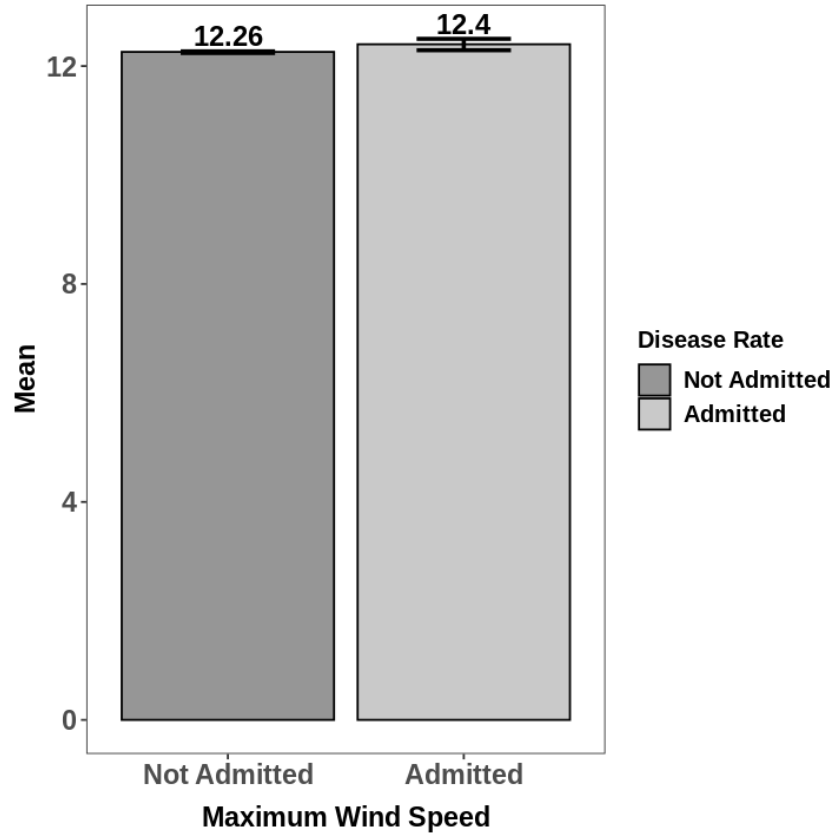
	Not Admitted	Admitted
Max Windspeed (mean ± sd, m/s)	12.26 ± 5.02	12.40 ± 4.96

P-value < 0.001

Difference in mean for admitted and unadmitted with maximum PM10
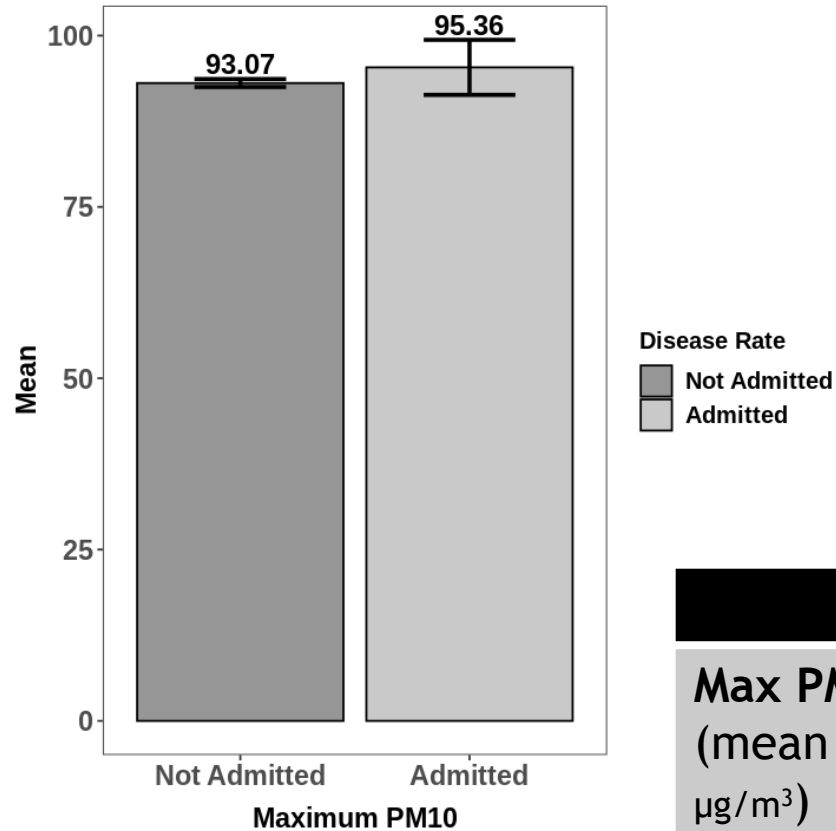
P-value = 0.268

	Not Admitted	Admitted
Max PM10 (mean ± sd, µg/m³)	93.07 ± 159.5776	95.36 ± 190.1412

Statistical Model

- The logistic regression model was used to predict the binary outcome; admitted and not admitted by analyzing the relationship between the independent variables.

- Variables are selected using the Akaike Information Criterion (AIC).

Adjusted Model: $\log(p/(1 - p)) = \beta_0 + \beta_1(\text{Season hot or cold}) + \beta_2(\text{Weekday or Weekend}) + \beta_3(\text{Average Outdoor Temperature}) + \beta_4(\text{Maximum Windspeed}) + \beta_5(\text{Sex}) + \beta_6(\text{Patient's age categorical}) + \beta_7(\text{Holiday})$

Univariate Logistic Odds Ratio

Variable	Levels	Odds Ratio	2.5%	97.50%	P-value
Age	1 - 17 (Reference)	1	-	-	-
	18 to 64	1.402	1.247	1.577	<.001
	65 and above	3.511	3.128	3.942	<.001
Sex	Female (Reference)	1	-	-	-
	Male	0.621	0.592	0.651	<.001

Variable	Levels	Odds Ratio	2.5%	97.50%	P-value
DSE or not	No (Reference)	1	-	-	-
	Yes	1.076	1.016	1.139	**0.013**

Variable	Levels	Odds Ratio	2.5%	97.50%	P-value
Maximum wind speed			1.005	1.001	1.009	**0.010**
Maximum PM10			1.004	1.004	1.004	0.192

Univariate Logistic Odds Ratio

Variable	Levels	Odds Ratio	2.5%	97.50%	P-value
Season	Hot (Reference)	1	-	-	-
	Cold	0.893	0.855	0.933	**<.001**
Weekend or weekday	False (Reference)	1	-	-	-
	True	1.192	1.133	1.255	**<.001**
DSE week 7 days or not	No (Reference)	1	-	-	-
	Yes	1.046	1.002	1.092	**0.047**
Average outdoor temperature		1.006	1.004	1.008	**<.001**
Average relative humidity		9.533	9.52	9.546	**0.002**

Adjusted Model Result

Variable	Levels	Odds Ratio	2.5 % CI	97.5 % CI	P-value
Season	Hot (Reference)	1	-	-	-
	Cold	1.091	1.015	1.174	**0.019**
Weekday	Weekday (Reference)	1	-	-	-
	Weekend	1.18	1.119	1.245	**< .001**
Average Temperature		1.008	1.006	1.01	**< .001**
Max Windspeed		1.005	1	1.009	**0.036**
Sex	Female (Reference)	1	-	-	-
	Male	0.63	0.6	0.661	**< .001**
Age	1 - 17 (Reference)	1	-	-	-
	18 to 64	1.336	1.188	1.508	**< .001**
	65 and above	3.441	3.066	3.877	**< .001**
Holiday	No (Reference)	1	-	-	-
	Yes	1.104	0.966	1.255	0.138

Summary

▶ The results suggest the **age of the patient** is a significant factor to consider for being hospitalized for the genitourinary system. The older group from 65 and above were more hospitalized for the disease than patients in the age category 1-17.

▶ The odds of a **male** getting admitted compared to a female reduces by 37%, keeping all other variables constant. Hence females got more admitted to the hospital for the disease.

▶ The odds of getting admitted on **weekends** are 18% higher compared to weekdays.

▶ The results also show that **windspeed**, **average outdoor temperature**, and **season** are the only significant weather variables.

▶ PM10 was not significant when tested in univariate and multivariate logistic regression models.

References

1. Herrera-Molina, E., T.E. Gill, G. Ibarra-Mejia, S. Jeon. (2021). Associations between Dust Exposure and Hospitalizations in El Paso, Texas, USA. Atmosphere. 12(11):1413.

2. Lanza, R., Langer, R., Vacanti, J. P., & Atala, A. (Eds.). (2020). *Principles of tissue engineering*. Academic press.

3. Langemeier, J. (2007). Tuberculosis of the genitourinary system. *Urol Nurs, 27*(4), 279-284.

THANK YOU

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Research Interests

- Ergonomic risk assessment
  - Work-related musculoskeletal disorders:
  - Tendinopathies (upper extremity)
  - Work-related fatigue
  - Workplace safety and hygiene
- Environmental health risk assessment
  - Air/water pollution
  - Health outcomes associated with heat and dust/dust storm event exposures.
  - Valley fever
  - Renal cancer and CKD

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