# Links

GitHub repository: <https://github.com/dkats/BMI-706-Rats/tree/main>

Streamlit App: <https://bmi-706-rats.streamlit.app/>

# Dataset and Tasks

## Identification of the Dataset

National Health and Nutrition Examination Survey (NHANES): https://www.cdc.gov/nchs/nhanes/index.htm

## Summary of Variables, Data Types, and Key Statistics

We will be using the NHANES dataset to create a pediatric blood pressure visualization tool that will help clinicians and patient families identify high blood pressure in children and adolescents. Normal pediatric blood pressure ranges vary based on age, sex, and height, so we will be using these variables in addition to systolic and diastolic blood pressure values. We will also incorporate 50th, 90th, 95th, and 99th percentiles of blood pressure by sex, age, and height to identify normal and abnormal blood pressure values per individual. Overall, this visualization will use 9 different variables (systolic blood pressure, diastolic blood pressure, age, sex, height, and the 4 different percentiles).

## What Kind of Information Can Be Derived Through Exploratory Visualization Analysis

The visualization will help clinicians determine normal and abnormal pediatric blood pressures and the degree of clinical significance to help with medical decision making. Clinicians will be able to filter the visualization based on age, sex, and height to get a global understanding of normal/abnormal blood pressure ranges, as well as view individual patient results. The visualization of the individual results will also be geared towards patients/caregivers to help in better understanding their blood pressures to empower more ownership of their health.

## Target Audience for the Visualization

Clinicians and patients

## List of Visualization Tasks

* Define “normal” ranges based on age, sex, and height
* Define clinically significant abnormal values based on percentiles
* Design a visualization of an individual’s blood pressure that indicates whether it is normal/abnormal
* Design a global visualization of normal/abnormal blood pressures

## References

1. NHANES - National Health and Nutrition Examination Survey Homepage. Published January 29, 2024. Accessed February 14, 2024. https://www.cdc.gov/nchs/nhanes/index.htm

2. National High Blood Pressure Education Program Working Group on High Blood Pressure in Children and Adolescents. The Fourth Report on the Diagnosis, Evaluation, and Treatment of High Blood Pressure in Children and Adolescents. *Pediatrics*. 2004;114(Supplement\_2):555-576. doi:10.1542/peds.114.S2.555

3. “Ai Voice Generator & Text to Speech.” *ElevenLabs*, elevenlabs.io/. Accessed 6 Mar. 2024.

# Steps

## Downloading and Processing NHANES

nhanes.ipynb

1. Download all NHANES XPT files for body measures, blood pressures, and demographics
2. Using the xport package, import the XPTs and only keep the relevant columns
3. Drop rows with incomplete data
4. Merge the data frames together by ID number (SEQN)
5. Recalculate age by dividing age in months (RIDAGEMN) by 12 and overwrite RIDAGEYR
6. Write the cleaned data to a csv

MR\_viz.py (lines 20–79)

1. Load the data generated by nhanes.ipynb
2. Filter out data patients who are older than 13 years (i.e., those who follow adult guidelines)
3. Convert the imported data into a new long-format data frame
4. Load tables of blood pressure percentiles (separate files for sex and systolic vs. diastolic blood pressures)
5. Calculate percentiles for all blood pressures
   1. Find the 50th and 95th percentile blood pressures for the patient’s rounded age, closest height percentile, and sex
      1. Find the right percentile reference table
      2. Find the blood pressure table height that is closest to the current patient’s (blood pressure percentiles are a function of height percentiles)
   2. Assuming a normal distribution, use the 50th and 95th percentiles to calculate the patient’s blood pressure percentile
   3. Categorize the blood pressure as ‘normal’ (≤90th percentile), ‘elevated’ (90th–95th percentile), or ‘hypertension’ (>95th percentile)

# Design Sketches

A screenshot of a computer

Description automatically generated

A screenshot of a computer

Description automatically generated

# Demo

A screenshot of a medical report

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4. Follow the recommendations based on the blood pressure classification

1. Choose an NHANES patient

3. Hover over a data point for more information

2. View their data on the plot

A screenshot of a video chat

Description automatically generated

2. View the data on the plot

1. Enter data

3. Hover over a data point for more information

4. Follow the recommendations based on the blood pressure classification

# Future Directions

* Plot multiple points per patient to see trends over time
* Build in FHIR support to allow safe integration of clinical data
* Extend chart to allow simultaneous viewing of pediatric and adult ranges/guidelines together, despite them using different units/parameters

# Team Member Contributions

Mondira

* Drafted Dataset and Tasks
* Edited Sketches
* Wrote code for visualizing the blood pressure data
* Wrote the script for the video

Dan

* Edited Dataset and Tasks
* Drafted Sketches
* Wrote code for importing and processing NHANES
* Merged the visualization and NHANES import code