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Learning from Two Decades of Blood Pressure Data: Demography-Specific Patterns Across 75 Million Patient Encounters

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Cuff-Based Blood Pressure Measurement Technologies

Hypertension is a global health concern with an increasing prevalence, underscoring the need for effective monitoring and analysis of blood pressure (BP) dynamics.



Bias in Blood Pressure Measurement Methods

The potential source of bias in BP measurement devices can be categorized in three groups as follows:

1.Measurement devices

2.Acquisition session

3.Subject-specific biases

Demographic features
Subject-wise factors
Individual-wise medical conditions
Eating, drinking, and smoking
Circadian rhythm

Aim of This Project

In this study, we investigate how various **demographic factors**, such as biological sex, age, and race, impact BP values using a large dataset collected at Emory University Hospital.



Data Pre-Processing

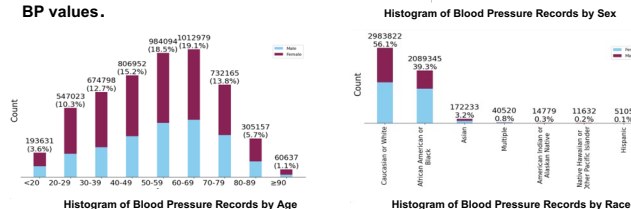
The preprocessing of the BP data involved several stages, including the removal of missing and duplicated values and ensuring all records had valid demographic features. The raw BP data includes 94,958,936 records. Below is a summary of the preprocessing steps:

Pre-processing steps	Number of records
Removing records with missing BP values	79,413,052
Removing duplicated BP records	78,401,036
Keeping records with SBP > DBP	78,360,983
Keeping records with certain range of BPs	78,336,377
Merging demographic features with BP data	75,636,128
Investigating age values	75,634,476
Investigating gender feature	75,634,206
Investigating race/ethnicity feature	71,859,435
Removing BPs with multiples of 10	69,802,762

Population Demographics

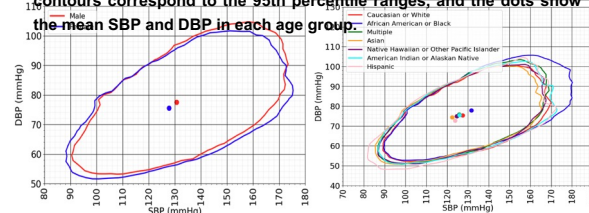
We grouped the pre-processed data based on the median of BP measurements of patients at a given age to ensure a fair analysis. This summarized the BP data into 5,317,436 median

BP values.



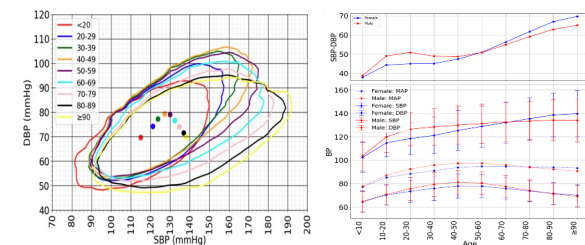
Data Analysis

Figures show the BP distribution of different groups. In each figure, the contours correspond to the 95th percentile ranges, and the dots show the mean SBP and DBP in each age group.



Blood Pressure Distribution Based on Sex

Blood Pressure Distribution Based on Race



Blood Pressure Distribution Based on Age

Blood Pressure Variations with Age

Conclusion

The study highlighted:

1. Significance of considering demographic factors in BP analysis
2. Variability of BP across sex, age, and race/ethnicity

Reference:
"Learning from Two Decades of Blood Pressure Data: Demography-Specific Patterns Across 75 Million Patient Encounters", The 48th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC 2024), Orlando, Florida, USA, July 2024.

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