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. In the process of hypertension management and treatment, cuff-based BP measurement devices play a critical role.

Data Pre-Processing

Pre-processing steps	Num. of records
Raw BP values	94,958,936
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 BPs within the following range: SBP: (30-300 mmHg) and DBP: (20-200 mmHg)	78,336,377
Removing records with missing demographic information	75,636,128
Keeping records with valid demographic information	71,859,435
Removing records with BPs multiples of 10 mmHg	69,802,762

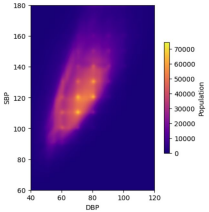
Valid demographic categories:

Age range: (0-120) years

Sex: Male and Female

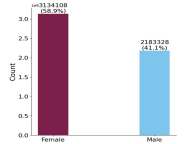
Race groups: Caucasian or White, African American or Black, Asian, Multiple, American Indian or Alaskan Native, Native Hawaiian or Other Pacific Islander, and Hispanic.

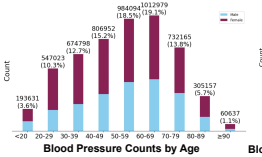
Statistically only 1% of the (SBP, DBP) pairs would be both multiples of 10 mmHg. This number was 2.83% in the dataset, indicating inaccurate misreported values. These BP values were excluded from the statistical analysis.



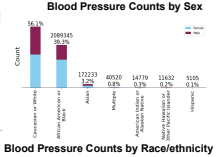
Population Demographics

We grouped the data based on the median BP measurements of patients at a given age to ensure that subjects with multiple measurements in a short period do not bias the average distribution. This approach summarized the BP data into 5,317,436 median BP values.





Blood Pressure Counts by Age

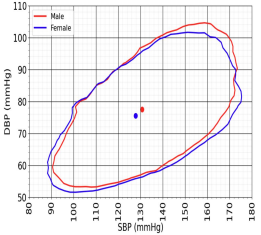


Blood Pressure Counts by Race/ethnicity

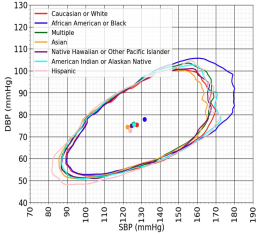
Aim of This Project

In this study, we investigate how various demographic factors, such as biological sex, age, and race, impact systolic blood pressure (SBP) and diastolic blood pressure (DBP) values using a large dataset collected at Emory Healthcare.

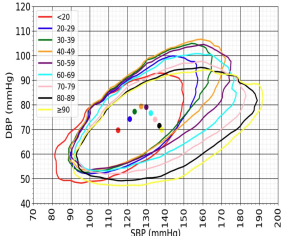
Data Analysis



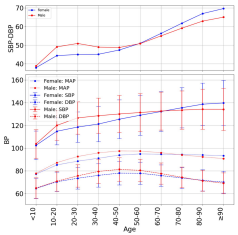
Blood Pressure Distribution Based on Sex



Blood Pressure Distribution Based on Race/ethnicity



Blood Pressure Distribution Based on Age



Blood Pressure Variations with Age

Conclusion

Data analysis highlights:

- Males have higher BP levels than females
- Average SBP consistently rises with age
- Average DBP peaks in the forties age group
- There is a significant correlation between SBPs and DBPs
- Significance of considering demographic factors in BP analysis
- Variability of BP across sex, age, and race/ethnicity

The contours correspond to the 95% percentile ranges, and the dots show the mean SBP and DBP in each group.

Reference: "Learning from Two Decades of Blood Pressure Data: Demography-Specific Patterns Across 75 Million Patient Encounters", The 46th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC 2024), Orlando, Florida, USA, July 2024. https://doi.org/10.48550/arXiv.2402.01598,

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