

About Blood Pressure & Hypertension

- **Cardiovascular disease** remains the leading cause of death worldwide
 - Hypertension affects 1.1 billion people annually according to AHA
- **Hypertension** is characterized by elevated levels of blood pressure (BP)
- **Blood pressure (BP)** is the force of blood against the body's artery walls
 - **Systolic BP (SBP)**: maximum arterial pressure during each ventricular contraction
 - **Diastolic BP (DBP)**: minimum arterial pressure during each ventricular dilatation
 - Measured in millimeters of Mercury (mmHg)
- **Blood Pressure Variability (BPV)** is the degree of BP fluctuation between cardiac cycles over a given time horizon (very short term, short term, middle term, long term)

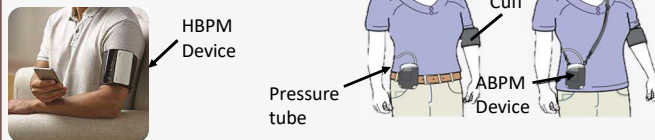
Blood Pressure Monitoring

Home Blood Pressure Monitoring (HBPM)

- User initiated recordings (i.e. user must be awake)
- Better for monitoring BP trends over the long term
- Better for assessing efficacy of pharmacological intervention

Ambulatory Blood Pressure Monitoring (ABPM)

- Automatic recordings at predetermined intervals
- Monitor BP during sleep
- Predominantly monitors BP in the short term within 24 – 48 hours



Data Processing

- Data must first be processed into a unified format for use with other bp functionality. This is done through the **bp_process** function which transforms the input data into the necessary format.
- Standardizes column naming conventions & adjusts data types accordingly
- Additional processing features include:
 - BP stage classification (according to [Lee et al. \(2020\)](#))
 - Data aggregation & consolidation
 - End-of-Day (EOD) hour adjustment
 - Create additional columns pertaining to BP analysis (PP, MAP, etc)

Overview of bp R Package

- **bp** is the **first package dedicated to blood pressure analysis in R**
- **Processing functionality** for external HBPM, ABPM, and AP data
- 10+ blood pressure **metrics from medical literature**
- **Visualization** functionality to highlight trends
- **Shiny App** web application available as a programming-free alternative

Included Data Sets

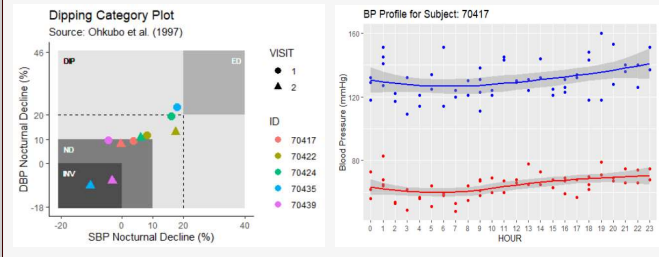
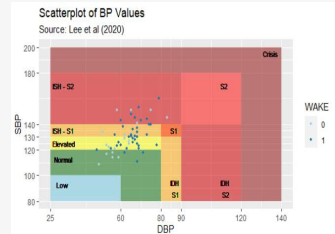
- Equipped with **6 publicly available data sets**
 - ✓ 4 HBPM data sets:
 - Single-subject aerobic exercise pilot study (bp_jhs)
 - Pregnancy-induced Hypertension (bp_preg)
 - Health coverage effectiveness in Ghana (bp_ghana)
 - BMI, sedentary time, and activity in children (bp_children)
 - ✓ 1 ABPM data set:
 - Type II Diabetic Subjects (bp_hypnos)
 - ✓ 1 Continuous Arterial Pressure (AP) data set:
 - Salt-Sensitive Dahl Rats (bp_rats)

Blood Pressure Metrics from Literature

- BP stage classification (bp_stages)
- Measures of center (bp_center)
- Coefficient of variation (bp_cv)
- Successive variability (bp_sv)
- Average real variability (bp_arv)
- BP Magnitude (Peak and Trough) (bp_mag)
- Dipping % and Classification (dip_calc)
- Wide array of sleep-specific metrics through the bp_sleep_metrics function:
 - Morning Blood Pressure Surge (MBPS)
 - Sleep-Trough (ST_mbps)
 - Pre-wake (PW_mbps)
 - Nocturnal Fall (noct_fall)
 - Morningness-Eveningness Average (ME_avg) and Difference (ME_diff)
 - Weighted Standard Deviation (wSD)

Visualizations

- Numerous visualizations available as both standalone functions (i.e. **bp_scatter**) and complements to metric calculations (i.e. **dip_class_plot**)
- Ability to generate a comprehensive **patient-specific report**



Shiny App

- Upload external data and analyze through user-friendly web interface

Shiny BP



Acknowledgments & Further Resources

- CRAN: <https://CRAN.R-project.org/package=bp>
- GitHub Development Version: <https://github.com/johnschwenck/bp>
- Shiny App URL coming soon (end of August)!
- ✓ Very special thank you to:
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