Usability of wearable, passive, noninvasive BP monitor to combat elderly hypertension at home

David DR Krucik*[1], Junjun Liu[1], Thomas Roxlo[1], Celine Liong[1], Doug Halperin[1], Will Sutherland[1], Dave Richardson[1], Vikram Fielding-Singh[2], Xina Quan[1]

[1] PyrAmes Inc, [2]Stanford University

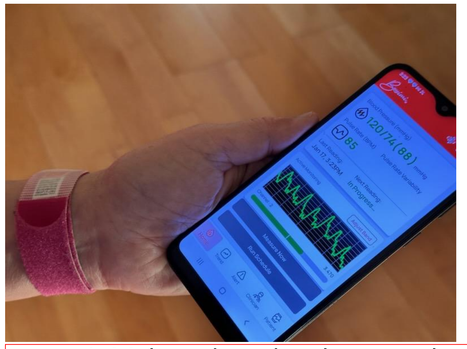
PennAITech Aging Focus Pilot Core

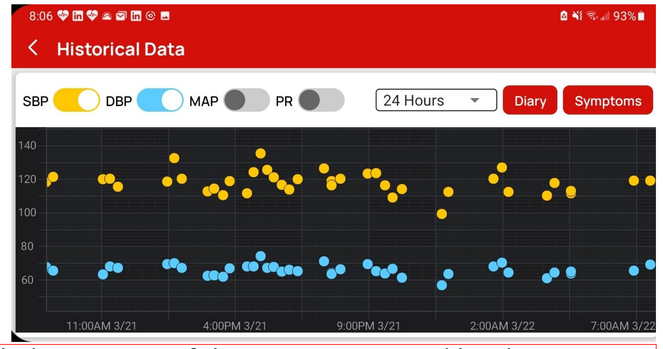
Background/Motivation

- Hypertension is an epidemic and national priority
- More than **75% of Americans aged 60+** are hypertensive
- Hypertension increases the risk of heart attack or stroke
- **Risk of dying doubles for every 20mmHg increase of average BP.**
- Over-medicating can lead to falls related to **hypotension**
- Capacitive technology validated by FDA clearance of Boppli®, a wearable monitor to continuously and non-invasively monitor blood pressure of critically-ill infants.
- **PyrAmes Inc. aims to utilize our machine learning and sensor platform to address the needs of older adults.**

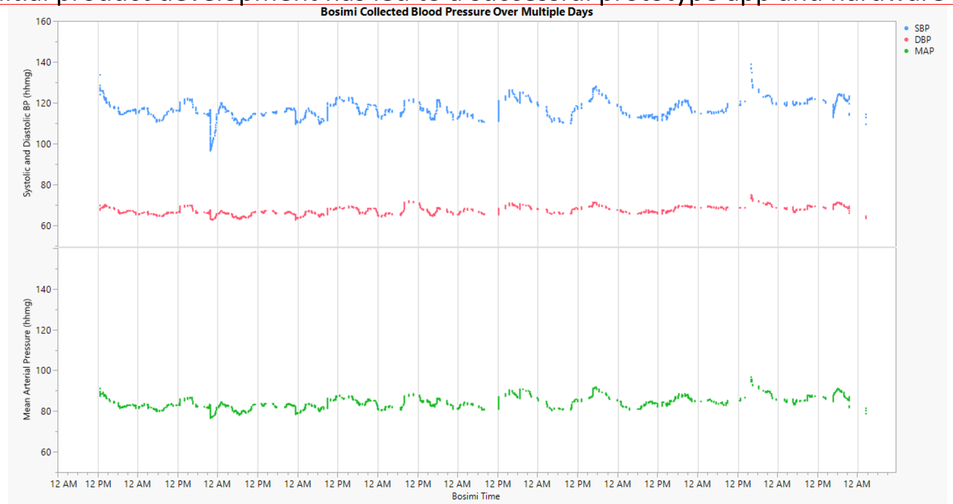
Objectives/Goals

1. Simultaneously collect Bosimi® sensor data and blood pressure data from 100 inpatients with invasive arterial lines (IALs)
2. Develop strategies to mitigate signal artifacts due to motion
3. Finalize an algorithm that does not require external calibration with accuracy within FDA guidelines





Initial product development has led to a successful prototype app and hardware



Early pilot data validates assumptions about variability in BP throughout a day

Model B12667	DBP	MAP	SBP	FDA spec	Internal goal
# of patients	42	42	42	85	85
Mean Average Error (MAE)	-0.2	-0.6	-0.1	≤ ± 5	≤ ± 1 mmHg
Standard Deviation (SD)	3.8	5.2	6.8	≤ 8	≤ 5 mmHg
Correlation	0.38	0.41	0.32		≥ 0.4
Slope	0.44	0.55	0.36		≥ 0.4

Current progress on best model, still anchored model

Methods

- Enrollment from post-op, ICU and cardiac patients at Stanford
- Patients have concurrent IAL
- Supplement PyrAmes' existing dataset with synthetic data
- Use machine-learning techniques such as convolutional neural networks to extract BP values from waveform shape

Current Progress

- **Successful enrollment of first few senior patients**
- No progress yet on mitigating signal movement artifact, but coverage during daily living approaches specification
- **Current algorithm requires anchor;** as patient enrollment continues, we plan to develop non-anchored model
- Stakeholder interviews have revealed **interest from care givers and users for remote BP monitoring**

Acknowledgment

We are gratetul to PennAITech for their support through National Institute on Aging grant P30AG073105.