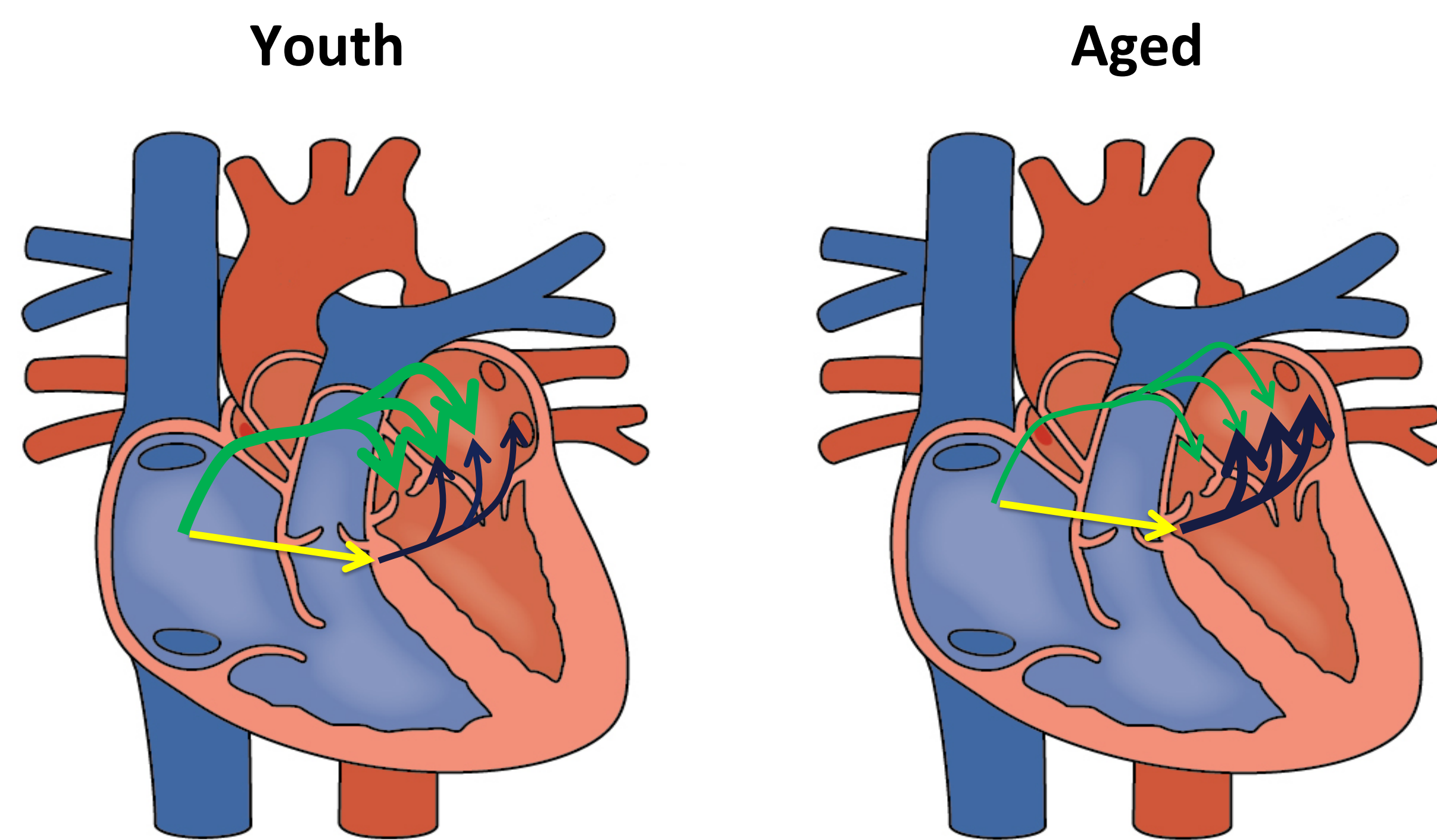


# Changing Characteristics Of The Surface P Wave With Aging, and Insights Into Inter-atrial Conduction - A Study Of 2,156 Patients Over 9 Decades Of Life

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## Background

- Atrial fibrillation (AF) increases with age
- Age-related changes in interatrial conduction (IAC) likely play a role
- Normal IAC occurs via 2 routes<sup>1</sup>:
  - Bachmann's bundle (BB) → Mainly cranio-caudal left atrial (LA) activation
  - The muscular medial 3rd of the coronary sinus (CS) → Some caudo-cranial activation
- Relative contributions of BB and CS to LA activation may change with aging, and may be discerned from changes in P-wave vector, morphology and duration



**Figure 1.** Interatrial conduction is thought to occur primarily via the specialized Bachmann's bundle (green) and secondarily via the musculature of the medial third of the coronary sinus (black). It is hypothesized that aging causes a gradual shift in conduction, favoring the CS over the BB<sup>2</sup>

## Objective

To define changes in surface ECG P-wave morphology, vector, and duration with advancing age, and make inferences about IAC and risk of atrial fibrillation

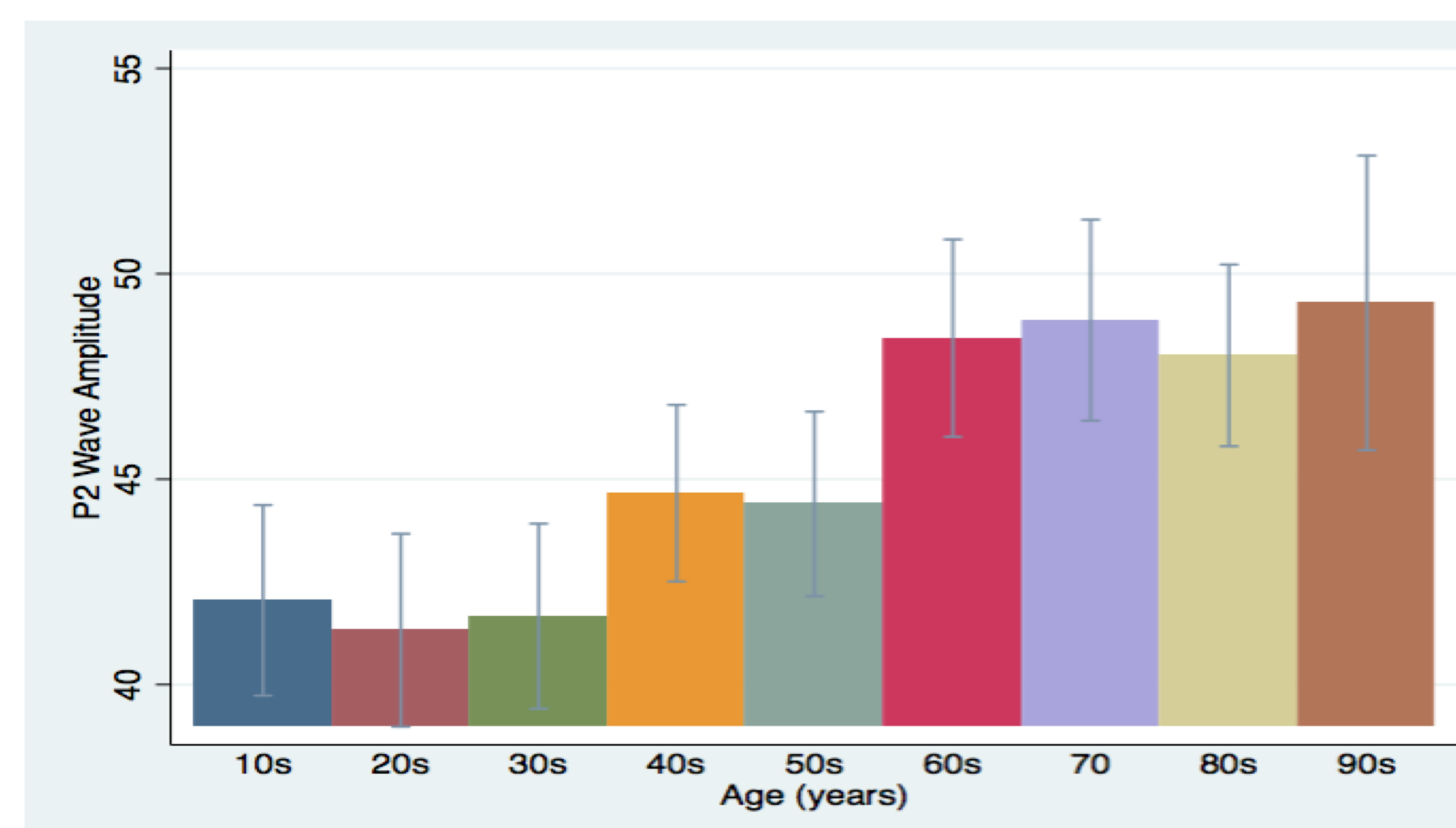
## Methods

- The hospital ECG database was queried for "Normal" ECGs grouped by each decade of life
- ECGs with automated reporting of amplitude and duration for the 2nd component of the P-wave (P2), representing LA depolarization, were selected
- P2 was measured in the 3 leads best aligned with LA forces: III, V1 (terminal negative force), and lead aVL (terminal positive force)
- The maximum P wave duration in any lead was noted
- Statistical analyses were performed with Stata 14.1 (StataCorp 2017, College Station, TX)
- ANOVA was used to assess ECG characteristics across each decade of life

## Results

- A total of 2,156 ECGs were analyzed
- Advancing age was associated with increasing P2 amplitude ( $p < .001$ ) and duration ( $p < .001$ ) in leads III, V1 & aVL, and progressive widening of the P wave ( $P = .0004$ )

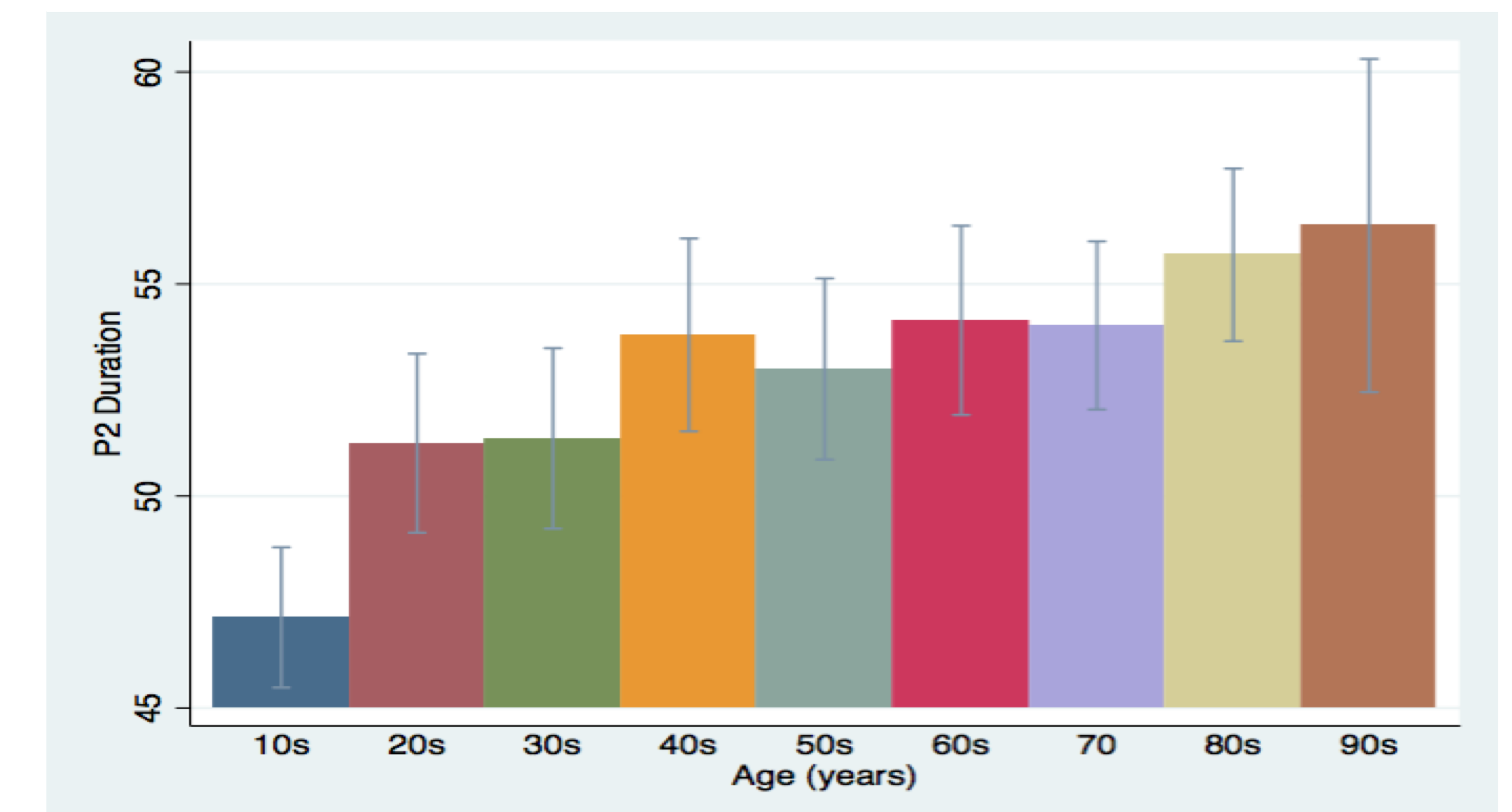
### P2 Wave Amplitude Across Decades of Life



**Figure 2.** Measurement of P2 amplitude in leads III, V1 and aVL. demonstrated a significant increase with aging progressing from the teens to the 90s+ age group ( $P < .001$ ). This was determined based on the highest absolute value of this variable in any of these leads

## Results (continued)

### P2 Wave Duration Across Decades of Life



**Figure 3.** Measurement of P2 wave duration in leads III, V1 and aVL also demonstrated a significant increase with aging moving from the teens age group to the 90+ age group ( $P < .001$ ).

## Conclusions

- With aging, the second component of the P wave (P2, representing LA activation) becomes progressively larger, the P wave becomes broader, and the terminal P wave vector is increasingly oriented leftwards, superiorly & posteriorly
- These observations suggest that cranio-caudal conduction via BB slows with aging, with increasing dependence on caudo-cranial activation via the CS
- These P-wave changes may provide insight into the rising incidence of AF with aging

## References

1. Martínez-Sellés M, Massó-van Roessel A, Álvarez-García J, García de la Villa B, Cruz-Jentoft AJ, Vidán MT, et al. Interatrial block and atrial arrhythmias in centenarians: Prevalence, associations, and clinical implications. *Heart Rhythm*. 2016 March 2016;13(3):645-51.
2. 2009 Congenital Heart Defects [Photograph]. (2013, December 14). Wikimedia Commons In OpenStax College.