

AORTIC PULSE WAVE VELOCITY IN PORTUGUESE CHILDREN AND ADOLESCENTS – RESULTS FROM THE PORTUGUESE VASCULAR PHENOTYPE IN CHILDREN AND ADOLESCENTS (PORT-VASPH) COHORT

Telmo Pereira, João Maldonado, Martins J, Margarida Carvalho



Telmo Pereira, Ph.D.
telmo@estescoimbra.pt



DISCLOSURE: No conflict of Interest

Conflict of Interest
Vasco Sá, 2009

Objective

The PORT-VASPh Cohort was designed to contribute to a better understanding of vascular function in children and adolescents, mostly focusing PWV and other aspects of arterial hemodynamics.

1. Definition of reference values in children and adolescents
2. Identification of the main determinants of PWV in this population
3. Definition of PWV trajectories with ageing

Children and adolescents (5-17 Years)

Same BP profile in 3 consecutive measurements (6 months apart)

Population - PORT-VASPh) Cohort

N = 953; Female = 38%

Mean Age = 12.08 ± 2.92 years

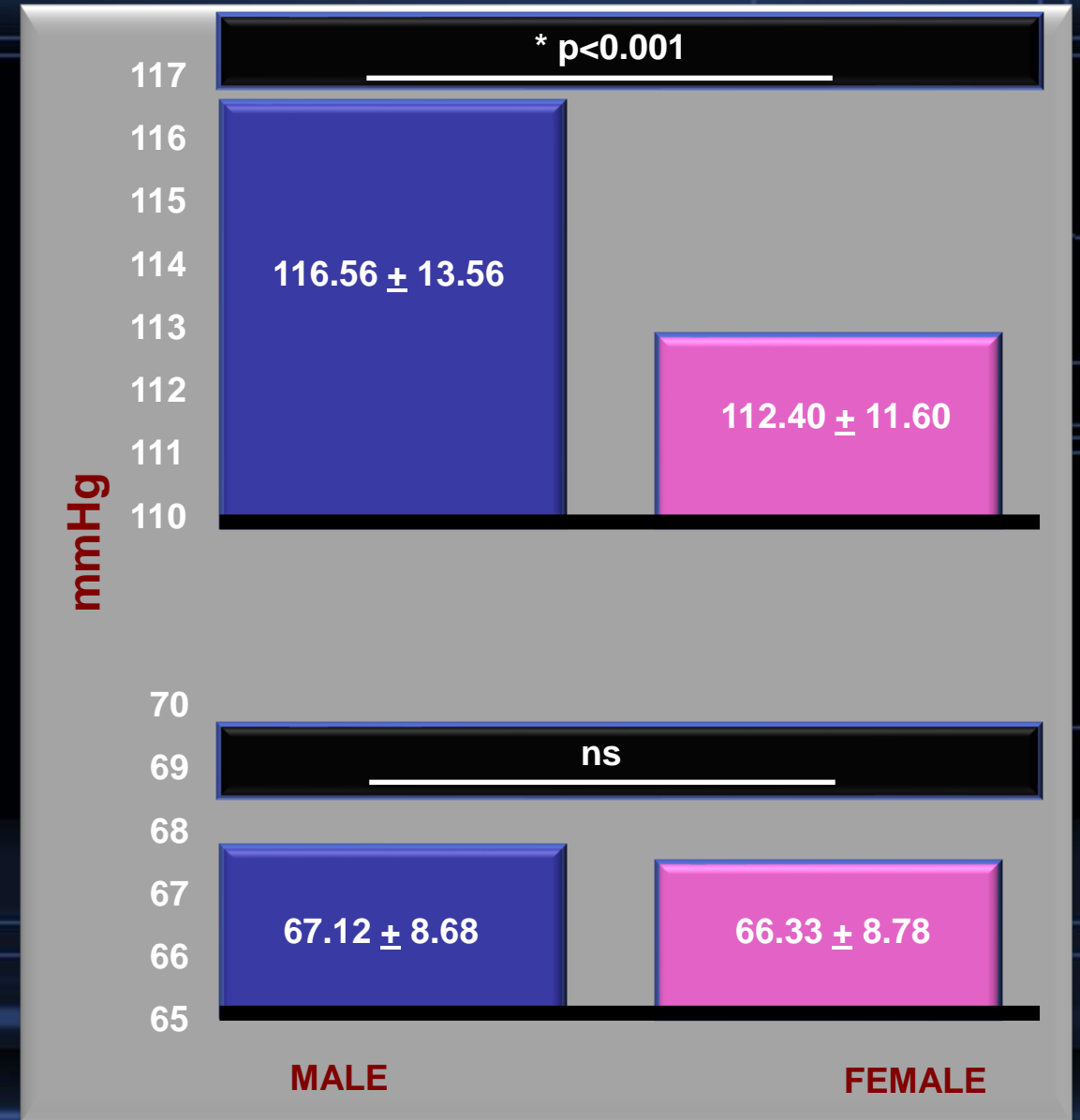
BMI = 18.96 ± 3.27 Kg/m²

Overweight: 11.8% Obesity: 5.5%

Family History of CVD: 8.3%

SBP = 114.98 ± 13.03 mmHg

DBP = 66.82 ± 8.73 mmHg



METHODOLOGY - Blood Pressure Measurement

Sitting position.

After 10 minutes of rest in a quiet environment.

Special room without doctors presence.

Encouraged family presence.

Avoidance of stimulants in the previous 30 minutes.

3 measurements at 2 minutes intervals .

Cuff individually adapted.



Age-validated automatic
blood pressure monitor



Face to abnormal blood pressure
values, confirmation was made with
a mercury sphygmomanometer.

METHODOLOGY - Blood Pressure Classification

| CATEGORY | 0-15 years SBP and/or DBP percentile | ➤ 16 years SBP and/or DBP (mmHg) |
|--------------|---|-------------------------------------|
| Normal | < 90th | < 130/85 |
| High-normal | ≥ 90th to < 95th | 130-139/ 85-89 |
| Hypertension | ≥ 95th | ≥ 140/90 |
| HT – Stage 1 | 95 th to 99 th + 5 mmHg | 140-159/90-99 |
| HT – Stage 2 | > 99 th + 5 mmHg | 160-179/100-109 |
| ISH | SBP ≥ 95 th and DBP < 90th | SBP ≥ 140 and DBP < 90 |

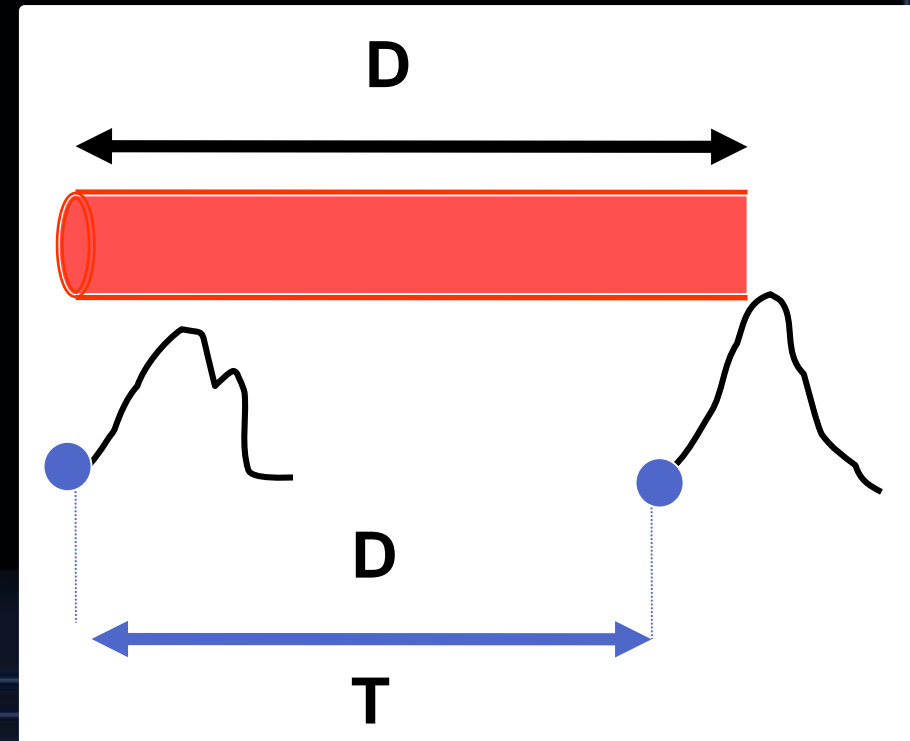
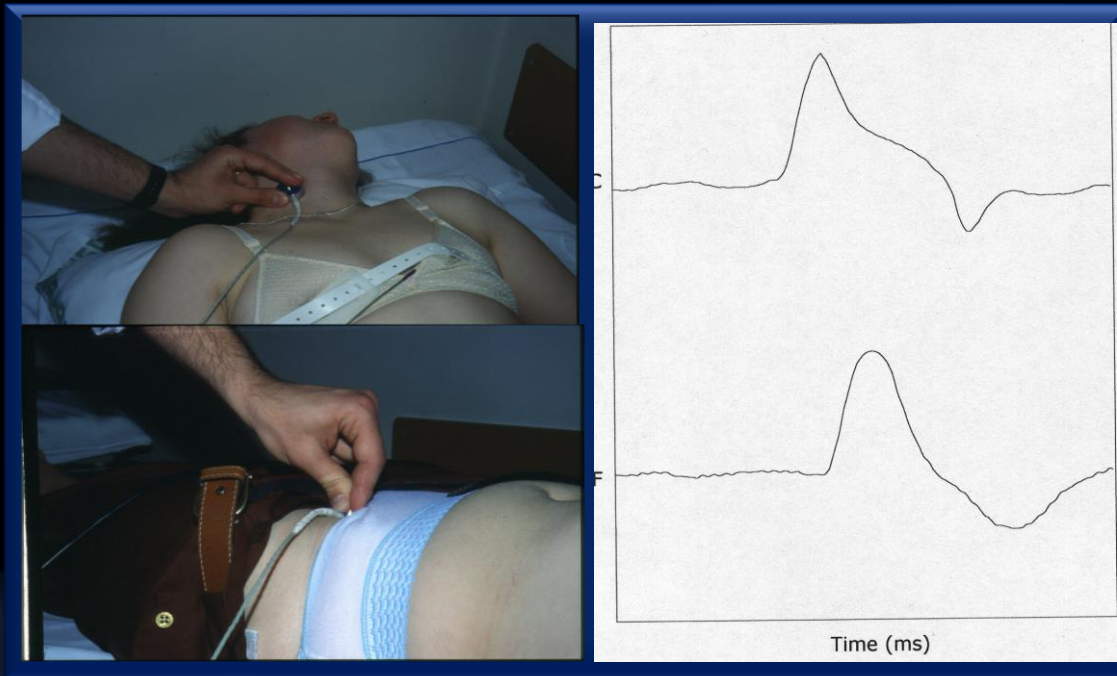
2016 ESH Guidelines for the management of high blood pressure in children and adolescents Lurbe E et al. J Hypertens 2016;34:1887-1920

METHODOLOGY -

cf PWV

“Gold Standard” methodology
for assessing arterial stiffness

Complior
SP



$$\text{Pulse Wave Velocity} = D / DT \text{ (m/s)}$$

Population for Reference Values

N = 758 (Cohort: n= 953)

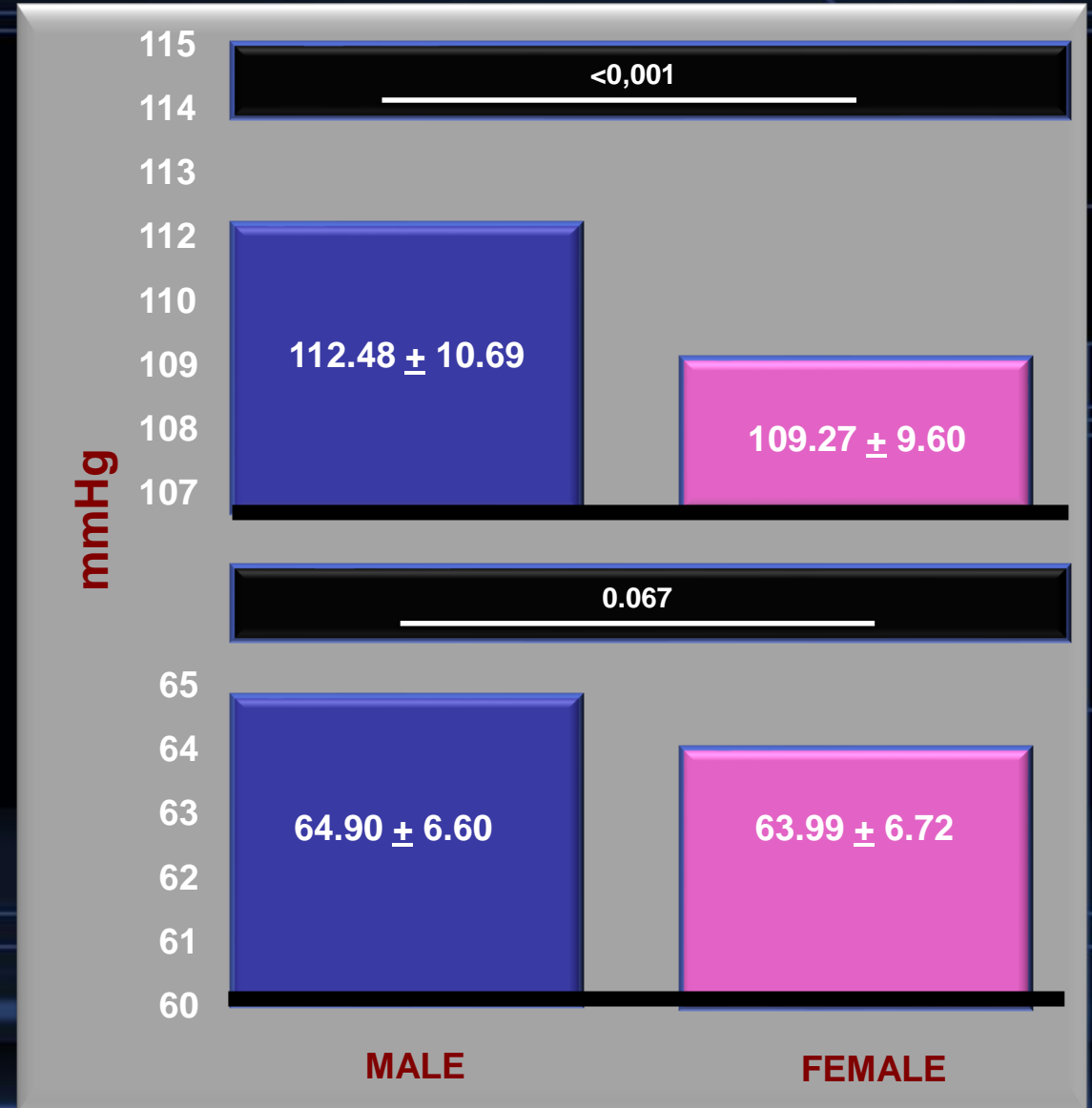
Female = 40%

Mean Age = 11.95 ± 2.87 years

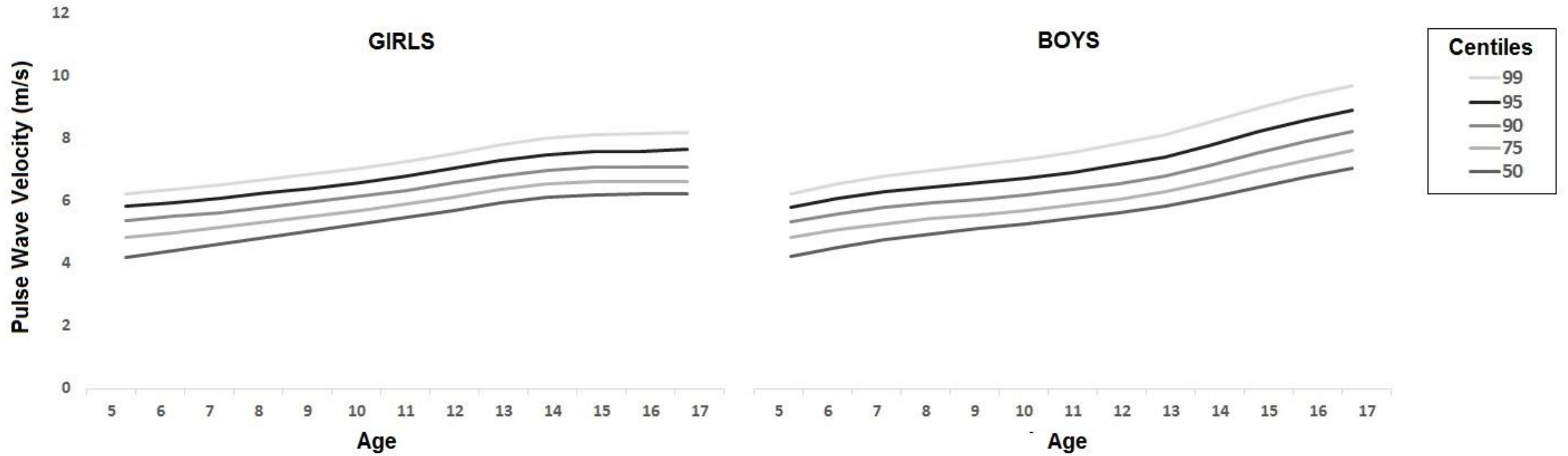
BMI = 18.56 ± 2.98 Kg/m²

SBP = 111.23 ± 10.40 mmHg

DBP = 64.54 ± 6.66 mmHg



REFERENCE VALUES OF cf PWV (n=758)



REFERENCE VALUES OF cf PWV (n=758)

Complior
SP

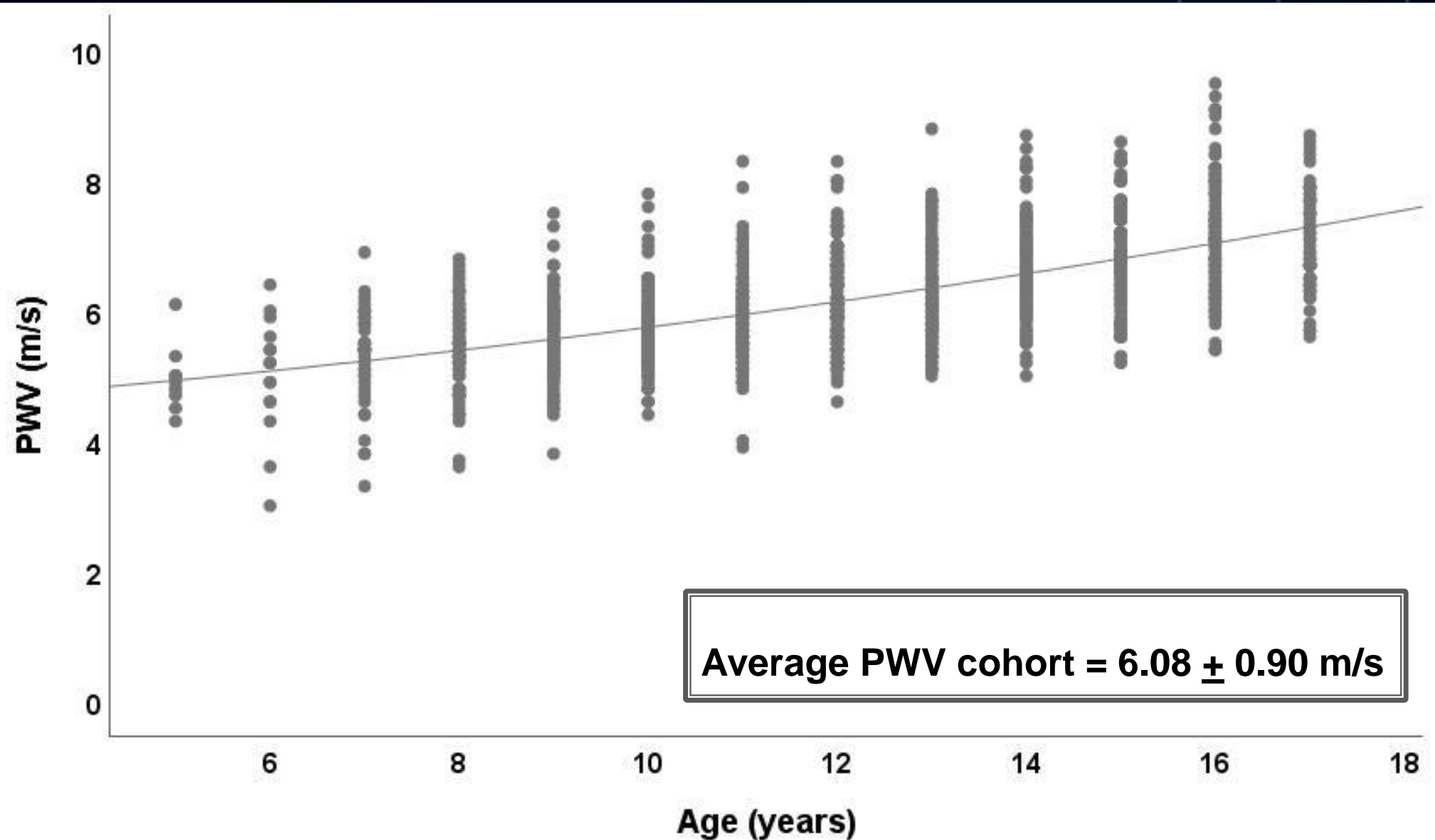
PWV GIRLS < PWV BOYS

| AGE | 50 th | 75 th | 90 th | 95 th | 99 th |
|------|------------------|------------------|------------------|------------------|------------------|
| 5,0 | 3,8 | 4,4 | 4,9 | 5,4 | 5,8 |
| 6,0 | 4,0 | 4,6 | 5,1 | 5,5 | 5,9 |
| 7,0 | 4,2 | 4,7 | 5,2 | 5,6 | 6,1 |
| 8,0 | 4,4 | 4,9 | 5,4 | 5,8 | 6,2 |
| 9,0 | 4,6 | 5,1 | 5,5 | 6,0 | 6,4 |
| 10,0 | 4,8 | 5,3 | 5,7 | 6,2 | 6,6 |
| 11,0 | 5,0 | 5,5 | 5,9 | 6,4 | 6,8 |
| 12,0 | 5,3 | 5,7 | 6,1 | 6,6 | 7,1 |
| 13,0 | 5,5 | 5,9 | 6,4 | 6,9 | 7,4 |
| 14,0 | 5,7 | 6,1 | 6,6 | 7,0 | 7,6 |
| 15,0 | 5,8 | 6,2 | 6,6 | 7,1 | 7,7 |
| 16,0 | 5,8 | 6,2 | 6,6 | 7,2 | 7,7 |
| 17,0 | 5,8 | 6,2 | 6,7 | 7,2 | 7,8 |

| AGE | 50 th | 75 th | 90 th | 95 th | 99 th |
|------|------------------|------------------|------------------|------------------|------------------|
| 5,0 | 4,1 | 4,6 | 5,0 | 5,4 | 5,7 |
| 6,0 | 4,3 | 4,8 | 5,2 | 5,6 | 6,0 |
| 7,0 | 4,5 | 4,9 | 5,4 | 5,8 | 6,2 |
| 8,0 | 4,7 | 5,1 | 5,5 | 5,9 | 6,4 |
| 9,0 | 4,8 | 5,2 | 5,6 | 6,0 | 6,5 |
| 10,0 | 4,9 | 5,3 | 5,7 | 6,2 | 6,7 |
| 11,0 | 5,1 | 5,4 | 5,8 | 6,3 | 6,8 |
| 12,0 | 5,2 | 5,6 | 6,0 | 6,5 | 7,1 |
| 13,0 | 5,4 | 5,8 | 6,2 | 6,7 | 7,3 |
| 14,0 | 5,6 | 6,0 | 6,5 | 7,0 | 7,7 |
| 15,0 | 5,9 | 6,3 | 6,8 | 7,4 | 8,0 |
| 16,0 | 6,2 | 6,6 | 7,1 | 7,7 | 8,4 |
| 17,0 | 6,4 | 6,9 | 7,4 | 8,0 | 8,6 |

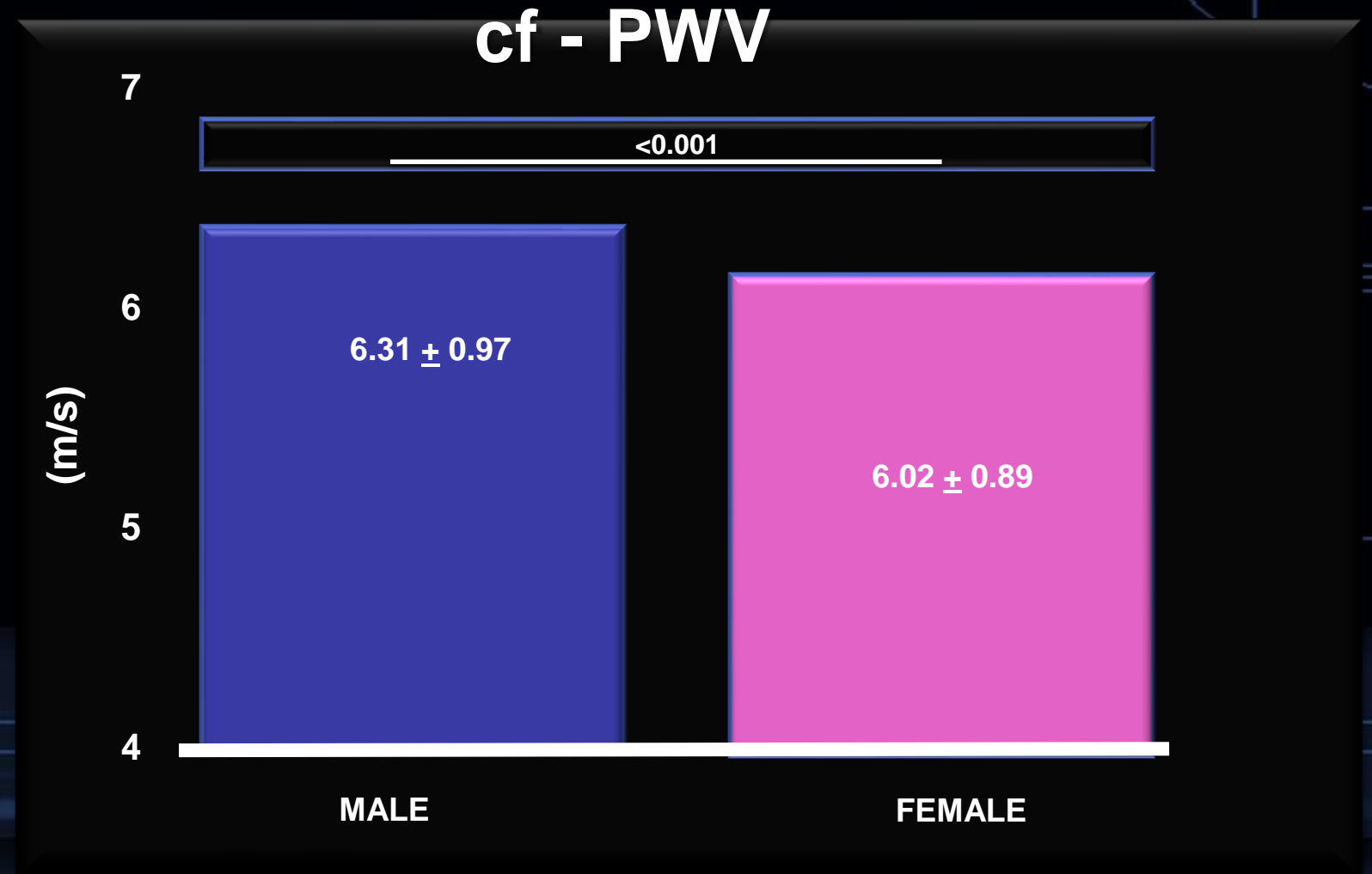
Pulse Wave Velocity and Age

RESULTS
(n=953)



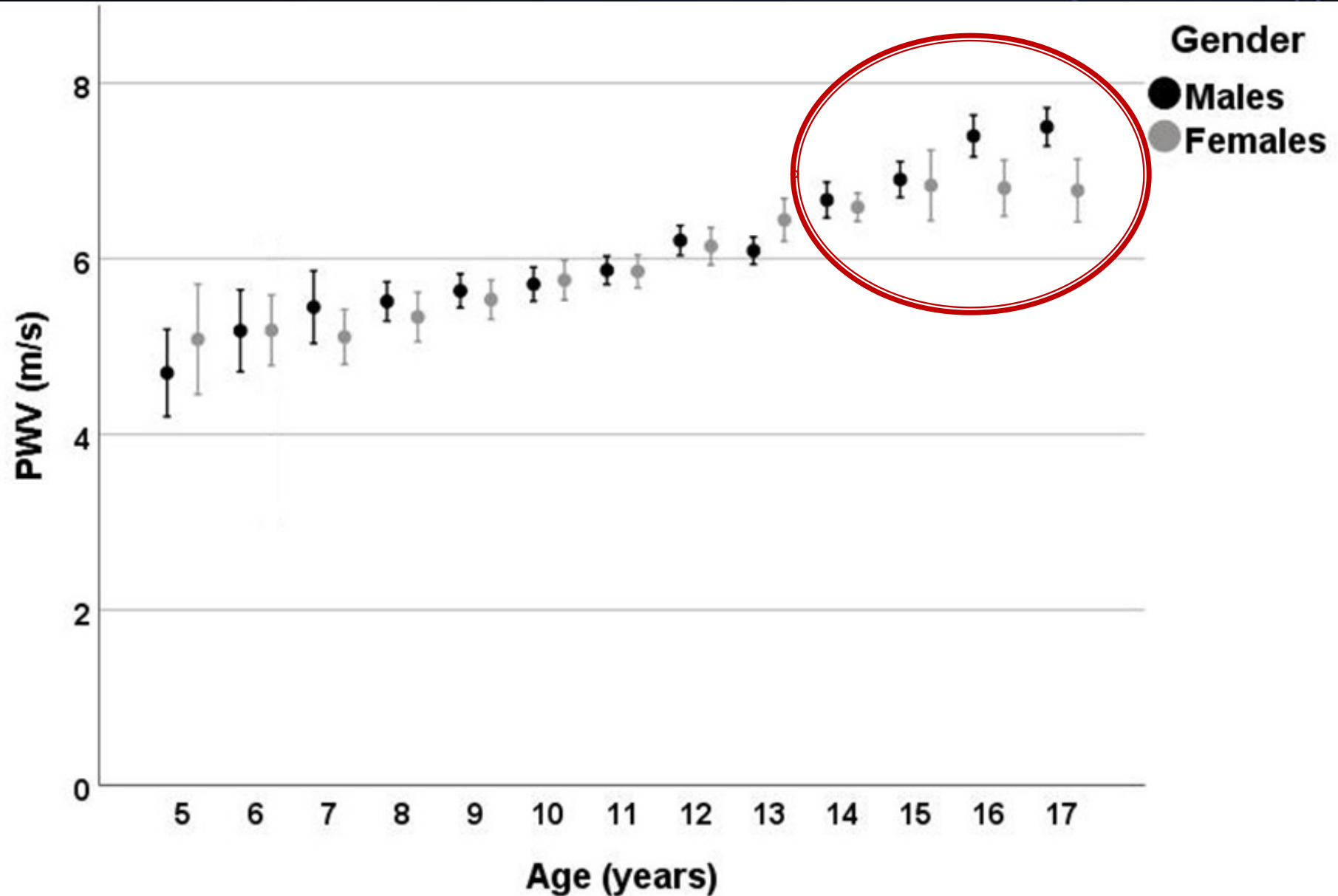
Pulse Wave Velocity and Gender

RESULTS
(n=953)



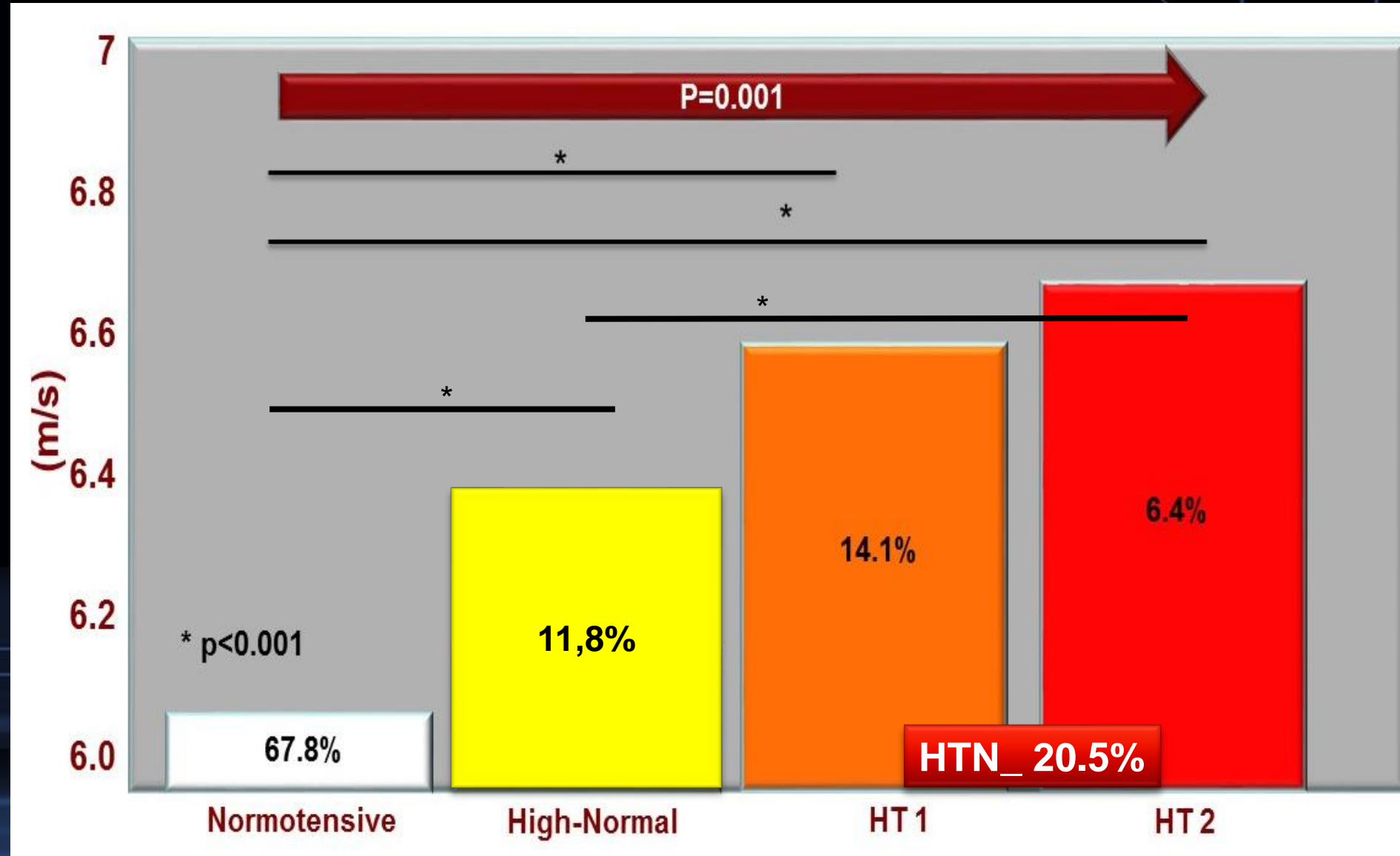
Pulse Wave Velocity and Age

RESULTS
(n=953)



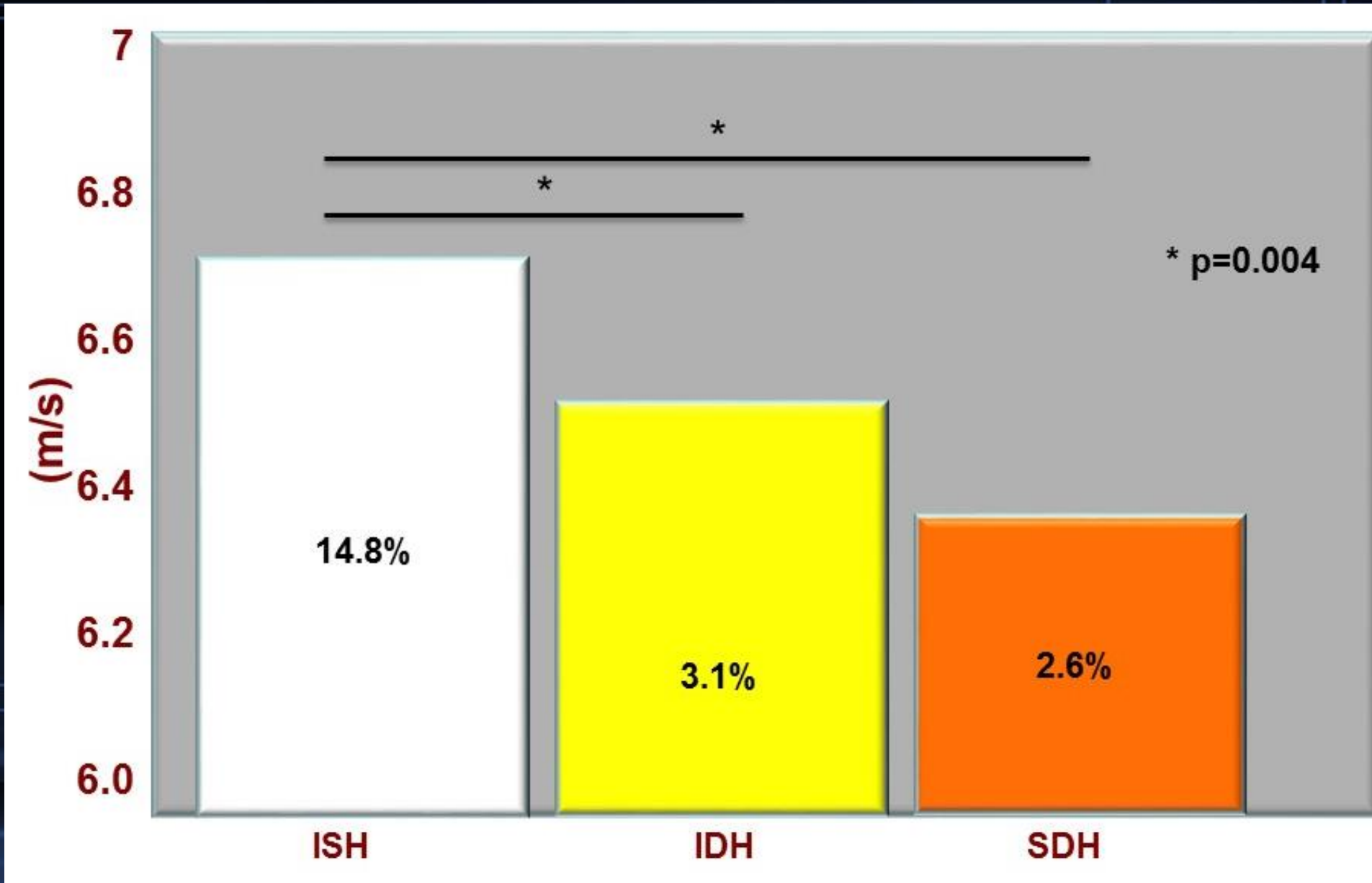
cf – PWV according to BP Classification

RESULTS

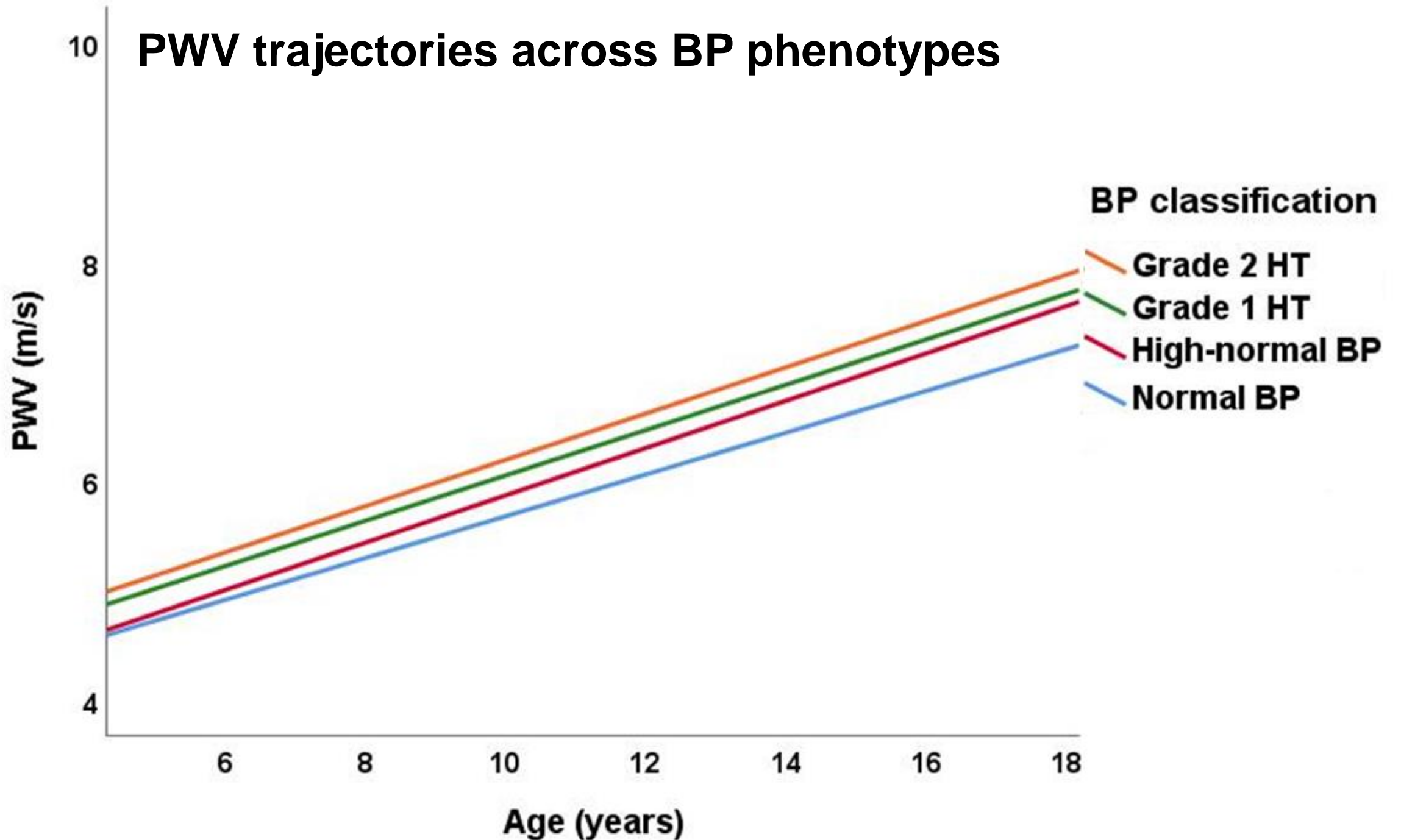


cf – PWV according to BP Phenotype in the Ht

RESULTS



PWV trajectories across BP phenotypes



DETERMINANTS OF cf PWV (n=953)

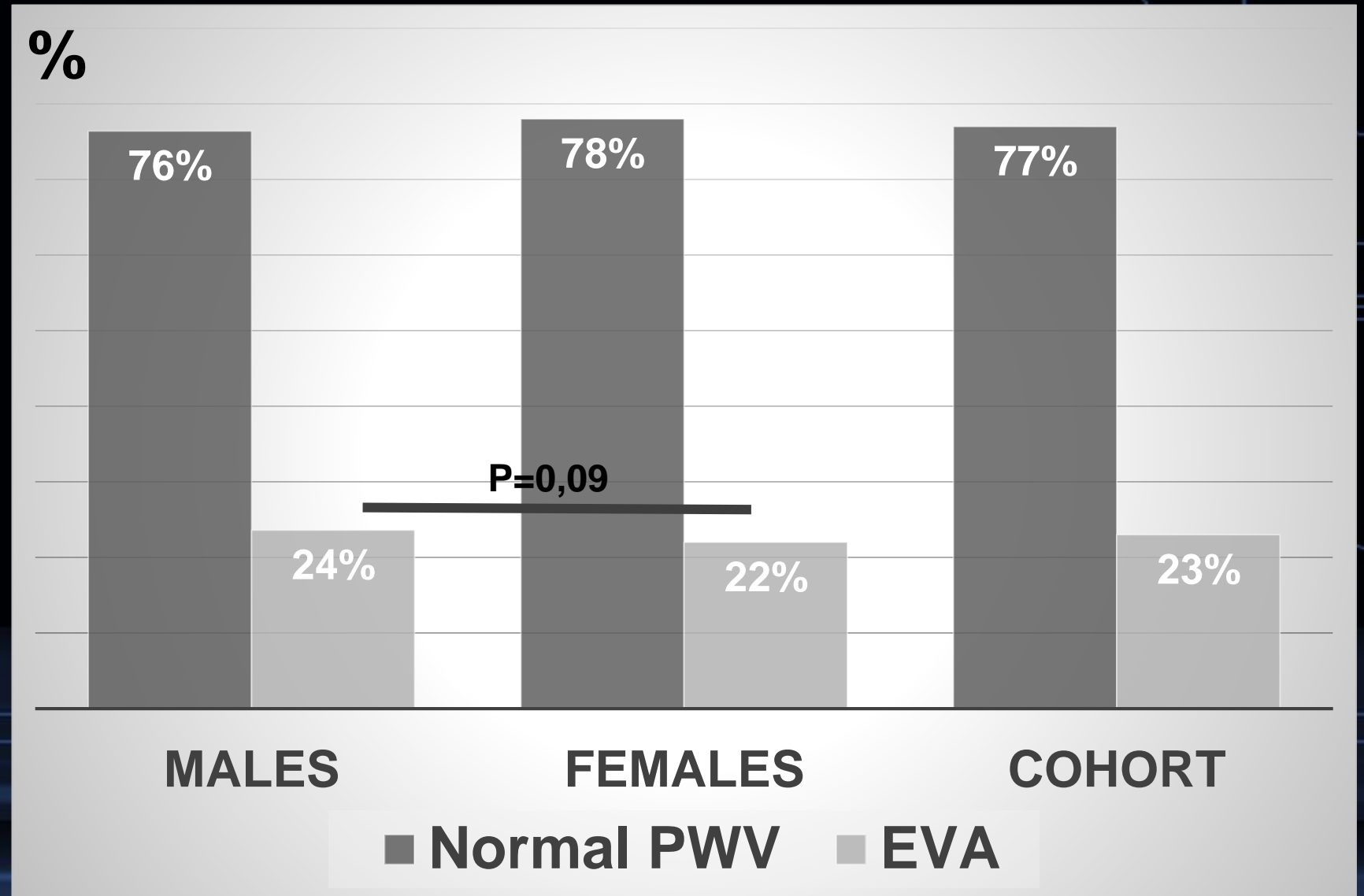
Multivariable Linear Regression

RESULTS

| | β | IC 95% | p |
|-----------------------|---------|----------------|--------|
| Age | 0.196 | 0.177; 0.216 | <0.001 |
| Gender | -0.098 | -0.194; -0.002 | 0.046 |
| BMI | 0.013 | -0.004; 0.031 | 0.128 |
| MBP | 0.009 | 0.006; 0.013 | <0.001 |
| Family History of CVD | 0.326 | 0.156; 0.496 | <0.001 |

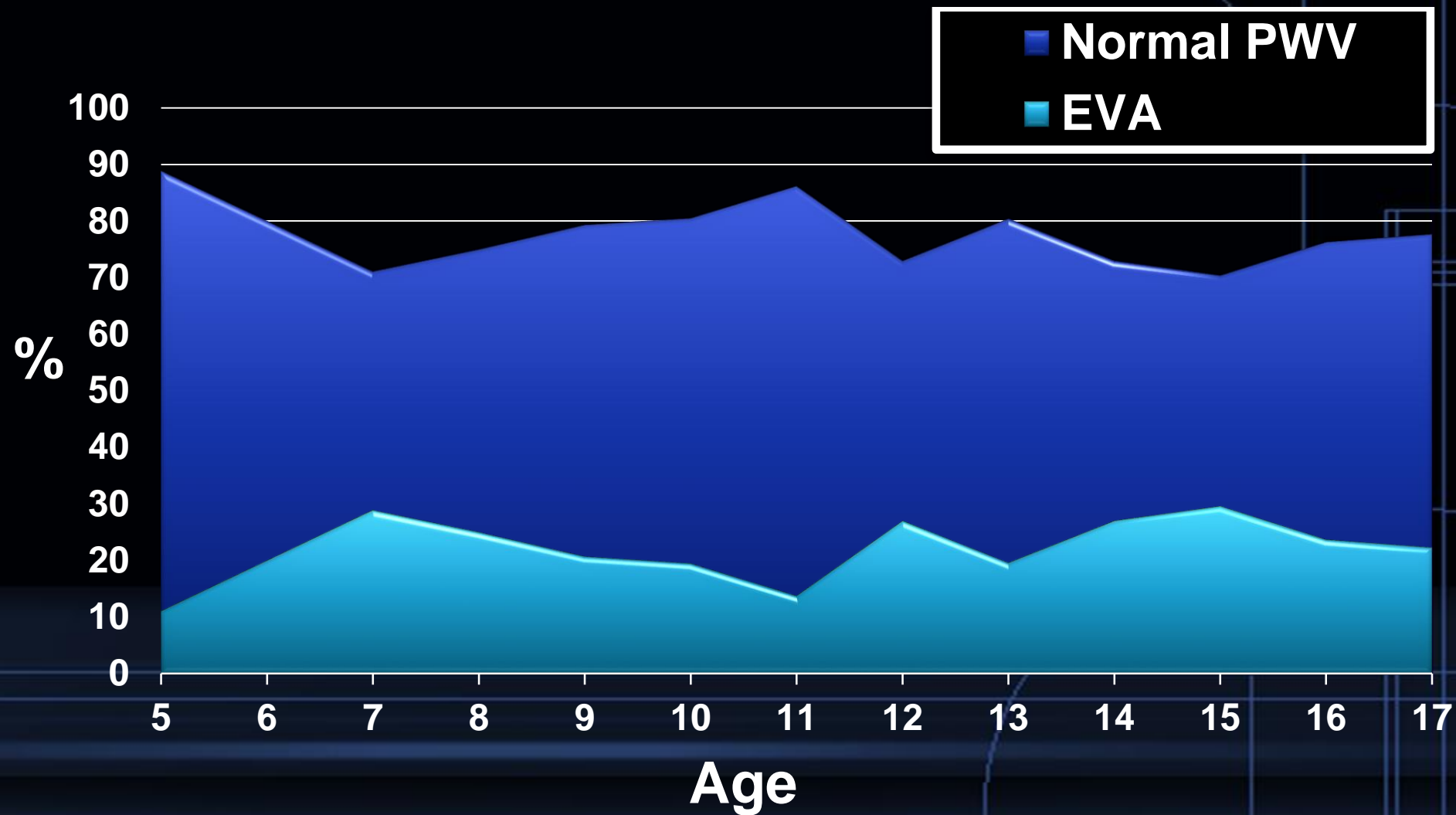
DETERMINANTS OF cf PWV

Prevalence
of EVA



DETERMINANTS OF cf PWV

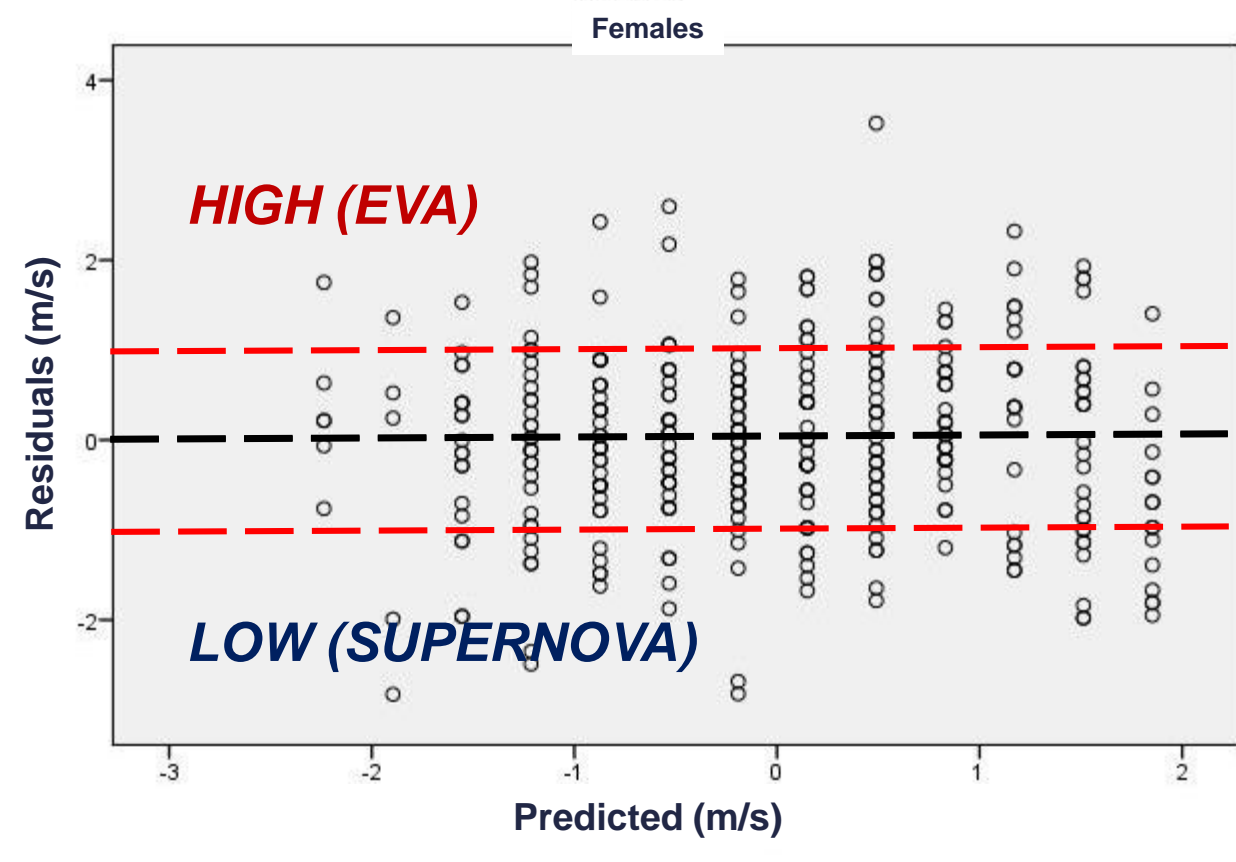
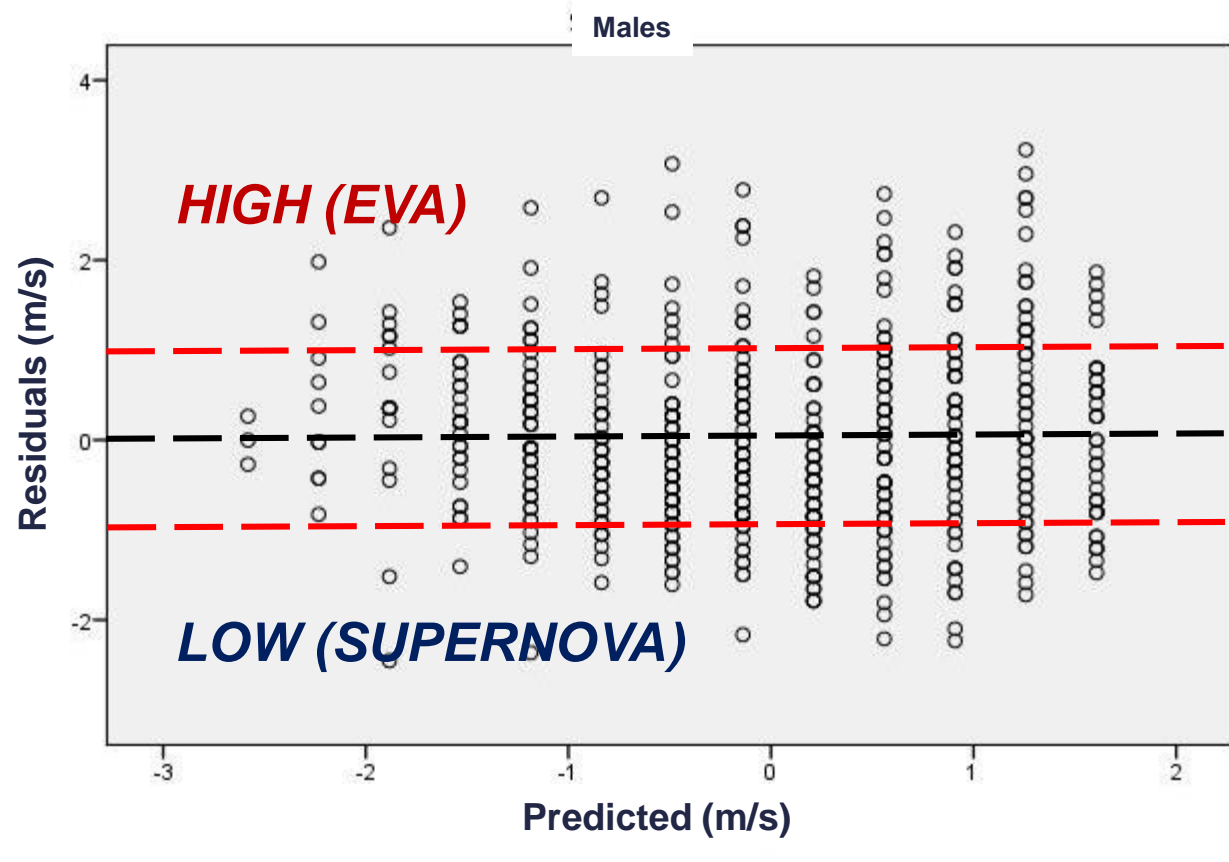
Prevalence
of EVA



DETERMINANTS OF cf PWV

$$Y = 3.618 + 0.217X$$

$$Y = 3.951 + 0.179X$$



HIGH (EVA): ↑ BMI, ↑ Blood Pressure, ↑ Family History (Genetics);
Nutritional differences (↑caloric intake); ↓ physical activity

CONCLUSION

In children and adolescents, aortic PWV is strongly influenced by age, gender, BP and genetics, in line with the available evidences in adult populations. Further studies are needed towards a thorough understanding of the arterial dynamics at these ages.

The availability of reference tables for PWV in children and adolescents is necessary, as it will allow the incorporation of the arterial stiffness concept into pediatric clinical decision, thus contributing for a better definition of the adequate preventive strategies for these particular populations.

FUTURE DIRECTIONS

- **Follow-up – currently, about 50% of the Cohort with two evaluations (1 year interval)**
- **Definition of individual longitudinal trajectories**
- **Also focusing on the SUPERNOVA subgroup will provide interesting additional insight over the vascular ageing continuum.**

