ISTITUTO DI MEDICINA DELLO SPORT DI FIRENZE

"dal 1950 al servizio dello sport"

# Should exercise electrocardiogram be included in preparticipation cardiovascular screening of competitive athletes? The 5-year experience of the Institute of Sports Medicine of Florence, Italy

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# Introduction

- Pre-participation screening is the systematic practice of evaluating sports participants before competition, with the primary aim of detecting cardiovascular abnormalities to prevent sudden death and/or disease progression

- In Italy, such screening constitutes an established medical program that has been implemented for over than 25 years, comprising a careful personal and family history, a physical examination with blood pressure evaluation, resting 12-lead and exercise electrocardiograms (ECGs)

- Over the last decades, a great debate among clinicians and experts for the clinical usefulness of such systematic practice in identifying athletes at high risk of disease progression and/or death has been raised

# Background

European Heart Journal (2005) 26, 516–524
doi:10.1093/eurheartj/ehi108

EUROPEAN SOCIETY OF CARDIOLOGY®

ESC Report

## Cardiovascular pre-participation screening of young competitive athletes for prevention of sudden death: proposal for a common European protocol

Consensus Statement of the Study Group of Sport Cardiology of the Working Group of Cardiac Rehabilitation and Exercise Physiology and the Working Group of Myocardial and Pericardial Diseases of the European Society of Cardiology

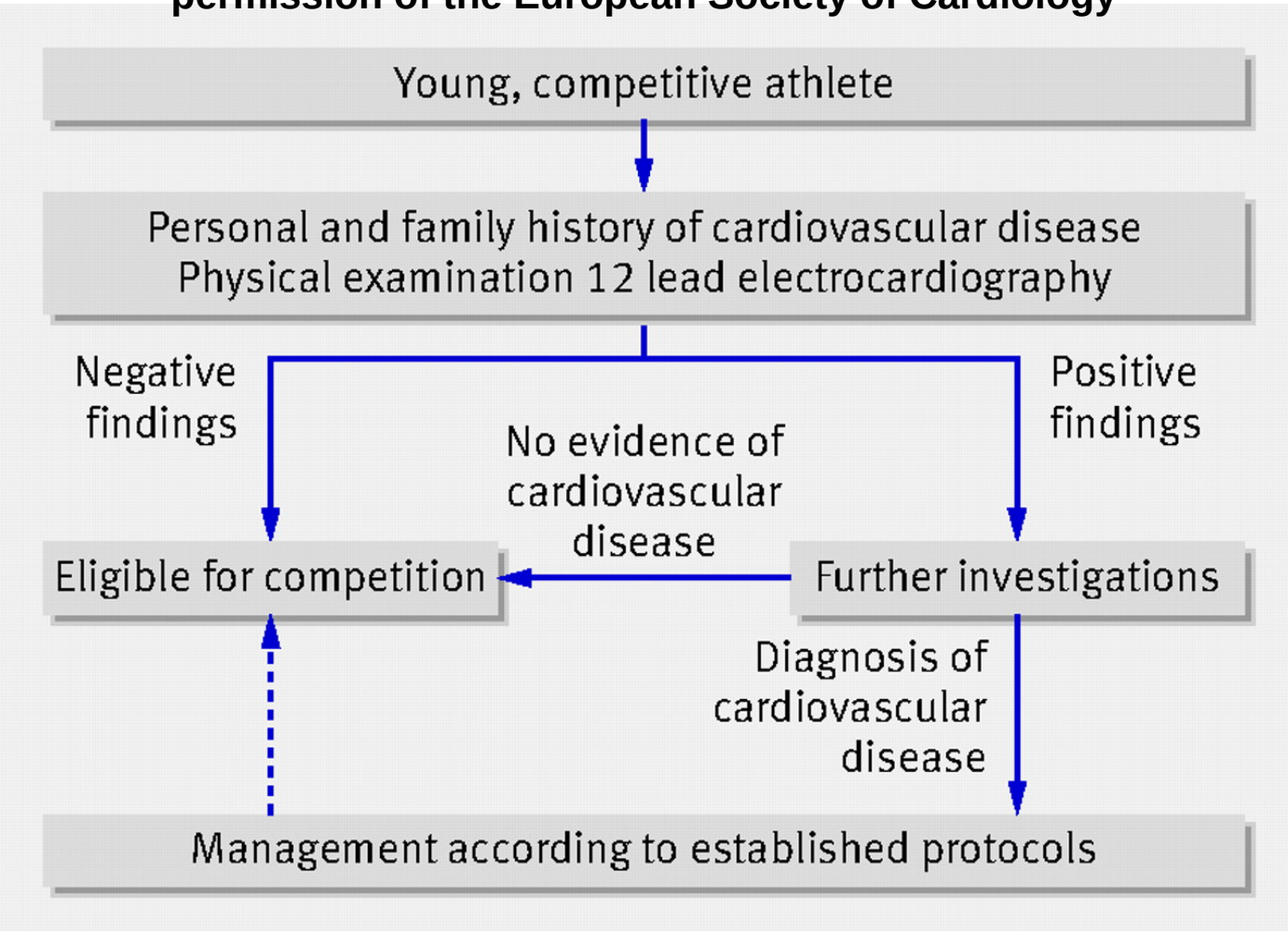
**AHA Scientific Statement**

## Recommendations and Considerations Related to Preparticipation Screening for Cardiovascular Abnormalities in Competitive Athletes: 2007 Update

A Scientific Statement From the American Heart Association Council on Nutrition, Physical Activity, and Metabolism

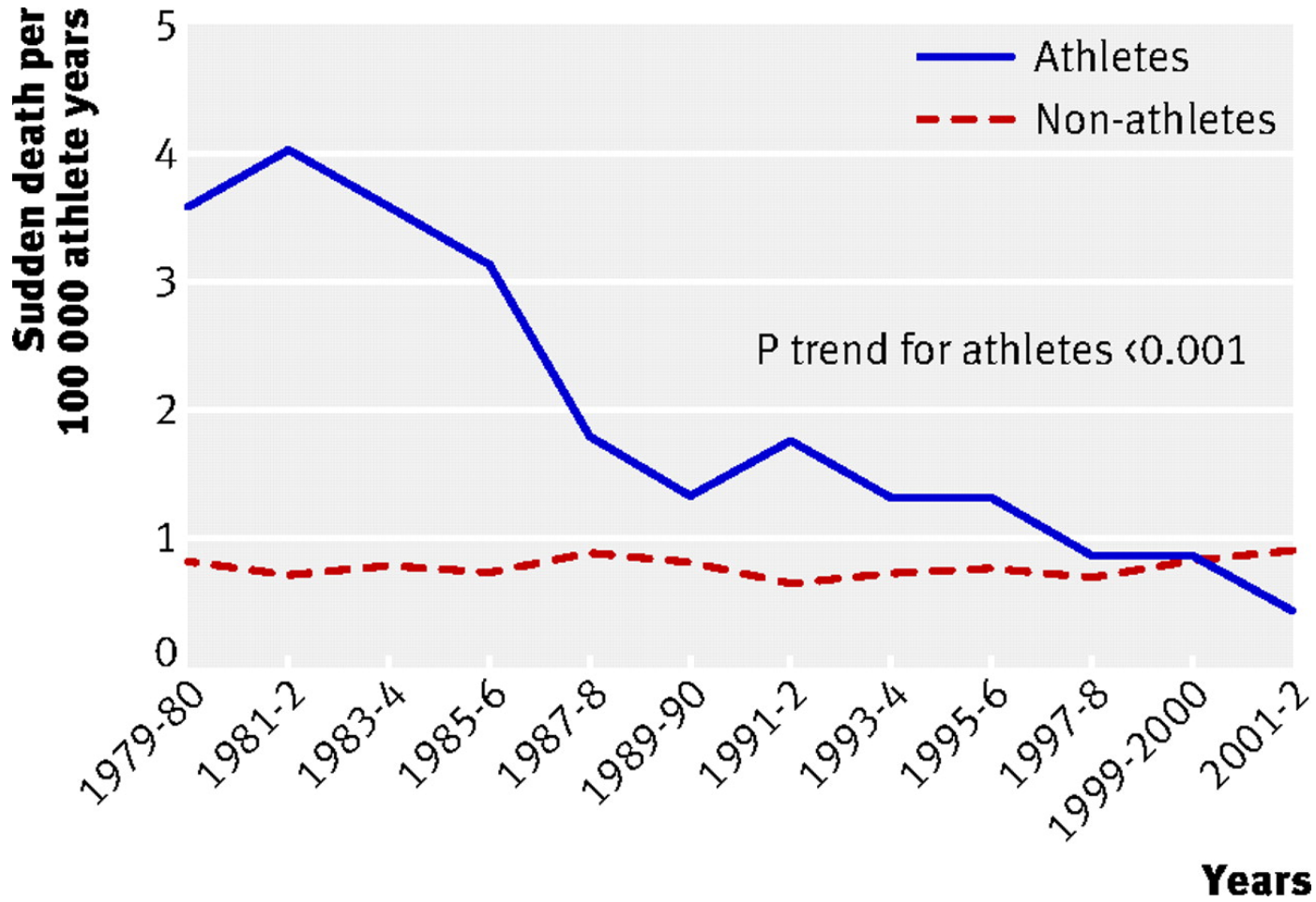
*Endorsed by the American College of Cardiology Foundation*

**Fig 2 Italian preparticipation screening protocol endorsed by International Olympic Committee, Federation Internationale de Football Association, European Football Associations, and European Society of Cardiology. Reproduced from Corrado et al6 with permission of the European Society of Cardiology**




**Papadakis, M. et al. BMJ 2008;337:a1596**

**Fig 3 Annual incidence of sudden cardiovascular death in screened competitive athletes compared with non-athletes in Veneto region, Italy, 1979-2004. Reproduced from Corrado et al17 with permission of JAMA**




**Papadakis, M. et al. BMJ 2008;337:a1596**

BMJ

# Aim

By using the large database of the Institute of Sports Medicine of Florence, Italy

To evaluate:

the **clinical usefulness** of a complete cardiovascular screening protocol that includes resting and exercise ECGs in a large cohort of sports participants

# Study population

30,065 sports participants

23,570 Males

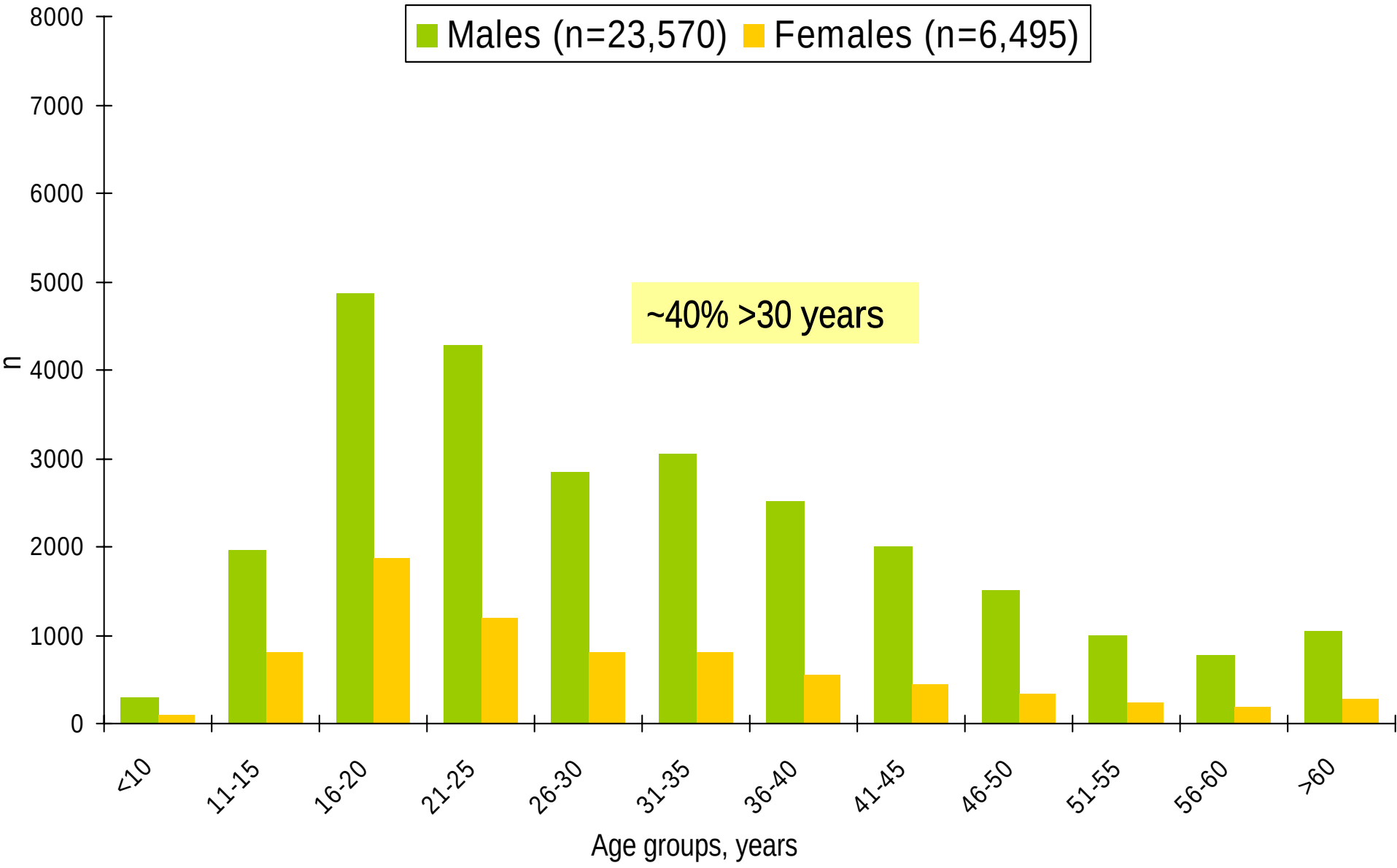
6,495 Females

Age: 30.7±14 years

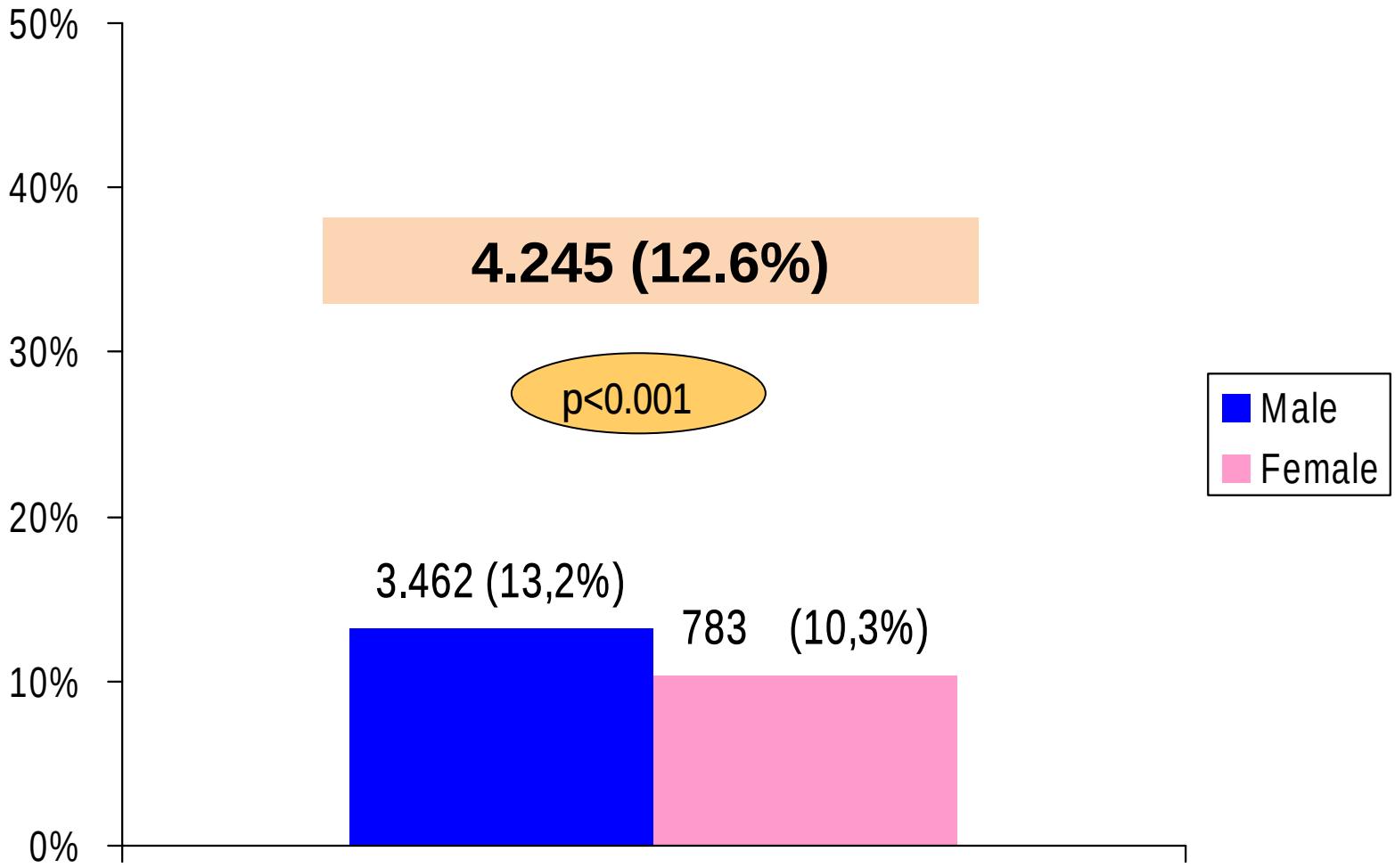
All subjects referred to the Institute of Sports Medicine of Florence, Italy to obtain eligibility to take part in competitive sports

- Personal and family history
- Physical examination
- Resting electrocardiogram
- Exercise electrocardiogram

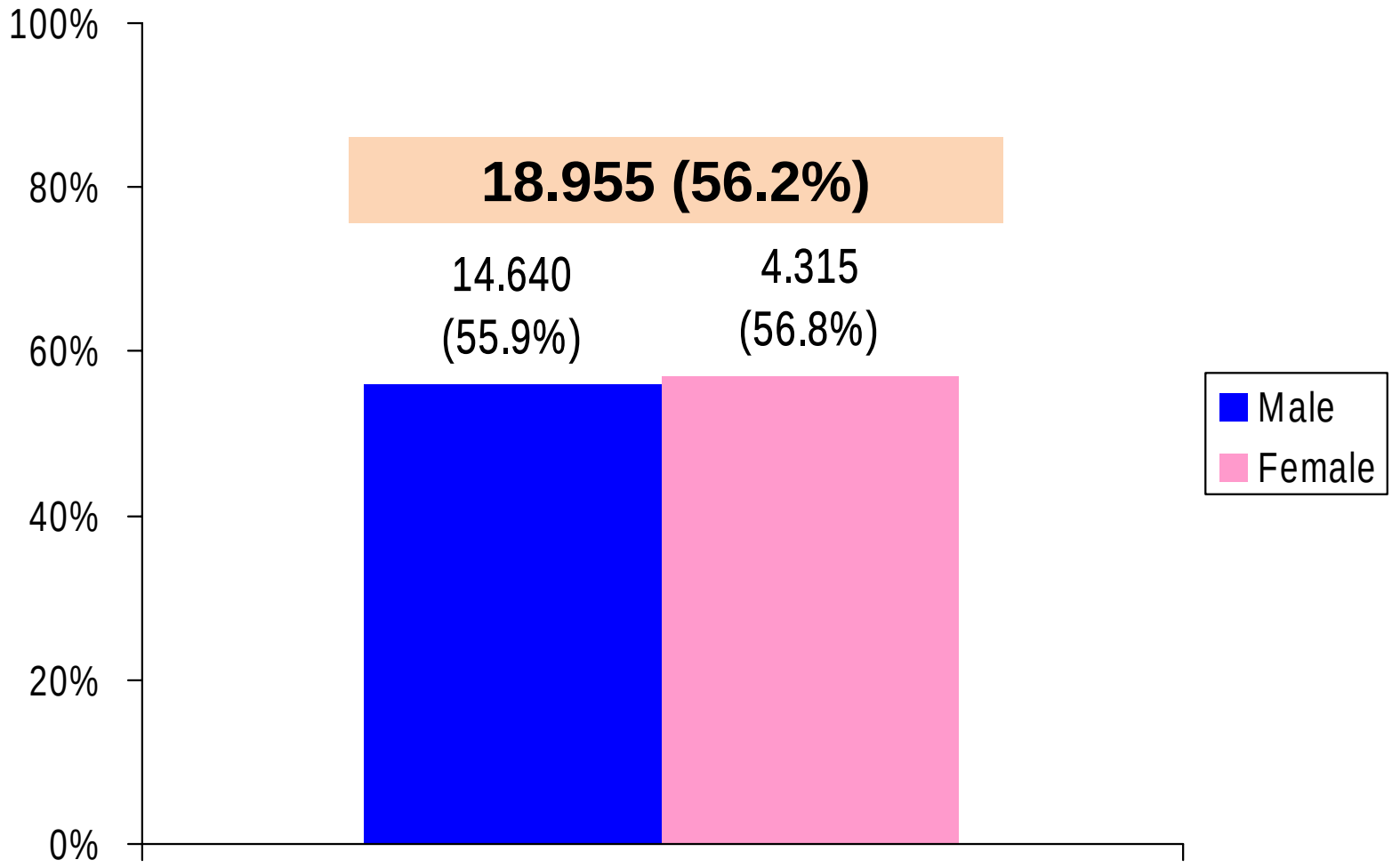
# Age distribution of the study population (n=30,065)



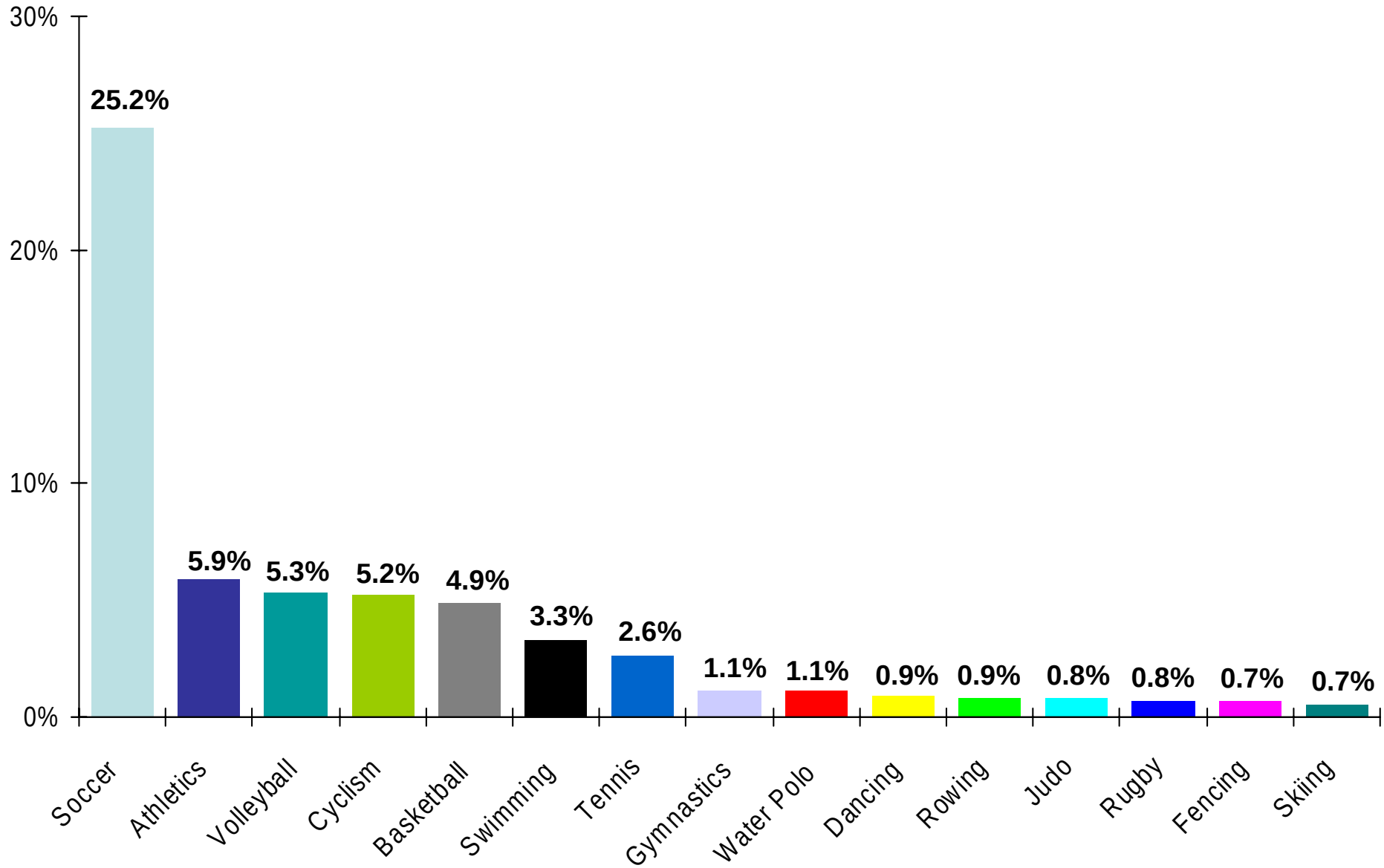
# Smokers



# Sedentary workers



# Type of sport practised (n=30,065)



# Resting electrocardiogram

| | All (n=30,065) | Males (n=23,576) | Females (n=6,495) | p |
|---|---|---|---|---|
| Normal, n (%) | 28,253 (94) | 22,000 (93.3) | 6,253 (96.3) | <0.0001 |
| PVBs, n (%) | 120 (0.4) | 95 (0.4) | 25 (0.4) | 0.9 |
| PSVBs, n (%) | 30 (0.1) | 24 (0.1) | 6 (0.09) | 0.9 |
| PEP, n (%) | 27 (0.09) | 21 (0.09) | 6 (0.09) | 0.7 |
| First-degree AVB, n (%) | 30 (0.1) | 24 (0.1) | 6 (0.09) | 0.9 |
| Second-degree AVB, n (%) | 3 (0.01) | 3 (0.01) | - | - |
| LABB, n (%) | 6 (0.02) | 5 (0.02) | 1 (0.01) | 0.8 |
| RBBB, n (%) | 331 (1.1) | 306 (1.3) | 25 (0.4) | < 0.0001 |
| Sinus bradycardia, n (%) | 872 (2.9) | 754 (3.29 | 118 (1.8) | < 0.0001 |
| Incomplete RBBB, n (%) | 210 (0.7) | 189 (0.8) | 21 (0.3) | < 0.0001 |
| ERP, n (%) | 21 (0.07) | 19 (0.08) | 2 (0.03) | 0.2 |
| ST-T alterations, n (%) | 150 (0.5) | 118 (0.5) | 32 (0.5) | 0.9 |
| Wandering PM, n (%) | 3 (0.01) | 3 (0.01) | - | - |
| Junctional rhythm, n (%) | 3 (0.01) | 3 (0.01) | - | - |
| Atrial fibrillation, n (%) | 6 (0.02) | 6 (0.03) | - | - |

# Resting electrocardiogram

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| PEP, n (%) | 27 (0.09) | 21 (0.09) | 6 (0.09) | 0.7 |
| AVB type I, n (%) | 30 (0.1) | 24 (0.1) | 6 (0.09) | 0.9 |
| AVB type II, n (%) | 3 (0.01) | 3 (0.01) | - | - |
| LABB, n (%) | 6 (0.02) | 5 (0.02) | 1 (0.01) | 0.8 |
| RBBB, n (%) | 331 ( | | 25 (0.4) | < 0.0001 |
| Sinus bradycardia, n (%) | 8 | | 118 (1.8) | < 0.0001 |
| Incomplete RBBB, n (%) | 210 ( | | 21 (0.3) | < 0.0001 |
| ERP, n (%) | 21 (0.07) | 19 (0.08) | 2 (0.03) | 0.2 |
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n=1,464
(> 80%)

# Resting electrocardiogram

| | All (n=30,065) | Males (n=23,576) | Females (n=6,495) | p |
|---|---|---|---|---|
| Normal, n (%) | 28,253 (94) | 22,000 (93.3) | 6,253 (96.3) | <0.0001 |
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| Second-degree AVB, n (%) | 3 ( | | - | - |
| LABB, n (%) | 6 | | 1 (0.01) | 0.8 |
| RBBB, n (%) | 331 (1.1) | | 25 (0.4) | < 0.0001 |
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| Wandering PM, n (%) | 3 (0.01) | 3 (0.01) | - | - |
| Junctional rhythm, n (%) | 3 (0.01) | 3 (0.01) | - | - |
| Atrial fibrillation, n (%) | 6 (0.02) | 6 (0.03) | - | - |

n=348 (1.2%)
~50% >30 years

# Exercise electrocardiogram

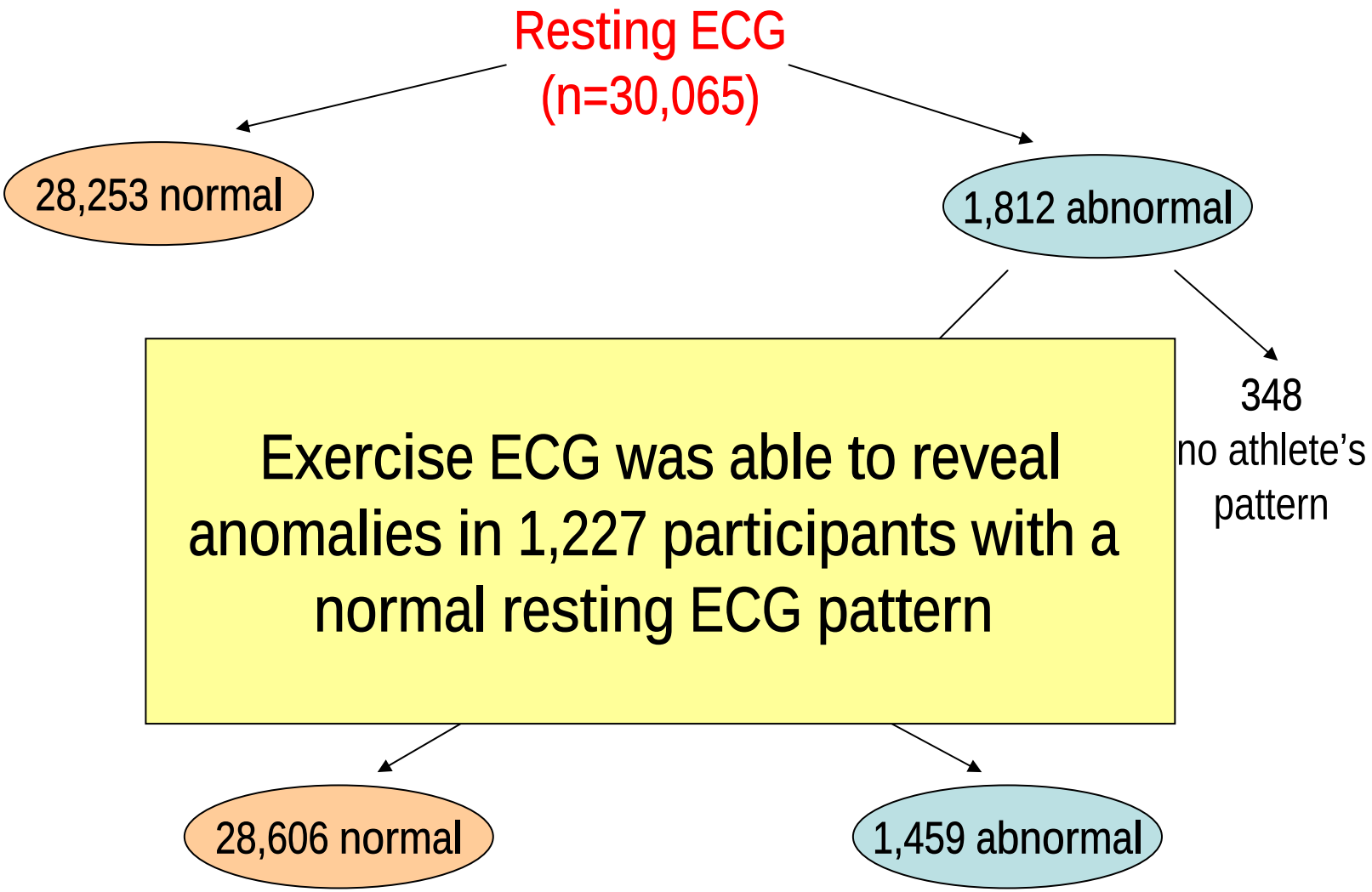
| | All (n=30,065) | Males (n=23,576) | Females (n=6,495) | p |
|---|---|---|---|---|
| Normal, n (%) | 28,606 (95.1) | 22,632 (96) | 5,974 (92) | <0.0001 |
| Isolated PVBs, n (%) | 815 (2.7) | 524 (2.2) | 291 (4.5) | <0.0001 |
| Isolated PSVBs, n (%) | 467 (1.6) | 319 (1.4) | 148 (2.3) | <0.0001 |
| Paired PVBs, n (%) | 58 (0.2) | 33 (0.1) | 25 (0.4) | <0.0001 |
| Paired PSVBs, n (%) | 31 (0.1) | 14 (0.06) | 17 (0.3) | <0.0001 |
| NSTV, n (%) | 3 (0.01) | 2 (0.009) | 1 (0.01) | 0.6 |
| SVT, n (%) | 3 (0.01) | 2 (0.009) | 1 (0.01) | 0.6 |
| ST-T alterations, n (%) | 54 (0.2) | 26 (0.1) | 28 (0.4) | <0.0001 |
| AVB type II, n (%) | 8 (0.03) | 7 (0.03) | 1 (0.01) | 0.5 |
| RBBB, n (%) | 20 (0.07) | 11 (0.05) | 9 (0.1) | 0.01 |

# Exercise electrocardiogram

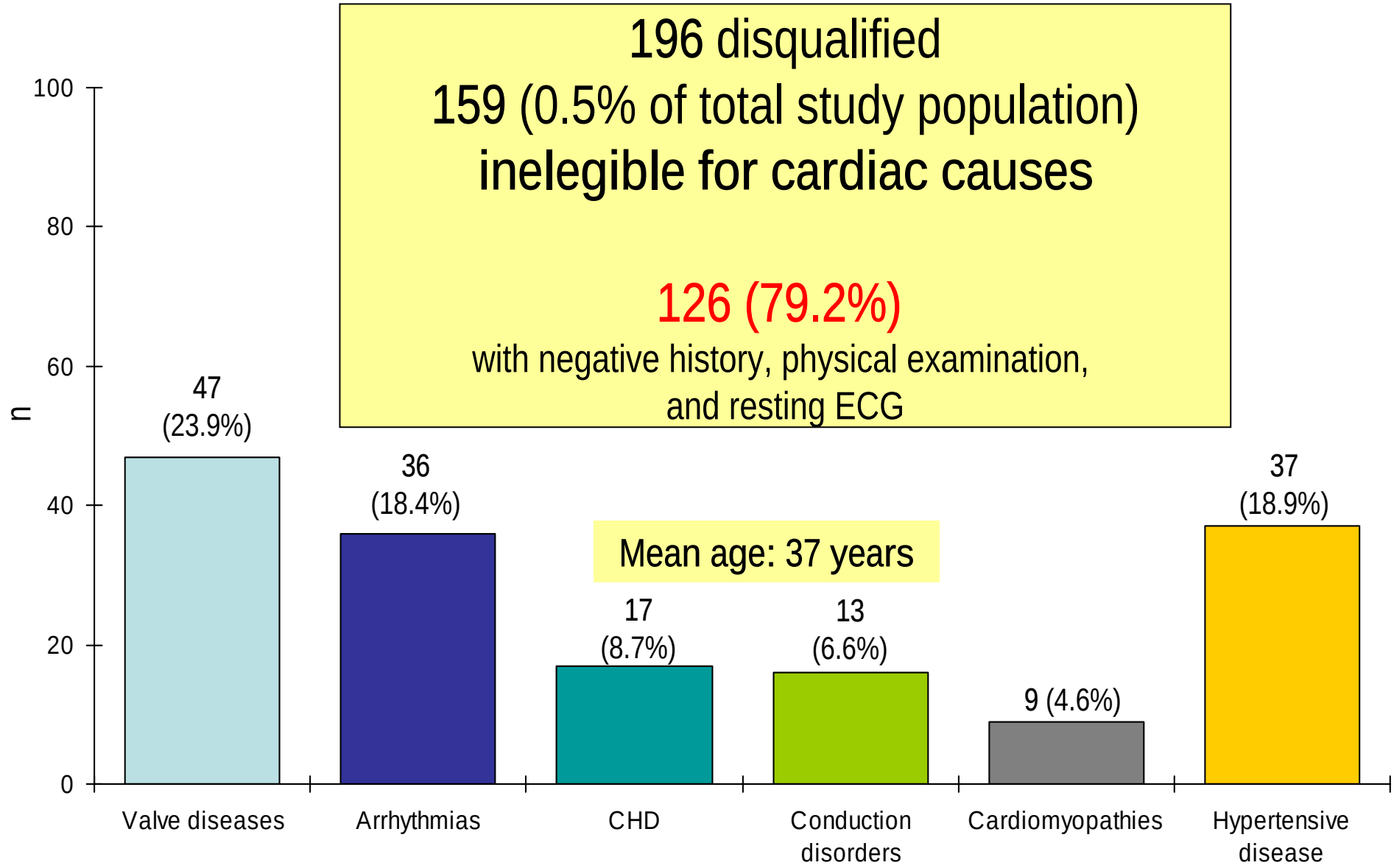
| | All (n=30,065) | Males (n=23,576) | Females (n=6,495) | p |
|---|---|---|---|---|
| Normal, n (%) | 28,606 (95.1) | 22,632 (96) | 5,974 (92) | <0.0001 |
| Isolated PVBs, n (%) | 815 (2.7) | 524 (2.2) | 291 (4.5) | <0.0001 |
| Isolated PSVBs, n (%) | 467 (1.6) | 319 (1.4) | 148 (2.3) | <0.0001 |
| Paired PVBs, n (%) | 58 (0.2) | | 25 (0.4) | <0.0001 |
| Paired PSVBs, n (%) | 31 | | 17 (0.3) | <0.0001 |
| NSTV, n (%) | 3 ( | | 1 (0.01) | 0.6 |
| SVT, n (%) | 3 (0.01) | | 1 (0.01) | 0.6 |
| ST-T alterations, n (%) | 54 (0.2) | 26 (0.1) | 28 (0.4) | <0.0001 |
| AVB type II, n (%) | 8 (0.03) | 7 (0.03) | 1 (0.01) | 0.5 |
| RBBB, n (%) | 20 (0.07) | 11 (0.05) | 9 (0.1) | 0.01 |

n=1,459 (4.9%)
~50% >30 years

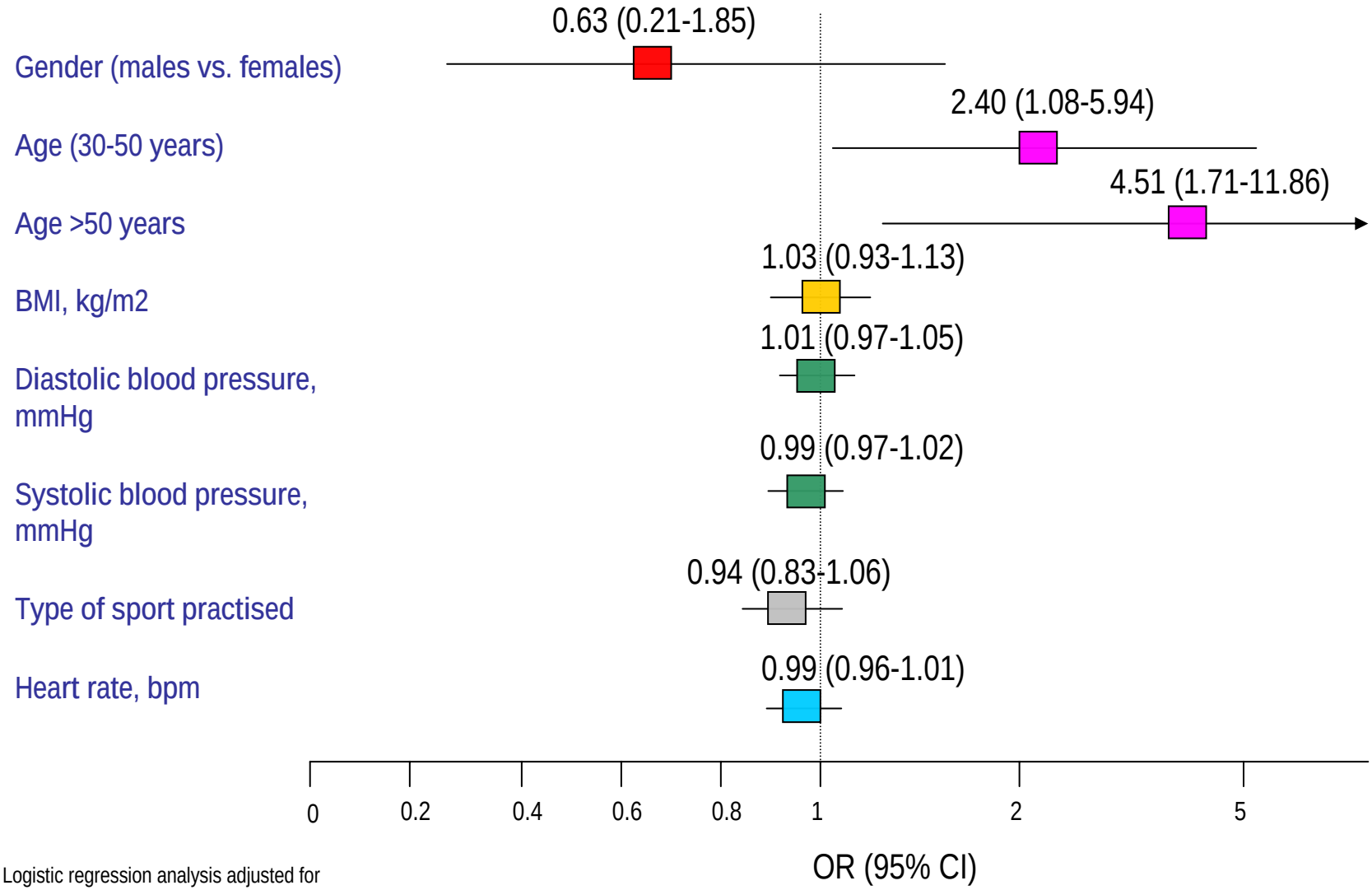
# Resting and exercise electrocardiograms



# Cardiac causes of disqualification (n=159)

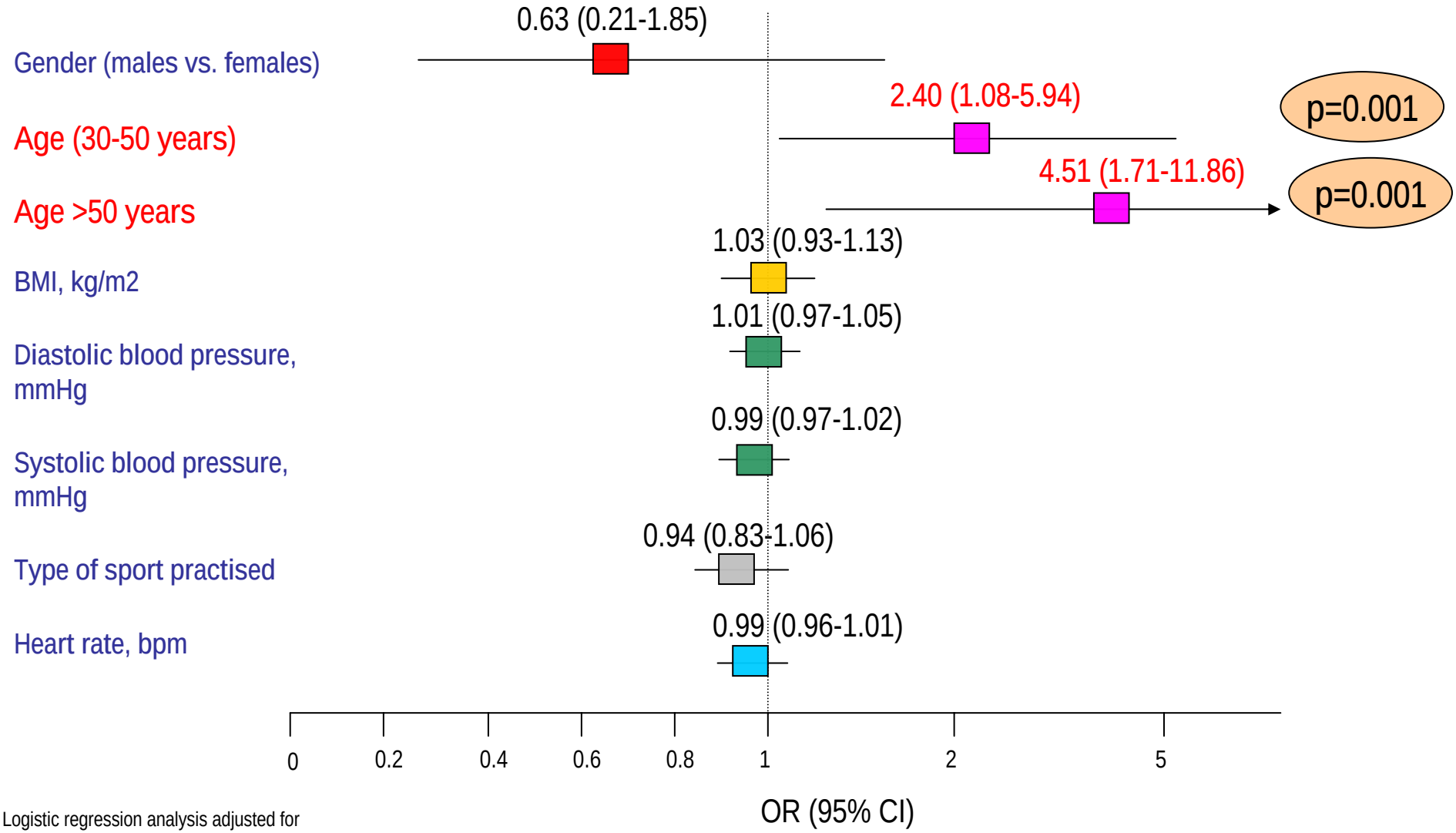


# Predictors of disqualification among athletes with a normal baseline ECG pattern




Logistic regression analysis adjusted for gender, age groups, BMI, blood pressure, smoking habit

# Predictors of disqualification among athletes with a normal baseline ECG pattern




Logistic regression analysis adjusted for gender, age groups, BMI, blood pressure, smoking habit

# Conclusions

- Although only preliminary and not supported by follow-up analyses, findings from this cross sectional study support the inclusion of resting and exercise ECGs to detect cardiac abnormalities among people taking part in competitive sports, especially those who are middle aged and older
- Indeed, a consistent proportion of subjects disqualified for cardiac disorders showed innocent or negative findings on resting ECG pattern, but clear pathological alterations on exercise ECG
- Further studies are needed to confirm these results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RESEARCH

# Cardiovascular evaluation, including resting and exercise electrocardiography, before participation in competitive sports: cross sectional study

Francesco Sofi, clinical researcher,[1] Andrea Capalbo, specialist in sports medicine,[1,2] Nicola Pucci, specialist in sports medicine,[1,2] Jacopo Giuliattini, specialist in sports medicine,[2] Francesca Condino, software engineering technician,[2] Flavio Alessandri, specialist in sports medicine and vice director of the institute of sports medicine,[2] Rosanna Abbate, full professor of internal medicine,[1] Gian Franco Gensini, full professor of internal medicine,[1,2,3,4] Sergio Califano, specialist in sports medicine and director of the institute of sports medicine[2]

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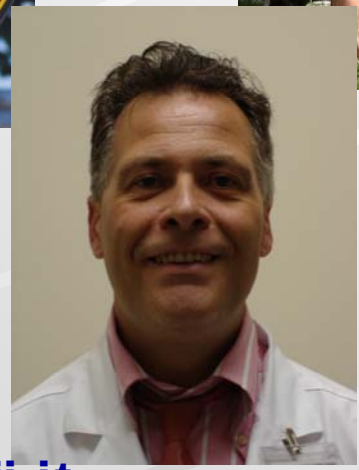
# GRAZIE A TUTTI I COLLABORATORI

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