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Should There be a Pre-Participation Screening for Athletes: The European Perspective

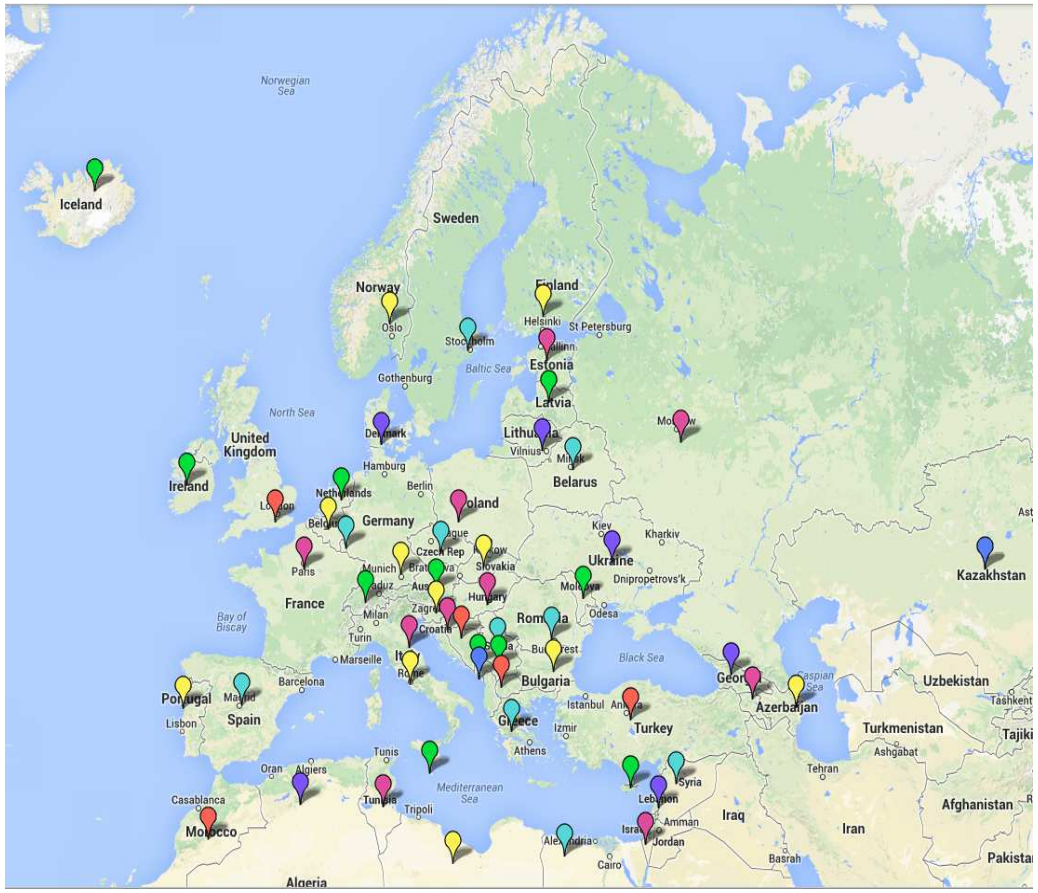
Prof. Josef Niebauer MD, PhD, MBA

Internal Medicine, Cardiology, and Sports Medicine Specialist

European Perspective:
Define *Europe* ?

European Union

European Society of Cardiology Member Countries



Pre-participations screening mandatory for FIFA Soccer World Championship 2006

„… if Foe had been seen by a sports cardiologist, the disease would have been recognized … “, says a FIFA physician ...

Sudden cardiac death: Athletes < 35 years

	Italy [%]	US [%]
Arrhythmogenic RV dysplasia (ARVD)	23	3
Coronary anomalies	12	12
Hypertrophic obstructive CM (HOCM)	2	32

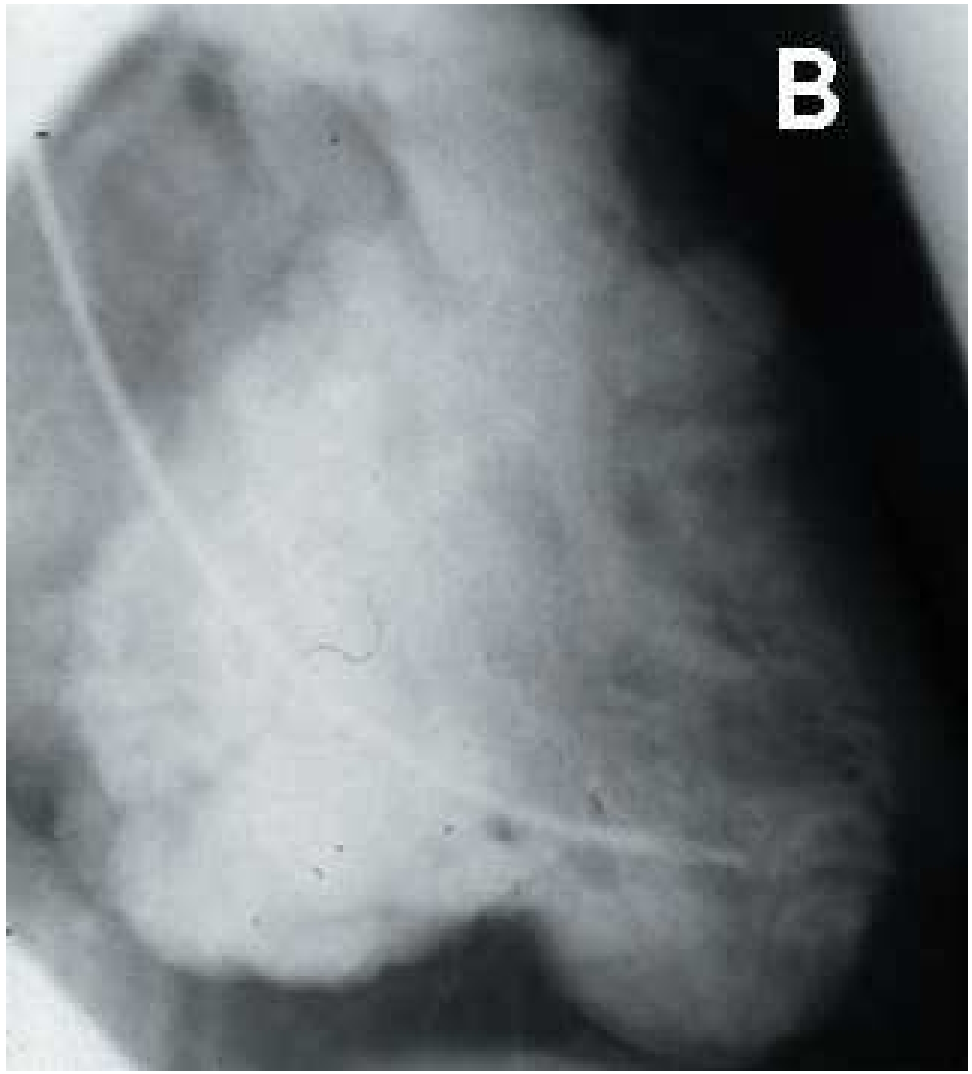
ARVD: Fatty and fibro-fatty infiltration of the right ventricle

Wichter T et al., Dtsch Z Sportmed 2005;56:118-125.

ARVD: RV-Angiogram

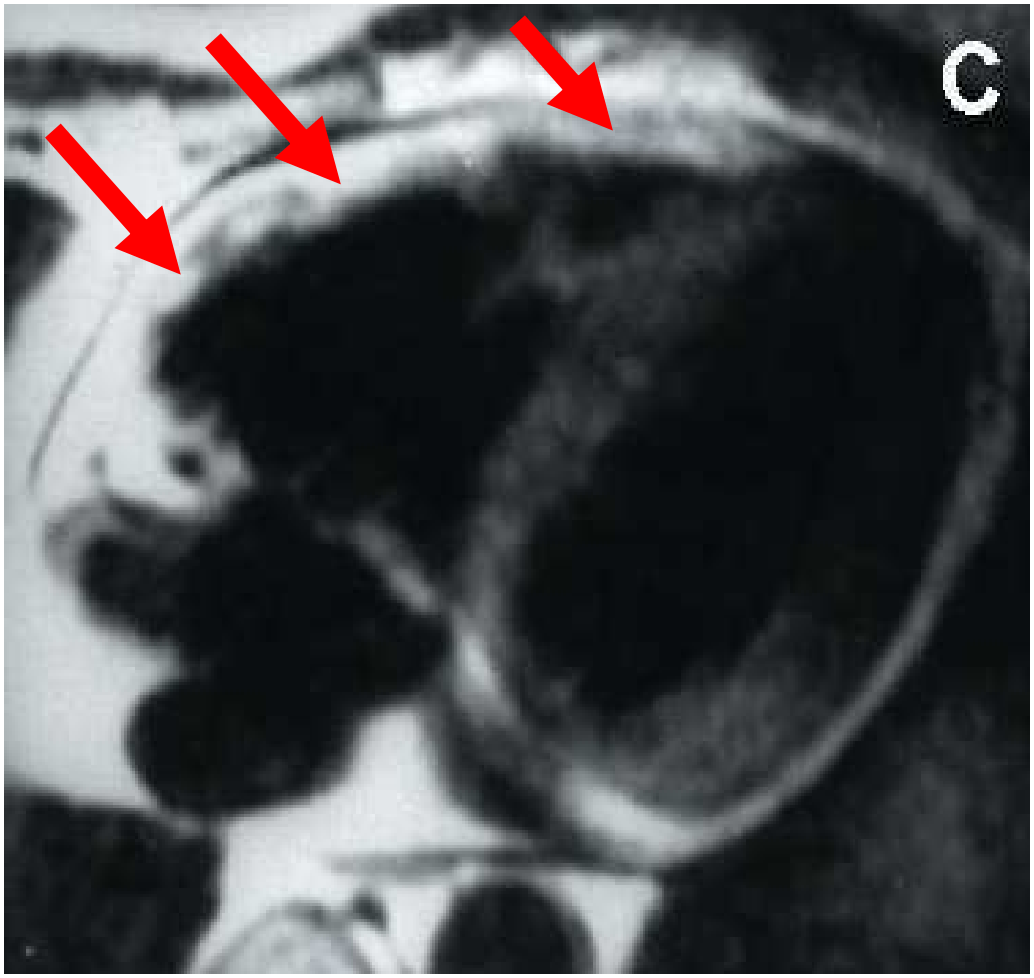
Right ventricular dysfunction :

- **severe dilatation and reduction of RV ejection fraction with little or no LV impairment**
- **localized RV aneurysms**
- **severe segmental dilatation of the RV**



Wichter T et al., Dtsch Z Sportmed 2005;56:118-125.

ARVD: MRI



Increased signal intensity of the free wall of the right ventricle

Wichter T et al., Dtsch Z Sportmed 2005;56:118-125.

ARVD: ECG

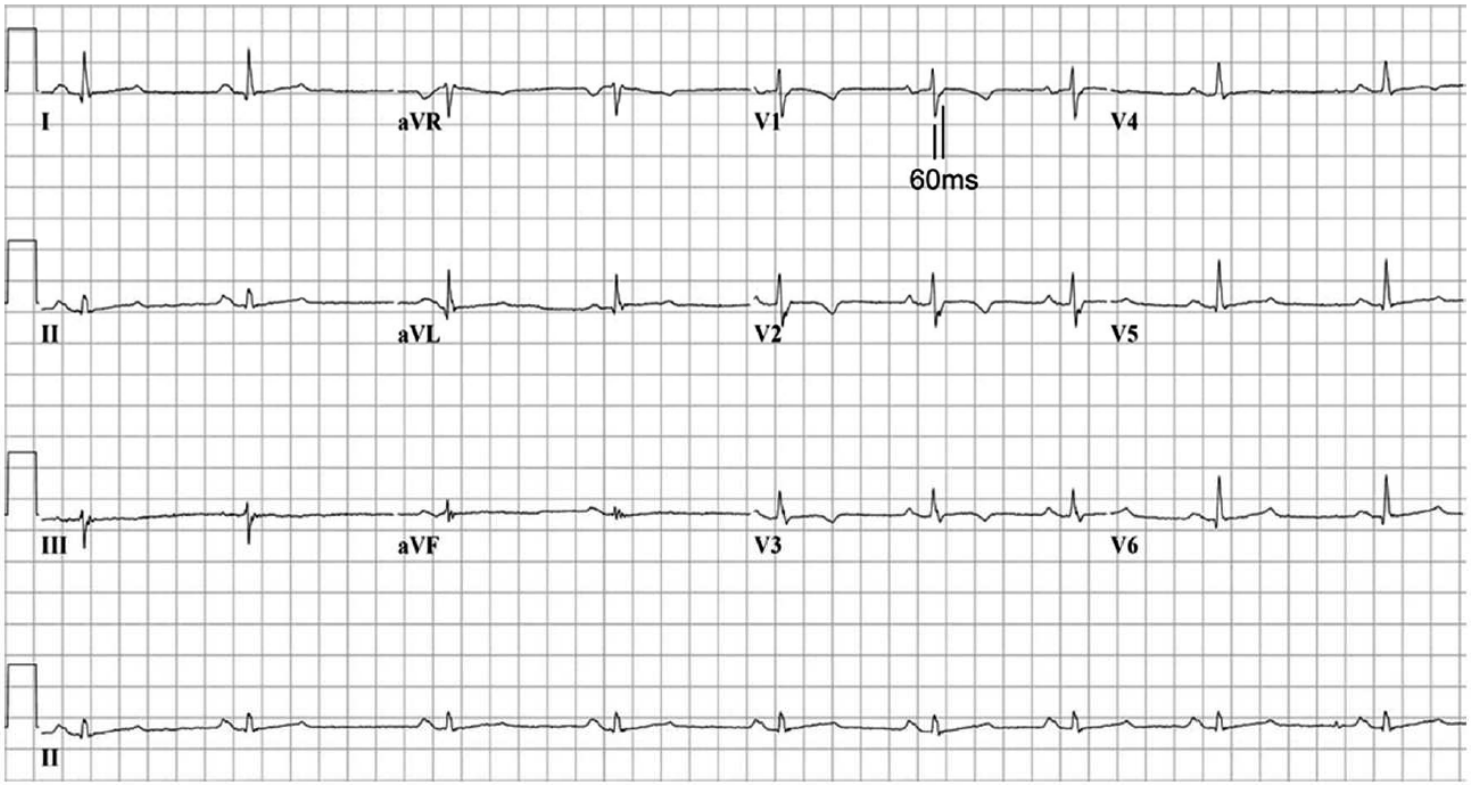
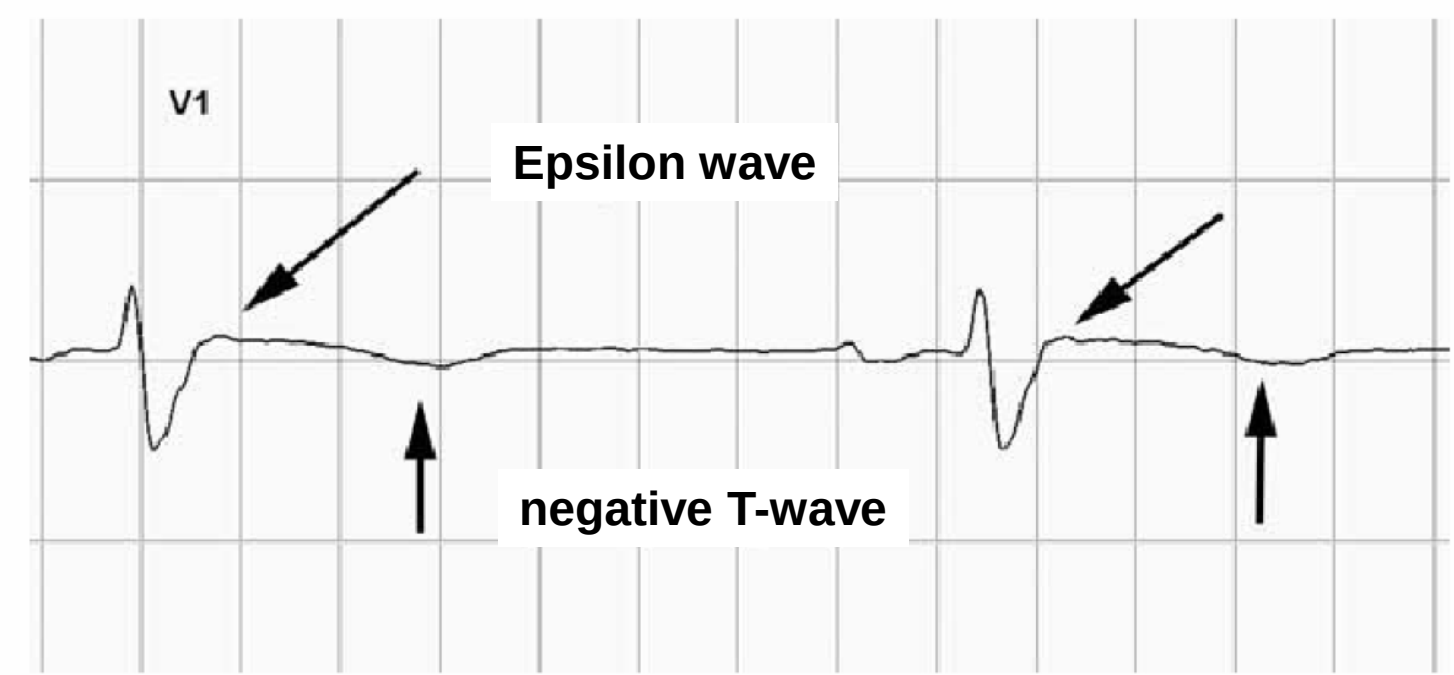


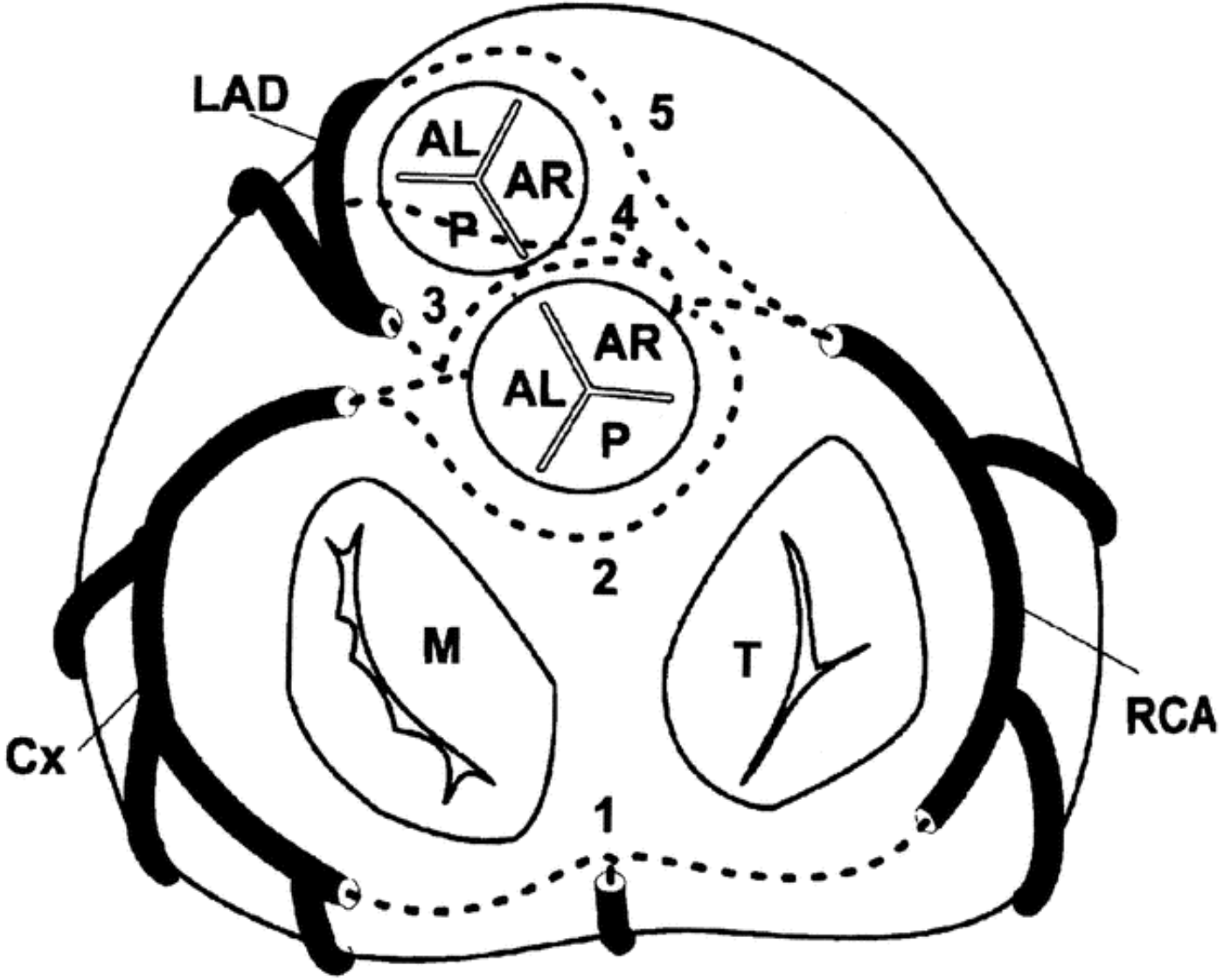
Figure 3. ECG from proband with T-wave inversion in V_1 through V_4 and prolongation of the terminal activation duration ≥55 ms measured from the nadir of the S wave to the end of the QRS complex in V_1. Contributed by M.G.P.J. Cox, Utrecht, the Netherlands.

Marcus FI et al., Circulation 2010;121:1533-1541

ARVD: ECG



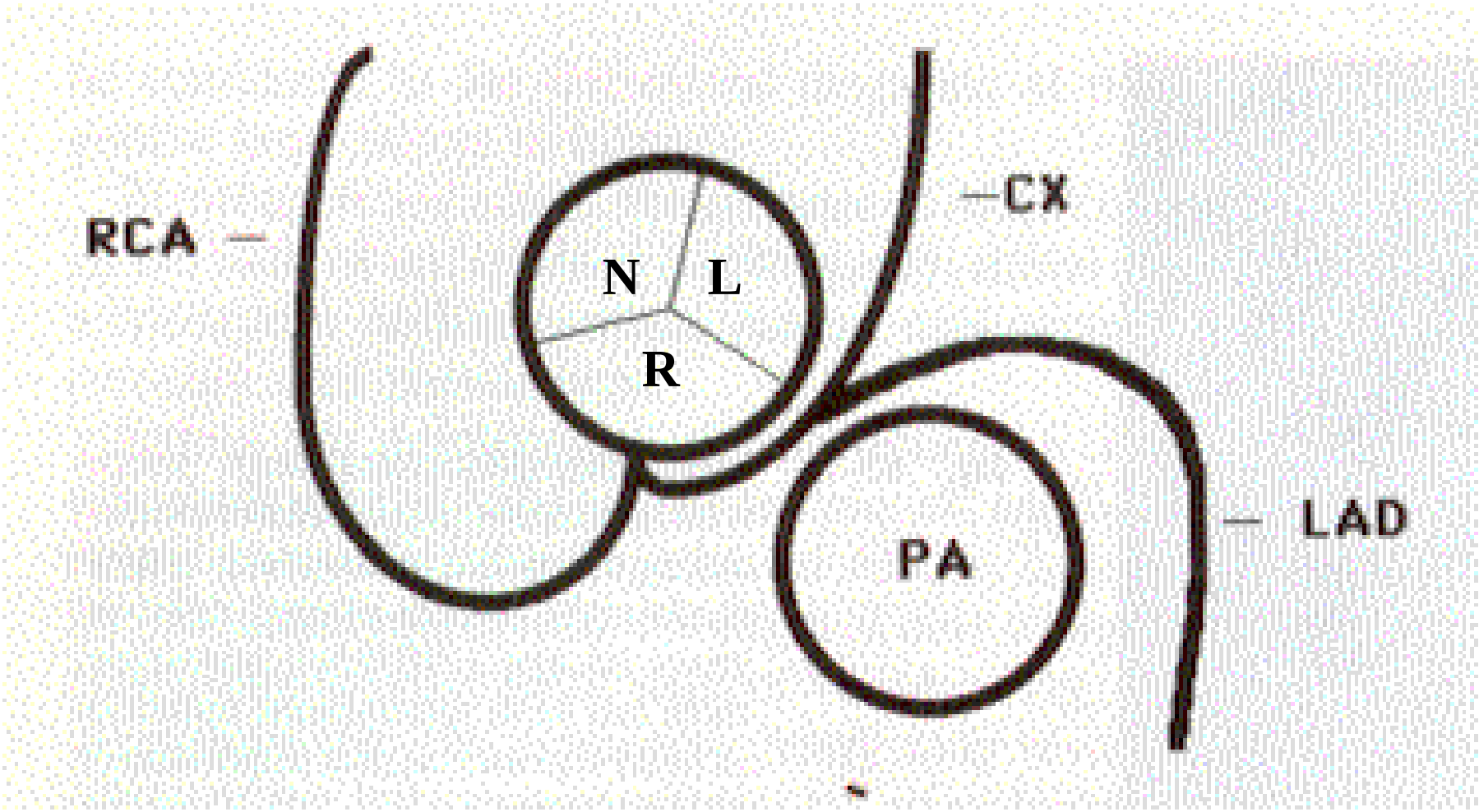
Coronary Artery Anomalies



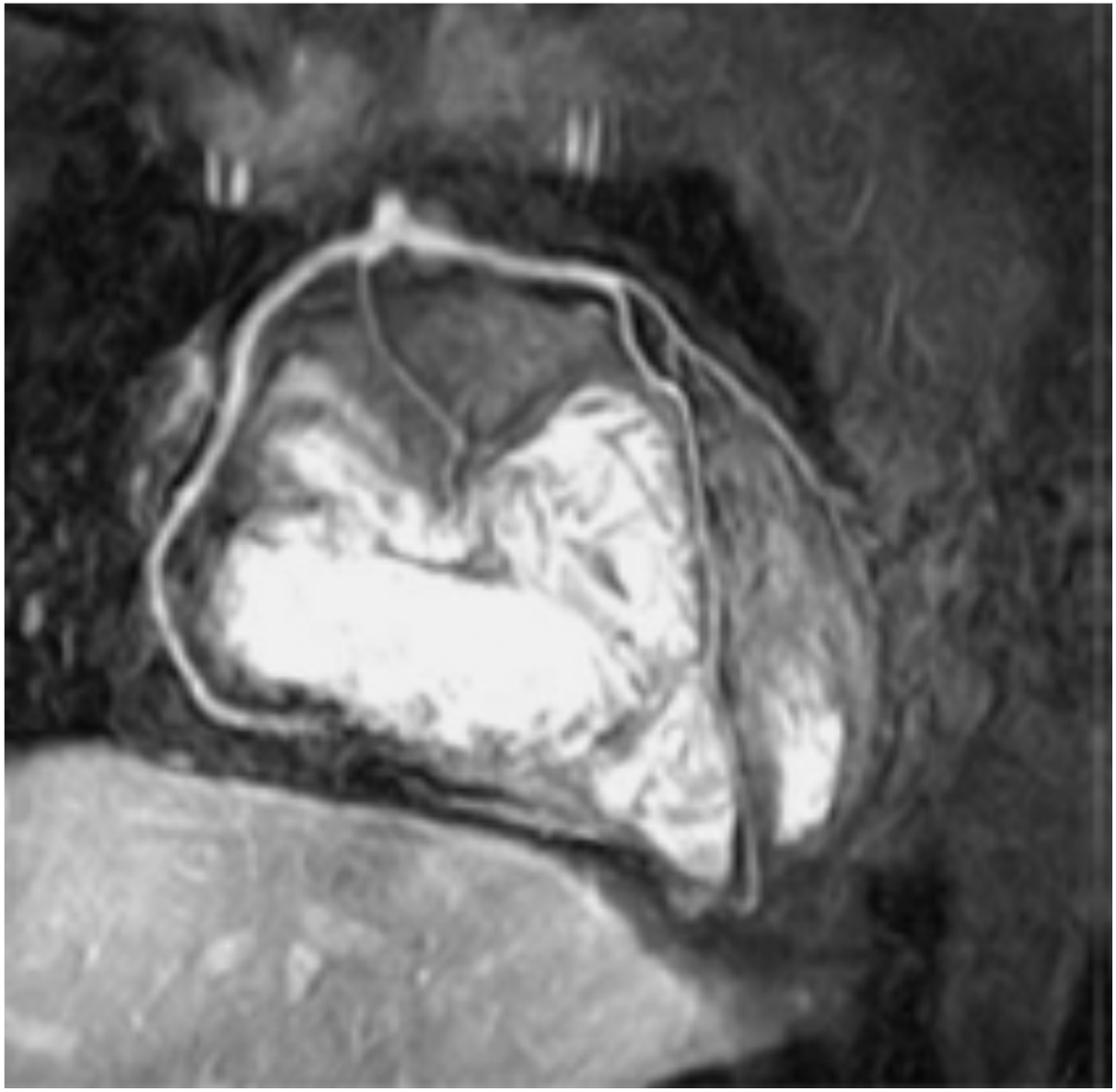
Conceptual diagram that shows most of the possible paths (1 through 5) by which the RCA, left anterior descending artery (LAD), and circumflex artery (Cx) can potentially connect with the opposite coronary cusps. Paths: 1, Retrocardiac; 2, retroaortic; 3, preaortic, or between the aorta and pulmonary artery; 4, intraseptal (supracristal); 5, prepulmonary (precardiac). AL indicates antero-left; AR, antero-right; P, posterior; M, mitral valve; and T, tricuspid valve.

From: Angelini: Circulation, Volume 115(10).March 13, 2007.1296-1305

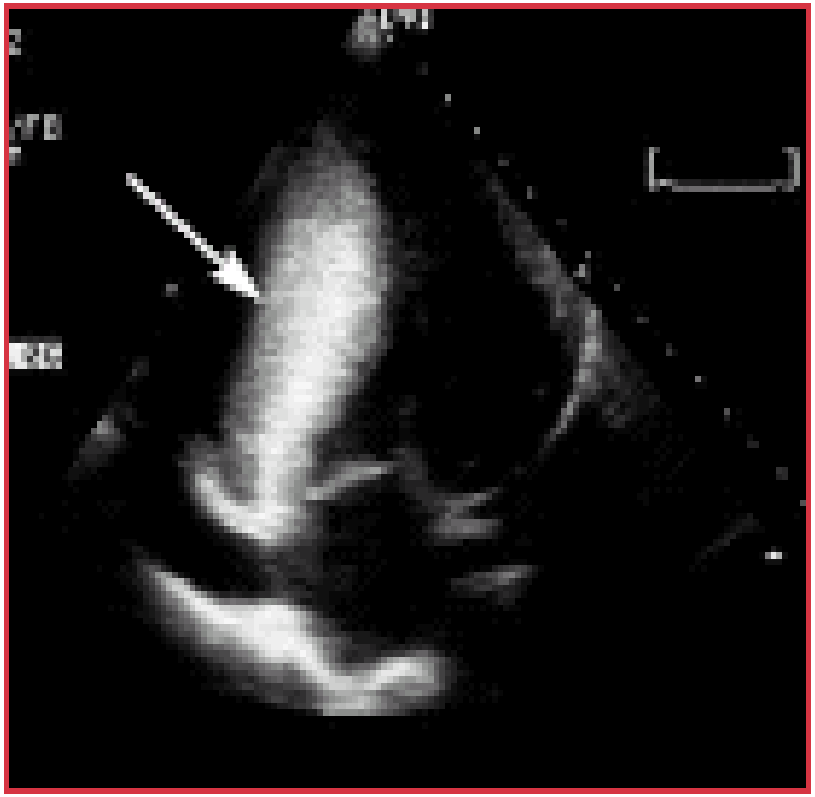
Coronary Artery Anomalies



Coronary Artery Anomalies:
Left from the right

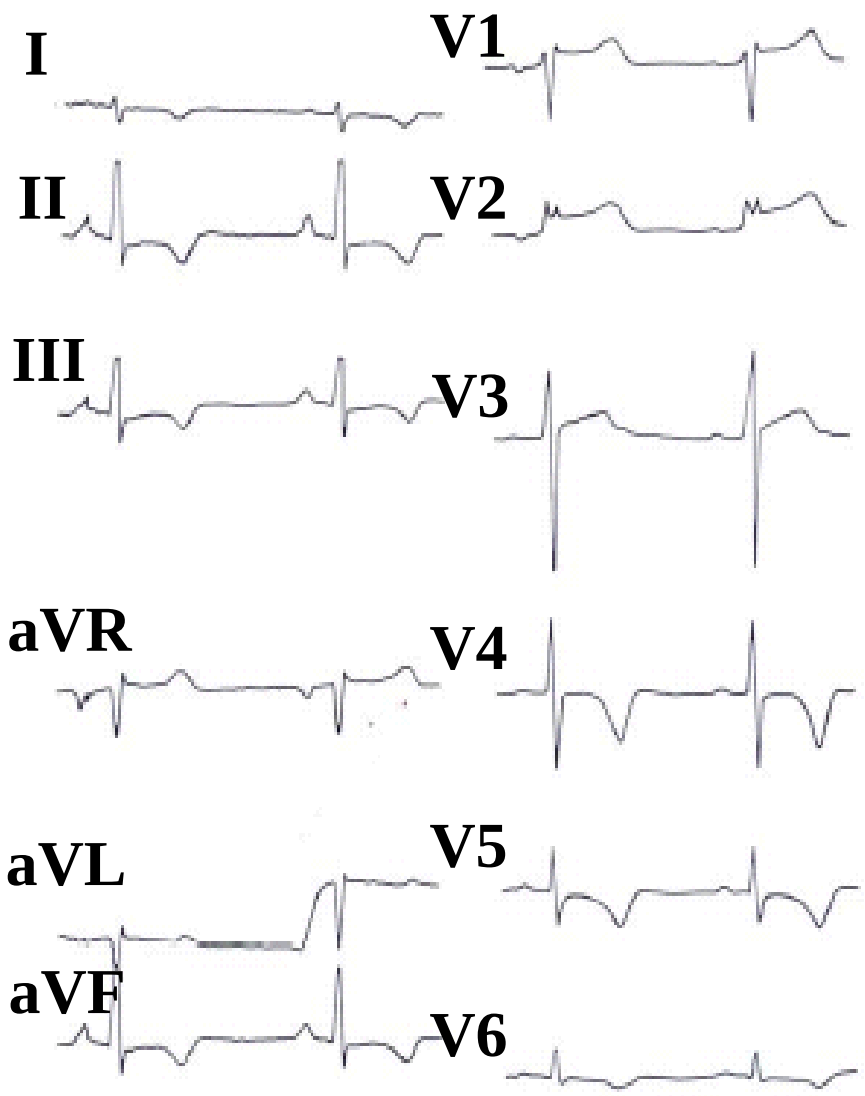


Hypertrophic Cardiomyopathy

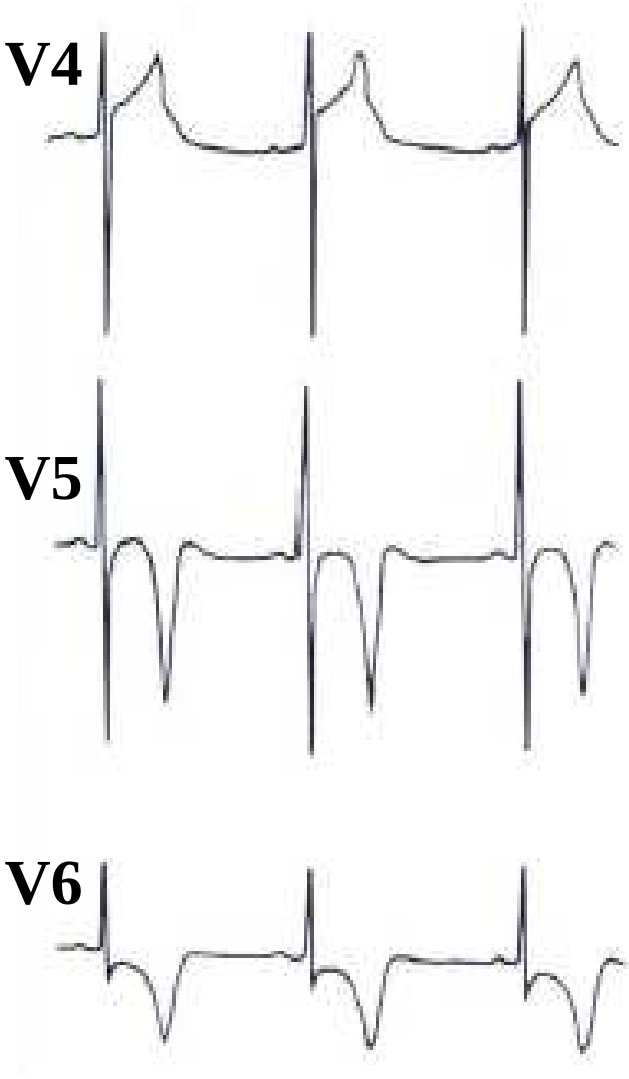


Ashley & Niebauer (eds.), Cardiology explained, Remedica 2004

Hypertrophic Cardiomyopathy



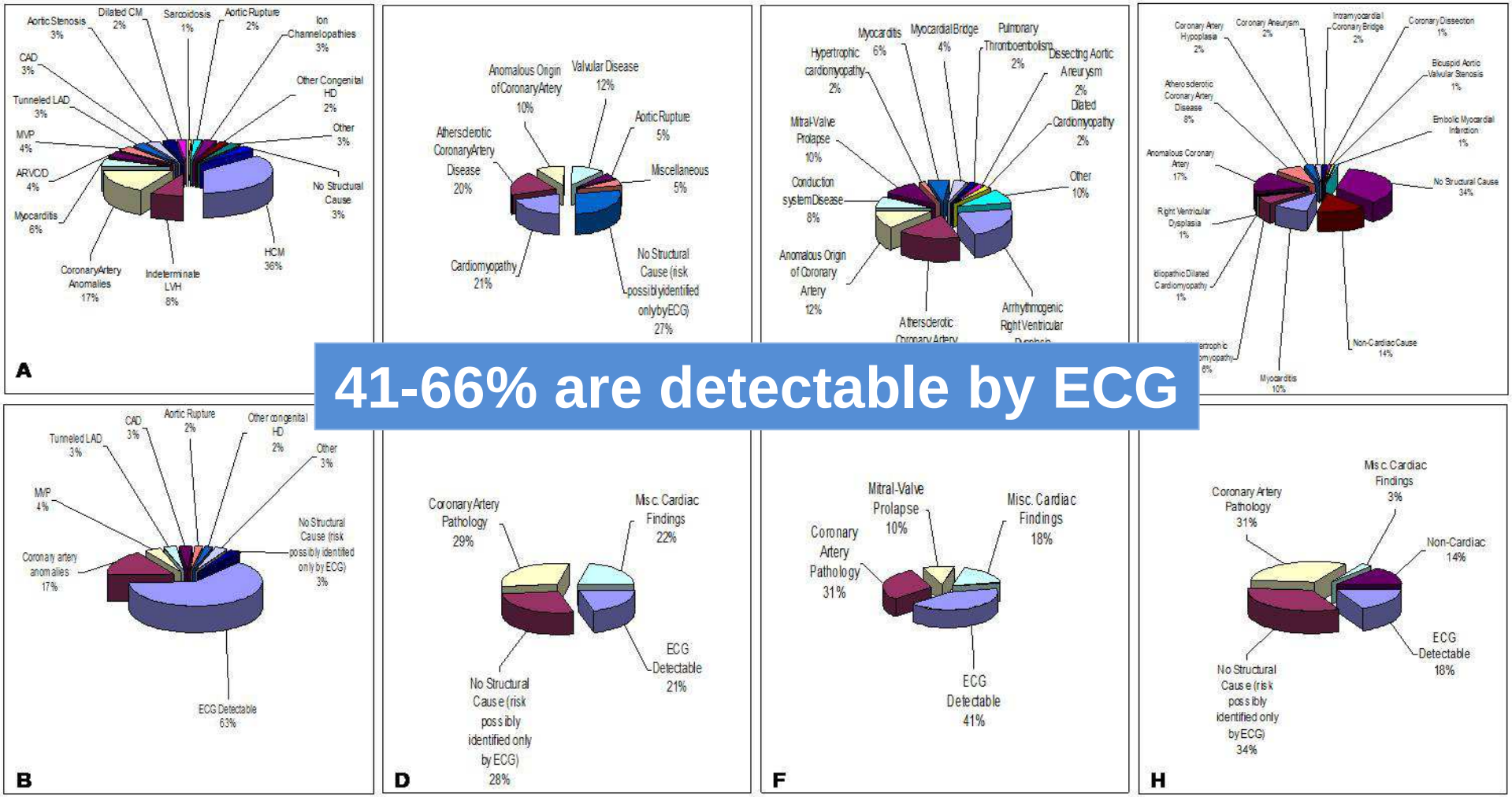
rest



stress

AUTOPSY STUDIES OF SUDDEN DEATH IN ACTIVE YOUNG ADULTS

FOUR STUDIES REVIEWED

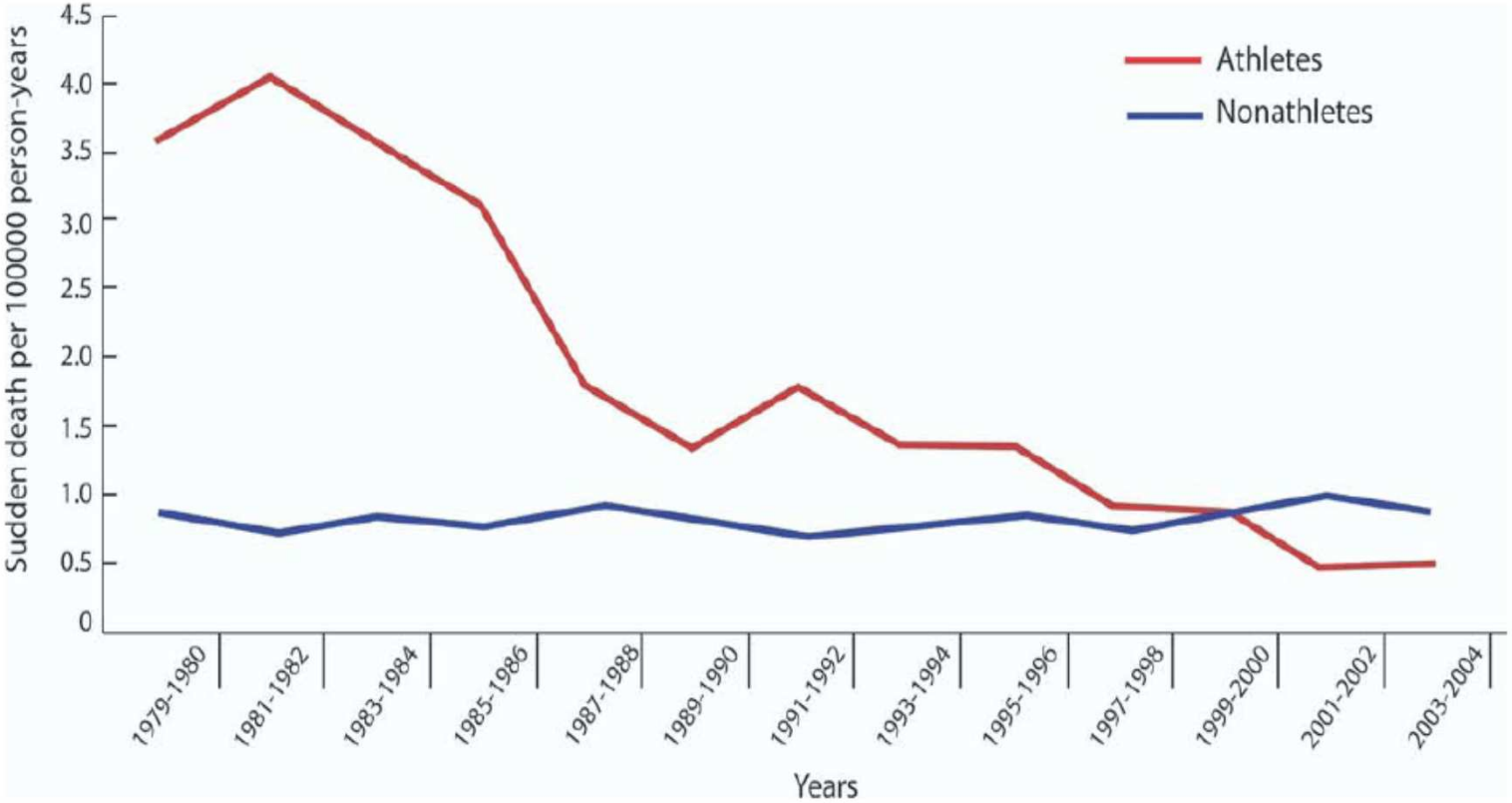


41-66% are detectable by ECG

Figure 1. **A**: Maron BJ et al. *Circulation*. 2007;115(12):1643-55. **B**: Data from A compiled to represent ECG detectable causes of death. **C**: Corrado D et al. *Cardiovascular Research*. 2001;50(2):399-408. **D**: Data from C compiled to represent ECG detectable causes of death. **E**: Corrado D et al. *N Eng J Med*. 1998;339(6):364-9. **F**: Data from E compiled to represent ECG detectable causes of death. **G**: Eckart RE et al. *Annals of Internal Medicine*. 2001;141(11)829-34. **H**: Data from G compiled to represent ECG detectable causes of death.

Hirzinger C, Froelicher V, Niebauer J. Trends Cardiovasc Med 2011;20:195-199

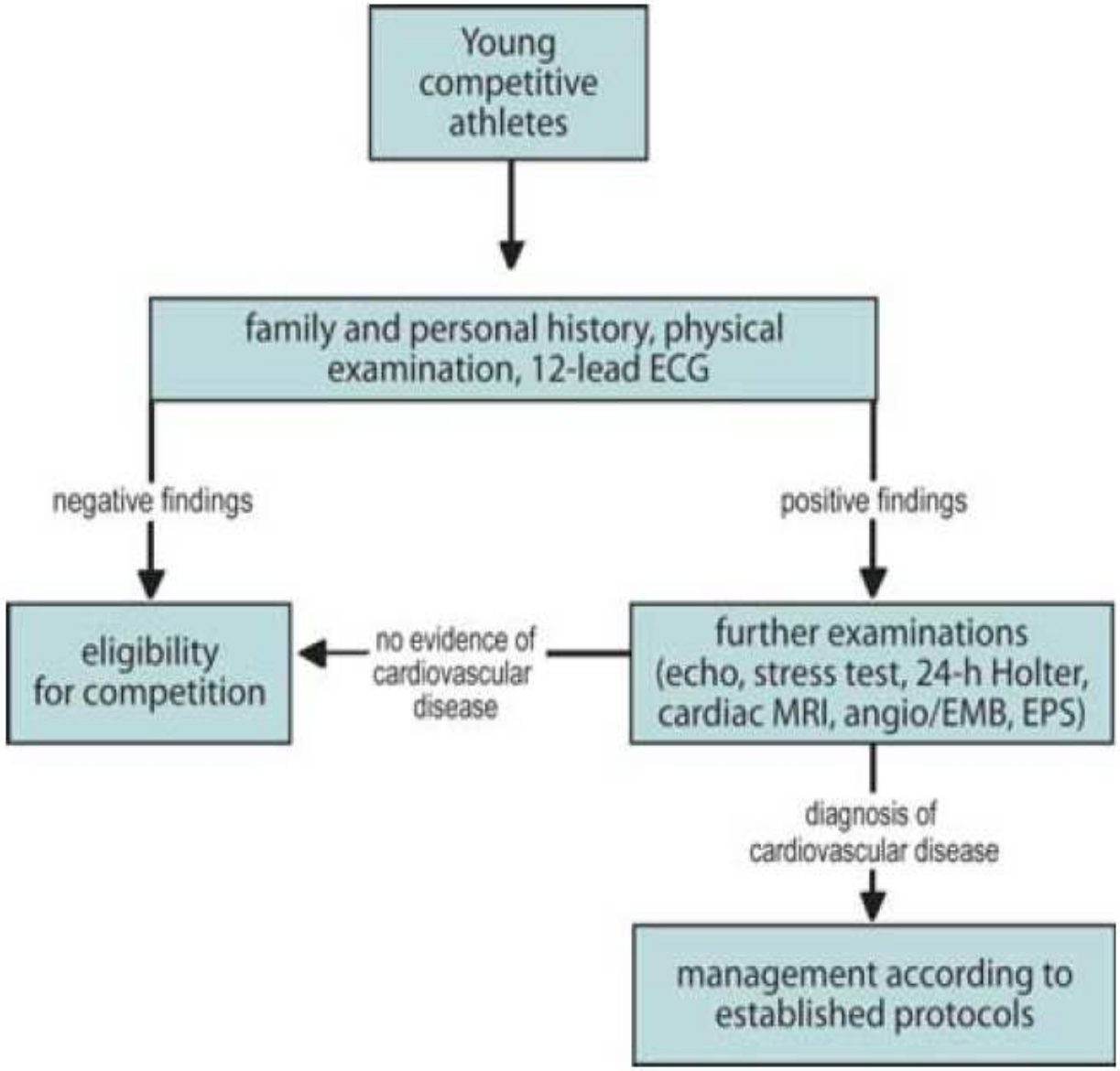
Figure. Annual Incidence Rates of Sudden Cardiovascular Death in Screened Competitive Athletes and Unscreened Nonathletes Aged 12 to 35 Years in the Veneto Region of Italy (1979-2004)



During the study period, the annual incidence of sudden cardiovascular death decreased by 89% in screened athletes (*P* for trend <.001). In contrast, the incidence rate of sudden cardiovascular death did not demonstrate consistent changes over time in unscreened nonathletes.

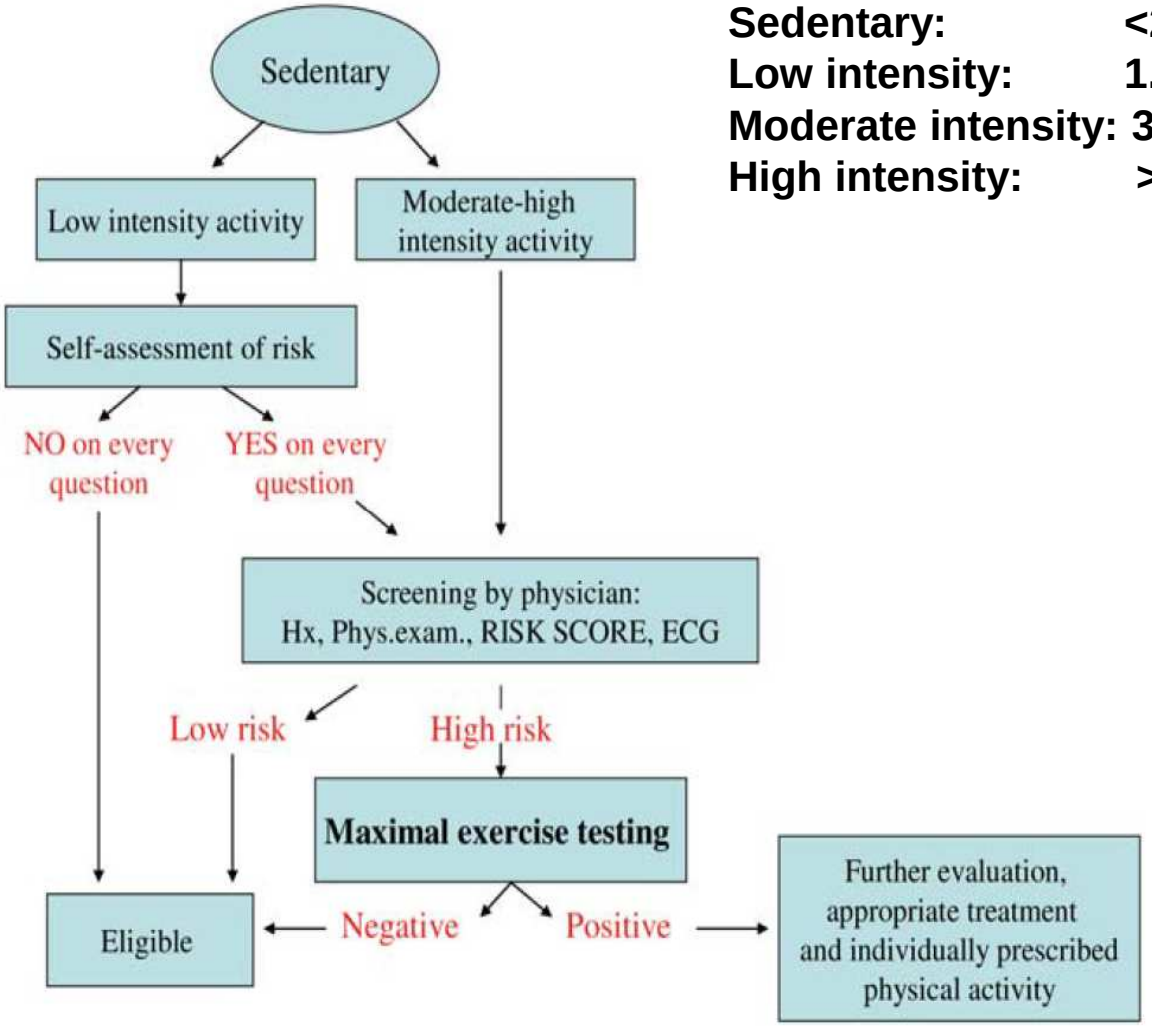
Corrado D et al., JAMA 2006;296:1593-1601

Pre-participation athletic screening of young competitive athletes in European countries



Corrado D et al., Eur Heart J 2011;32:934-944.

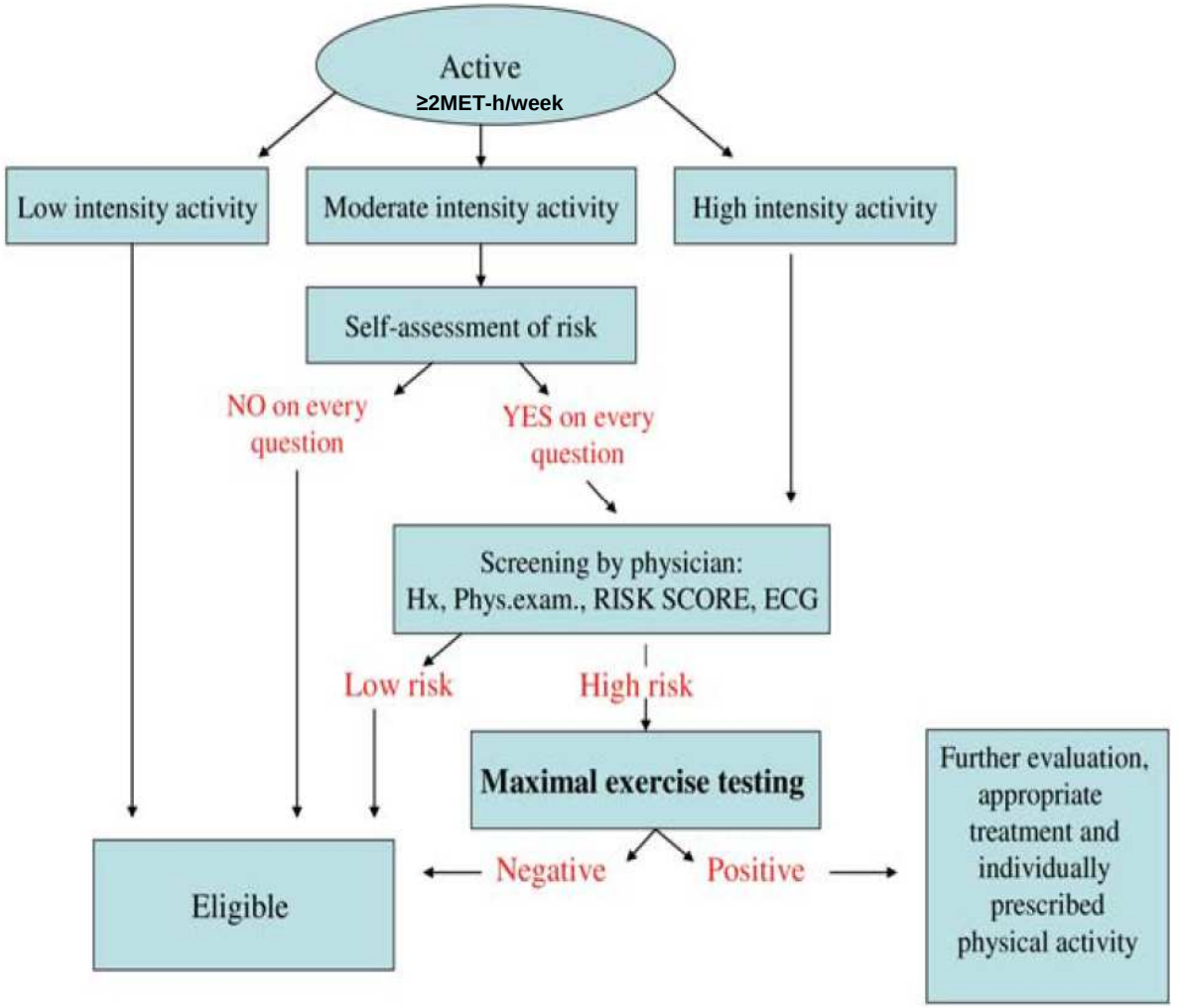
Preparticipation screening for sedentary middle-aged/senior individuals



Sedentary: **<2MET-h/week**
Low intensity: **1.8-2.9 METS**
Moderate intensity: **3-6 METs**
High intensity: **>6 METs**

Corrado D et al., Eur Heart J 2011;32:934-944.

Preparticipation screening for regularly active middle-aged/senior individuals



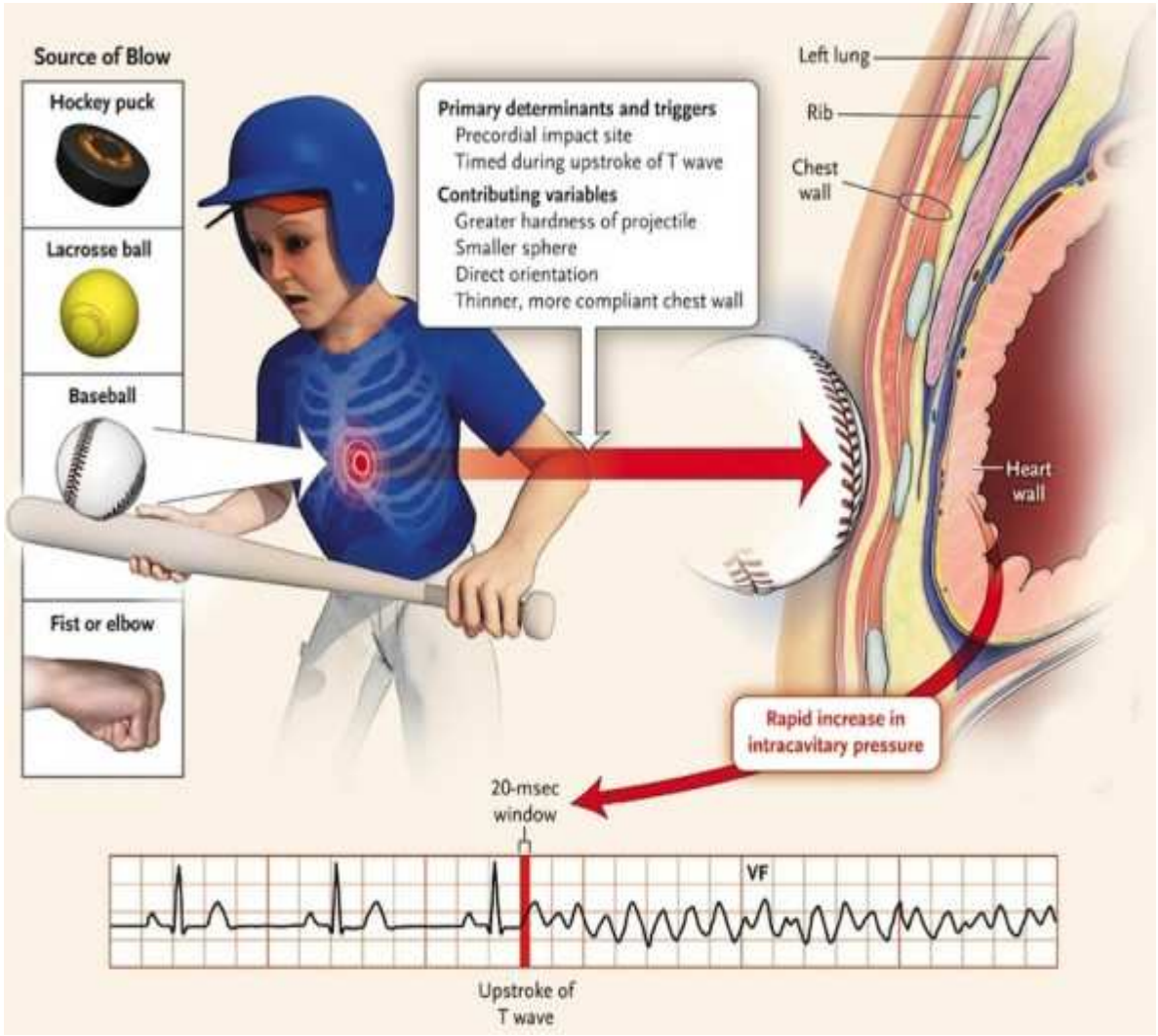
Corrado D et al., Eur Heart J 2011;32:934-944.

Pre-participation screening in European countries

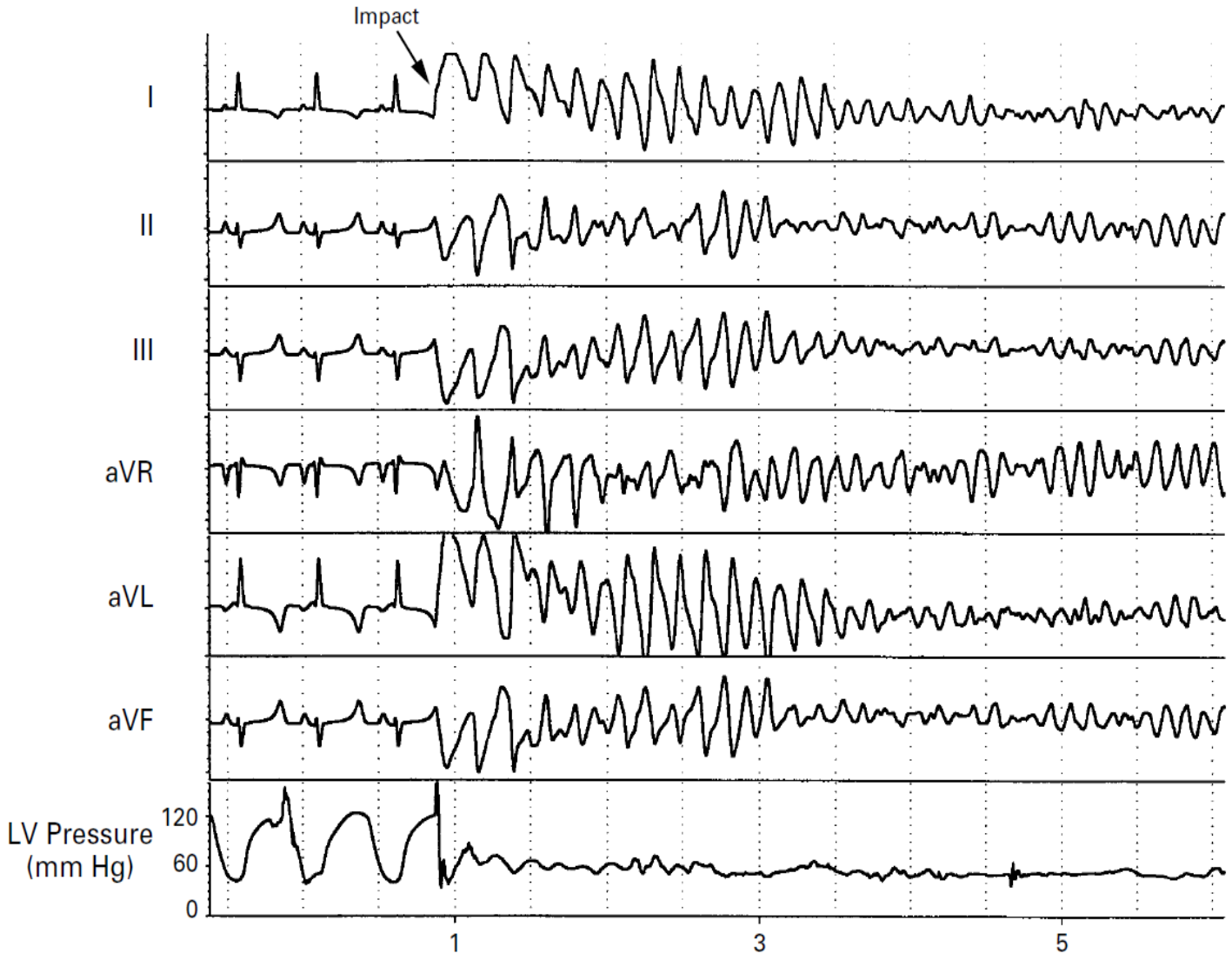
Country	Target athletic population	Screening protocol
Luxemburg	Competitive athletes of all sports	History, physical examination, ECG (required)
Sweden	Elite athletes of all sports	History, physical examination, ECG (recommended)
Norway	Professional football players	History, physical examination, ECG, echocardiography (required)
Germany	Elite athletes of all sports	History, physical examination, ECG, echocardiography, exercise testing (required)
Poland	Competitive athletes (age <23 years) of all sports and national team members	History, physical examination, ECG (required)
France	Professional athletes of all sports	History, physical examination, ECG, echocardiography, exercise testing (required)
	Competitive athletes of all sports	History, physical examination, ECG (recommended)
Scotland	Football, competitive athletes >16 years old	History, physical examination, ECG (required)
England	Competitive athletes	History, physical examination, ECG (required)
Greece	Competitive athletes of all sports	History, physical examination, ECG (recommended)
Belgium	Athletes of cycling and motocross sports	History, physical examination, ECG (required)
Spain	Competitive athletes of all sports	History, physical examination, ECG (recommended)
The Netherlands	Elite competitive athletes (age <35 years) of all sports	History, physical examination, ECG (required)
	Professional football players	History, physical examination, ECG, echocardiography (required)
	Elite athletes of cycling, motor and flying sports and diving	History, physical examination, ECG (required)

Corrado D et al., Eur Heart J 2011;32:934-944.

Commotio cordis

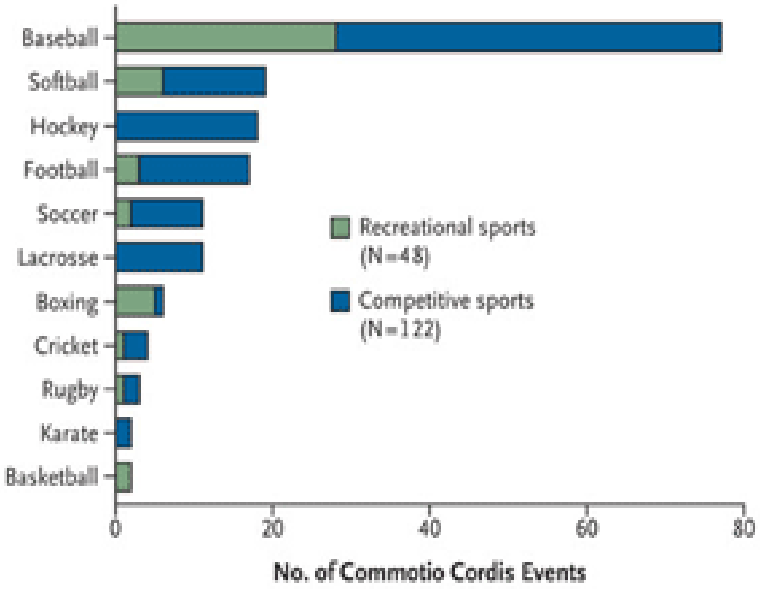


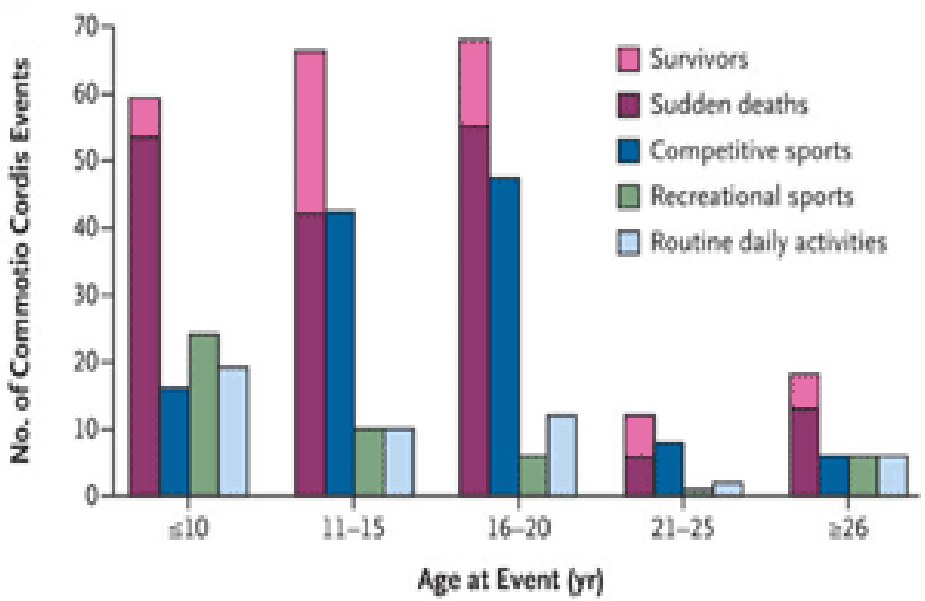
Commotio cordis



Link MS et al., NEJM 1998;338:1805-1811

Commotio cordis





Maron, B. Estes, M. NEJM 2010,362:10

Prevention through safety equipment

Prevention through on-site AICDs

Why isn’t an ECG mandatory in the USA ?

- **US medical-legal system: more likely to be sued, higher fines**
- **Huge distances: not enough specialists, especially in remote areas**
- **Financial resources, manpower, and logistics: not a healthcare priority**

Maron BJ et al., Circulation 2007

ECG and echocardiographic findings in 10–15-year-old elite athletes

Method:

Pre-participation screening in 343 youth elite athletes

Costs:

history and physical examination:	**€ 26.23**	**(US$37)**
12-lead resting ECG:	**€ 14.75**	**(US$21)**
Echocardiogram:	**€ 40.80**	**(US$58)**

Koch S et al., Eur J Prev Cardiol 2013; in press.

Anthropometrics

Age group (years)	Sex	*n*=343	%	Years of training	Hours of training (h/week)
10–11	MF	116	34	4.6 ± 2.0	5.9 ± 2.9
	M	58		5.3 ± 2.0	6.0 ± 3.2
	F	58		4.0 ± 1.8	5.7 ± 2.6
12–13	MF	191	56	4.7 ± 2.3	5.7 ± 2.8
	M	116		4.8 ± 2.3	5.8 ± 2.8
	F	75		4.6 ± 2.2	5.6 ± 2.8
14–15	MF	36	20	5.9 ± 3.4	13.7 ± 6.7
	M	15		4.8 ± 2.6	11.3 ± 8.1
	F	21		6.6 ± 3.8	14.8 ± 5.2

modified from Koch S et al., Eur J Prev Cardiol 2013; in press.

ECG and echocardiographic findings in 10–15-year-old elite athletes

Number needed to screen:

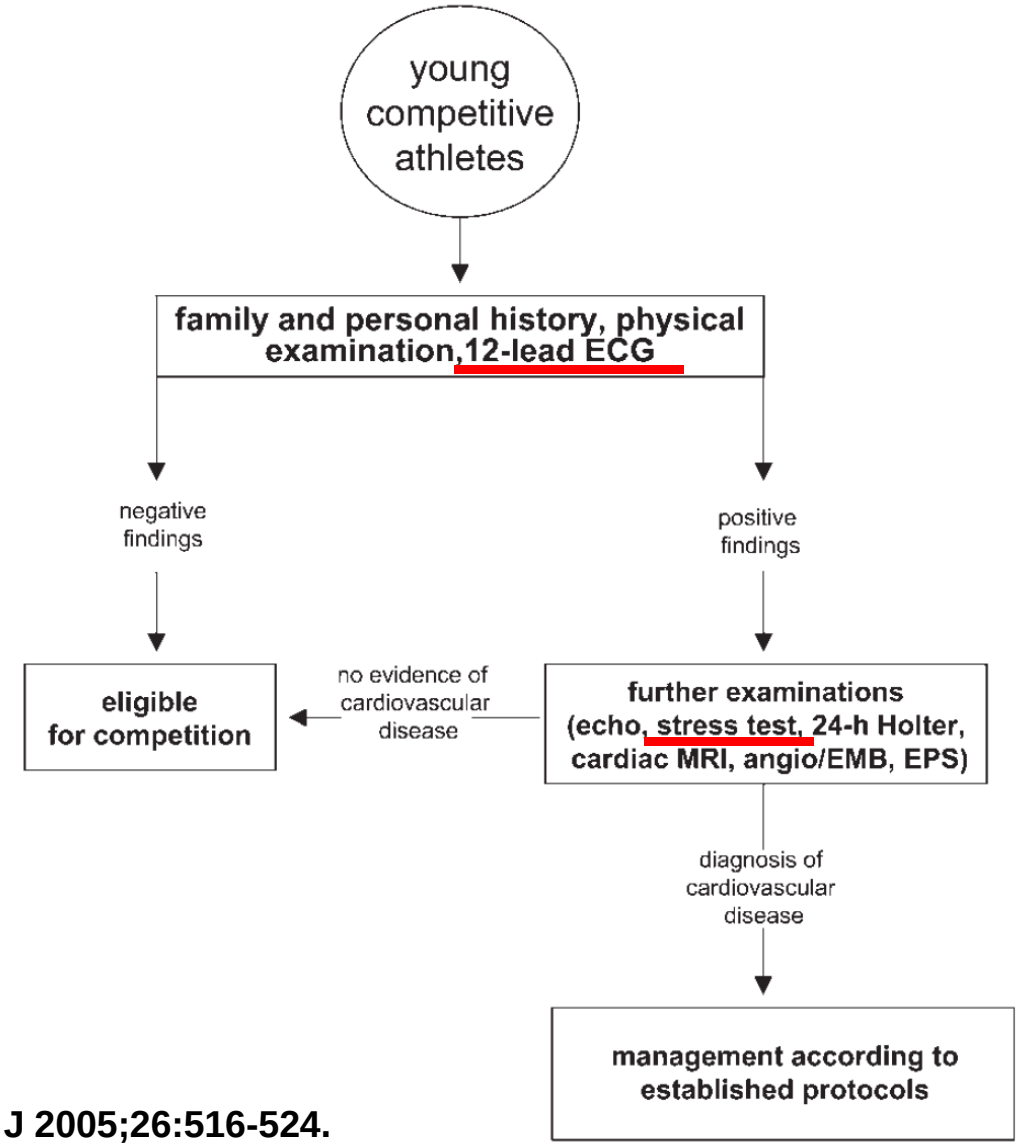
ECG:	**172**
Echo:	**172**
ECG + Echo:	**114**

Costs:

ECG:	**€ 7,049**	**(US$10,088)**
Echo:	**€11,530**	**(US$16,507)**
ECG + Echo:	**€ 9,323**	**(US$13,351)**

Koch S et al., Eur J Prev Cardiol 2013; in press.

Screening of young competitive athletes: How about stress test?



Corrado D et al., Eur Heart J 2005;26:516-524.

ExT before participation in vigorous exercise

- ExT in asymptomatic adults before vigorous exercise is controversial
- even more so for routine screening of young people before engaging in athletics

- several guidelines/recommendations specify that routine screening of asymptomatic low-risk younger individuals is not recommended

- ExT before starting a vigorous exercise program in asymptomatic people with
  - diabetes mellitus
  - men >45 and women >55 years
  - major coronary risk factors

Fletcher GF et al.: Exercise standards for testing and training: AHA statement. Circulation 2013;128:873-934.

Sudden cardiac death: Athletes > 35 years

coronary artery disease	80%
hypertrophic cardiomyopathy	5%
acquired valvular disease	5%
mitral valve prolapse	5%
unknown cause	5%

Purpose of Exercise Testing

- **Detection of coronary artery disease (CAD) in patients with chest pain syndromes (chest discomfort) or potential symptom equivalents**

- **Evaluation of the**
  - **anatomic and functional severity of CAD**
  - **physical capacity and effort tolerance**
  - **exercise-related symptoms**

- **Assessment of chronotropic competence**
  - **arrhythmias**
  - **response to implanted device therapy**
  - **response to medical interventions**

- **Prediction of cardiovascular events and all-cause death**

Fletcher GF et al.: Exercise standards for testing and training: AHA statement. Circulation 2013;128:873-934.

Indications for exercise testing

Exercise testing is recommended before vigorous exercise or competitive athletics in individuals with chest pain and/or dyspnea on exertion, with or without known CAD

- **to evaluate whether vigorous exercise is appropriate**
- **to establish training limits**
- **to develop an exercise prescription**

Fletcher GF et al.: Exercise standards for testing and training: AHA statement. Circulation 2013;128:873-934.

Indications for exercise testing: Conclusion

- **predictive value of any test in low-risk populations must be low**

- **prospective, multicenter studies to demonstrate that interventions based on ExT can favorably alter clinical outcomes in asymptomatic subjects do not exit**

Fletcher GF et al.: Exercise standards for testing and training: AHA statement. Circulation 2013;128:873-934.

Stress testing as part of PPE

in young athletes?

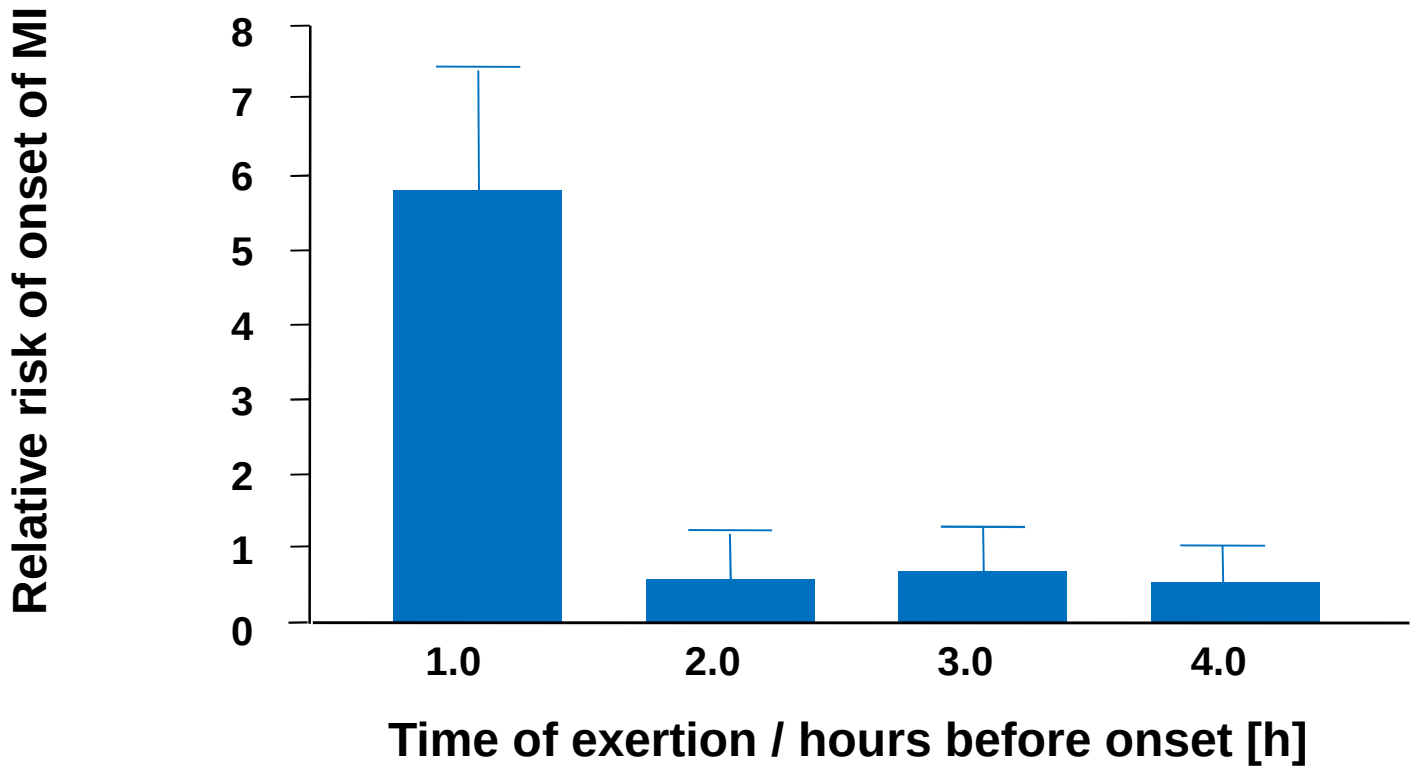
- **pre-participation examination (PPE) ?**

- **work-up of a suggestive or positive finding during PPE**

- **evaluation of known congenital heart disease**

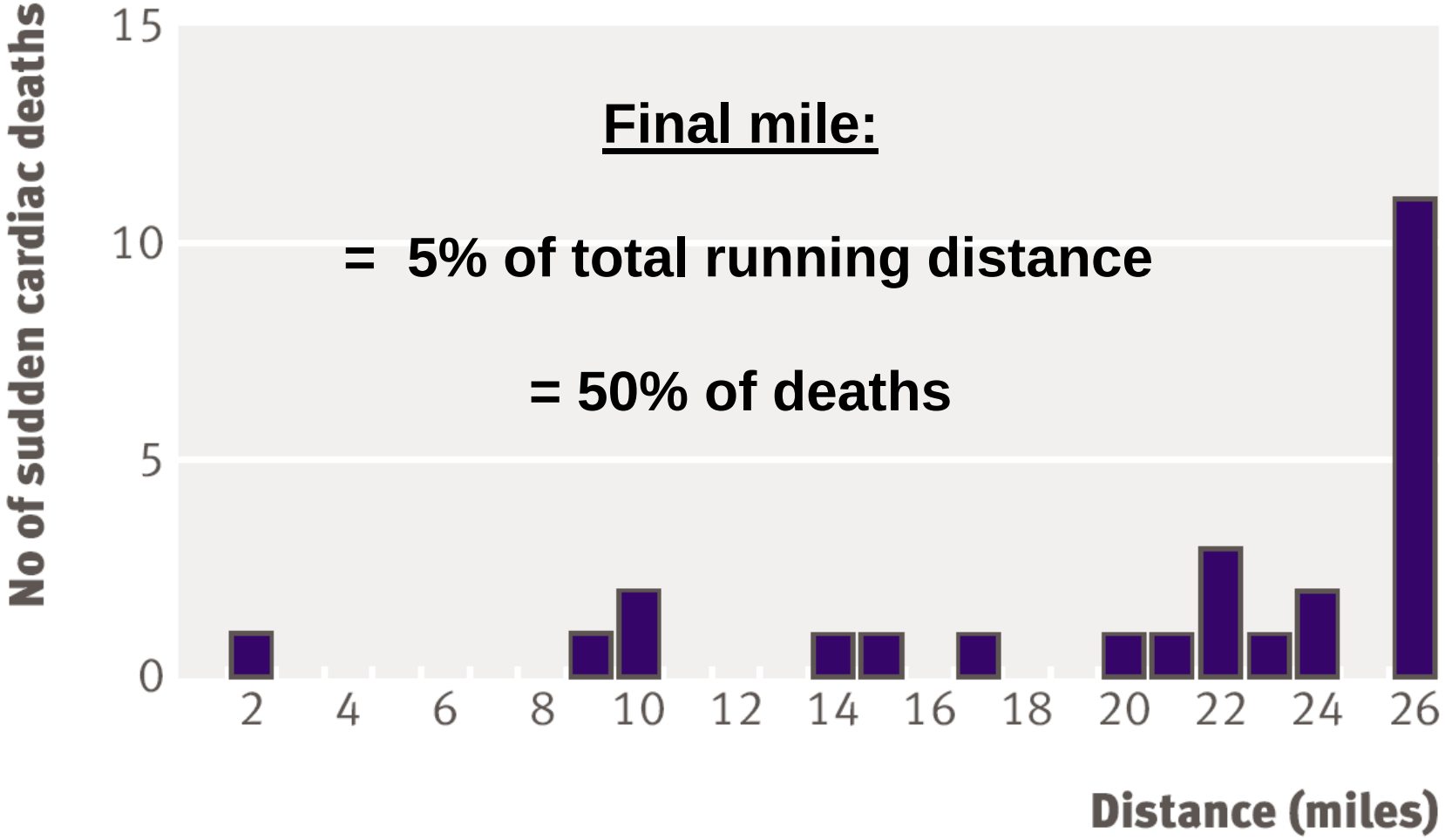
- **individualized exercise prescription**

Time of onset of MI after an episode of heavy physical exertion



Mittleman MA et al., NEJM 1993(329):1677

Sudden cardiac death during marathons



Redelmeier DA, British Medical Journal 2007;335:1275-1277

Cardiovascular pre-participation screening does not distress professional football players

AIM OF STUDY:

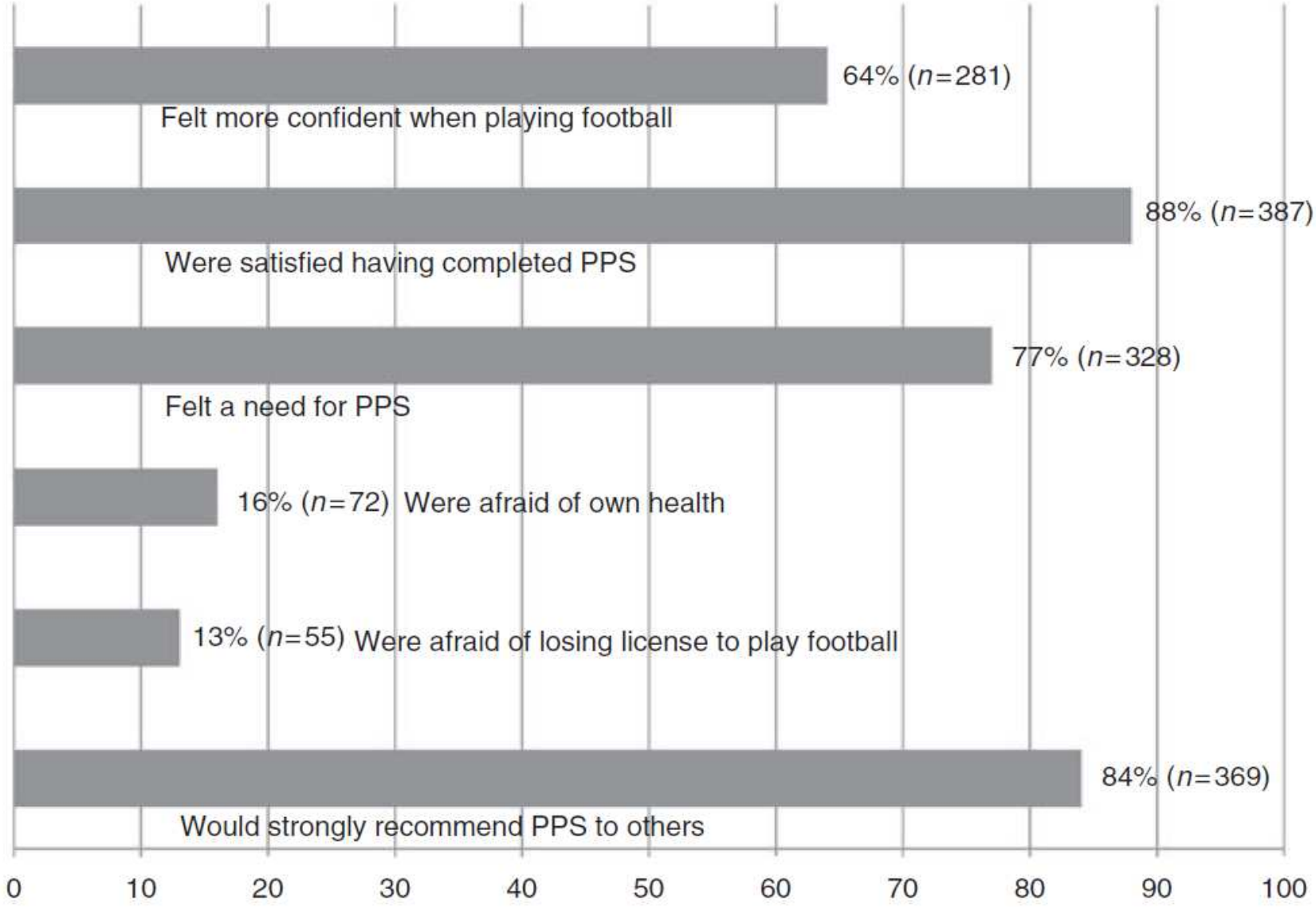
Does pre-participation screening create distress among Norwegian elite male football players?

METHODS:

25/28 teams, i.e. 441/591 players (75%, 26 [18-39] years) participated.

Solberg EE et al., Eur J Prev Cardiol 2012;19:571-577.

Players' evaluation of pre-participation screening



Solberg EE et al., Eur J Prev Cardiol 2012;19:571-577.

Cardiovascular pre-participation screening does not distress professional football players

CONCLUSIONS:

- **majority of players were satisfied having completed the screening**
- **felt more confident**
- **would recommend it to other players**

Solberg EE et al., Eur J Prev Cardiol 2012;19:571-577.

Conclusion

- **No multicenter studies demonstrate that interventions based on ExT can favorably alter clinical outcomes in asymptomatic subjects.**
- **Therefore ExT is not recommended for the assessment of young athletes by current guidelines.**

- **Still, there is a place for ExT in the assessment of young athletes.**
- **Thus, ExT will rightly continue to be widely performed, but not necessarily by physicians.**

- **Whenever ExT is performed, it should include continuous ECG monitoring and blood pressure recording.**
- **Therefore, it ought to be performed by medical staff.**

Conclusions

- **Pre-participation screening is medically indicated in all competitive athletes**
- **Provides important information about health and exercise capacity**
- **Helps tailor training and contributes to athlete's success**
- **Screened athletes feel more confident – and are possibly more successful**
- **Failure to screen is largely caused by lack of funding**
- **Funding is available for other screening programs with higher NNS**
- **In many countries costs are negligible; could be covered by athlete or society**
- **Societies benefit from athletes: they deserve to benefit from health care system**
- **Athletes are role models and help us battle physical inactivity**
- **Cannot afford to lose even one of them due to preventable injury, disease or death**

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www.salk.at/sportmedizin
j.niebauer@salk.at