Is there a role for preparticipation screening in middle-aged athletes?

Europrevent,

Prague,

100507

Mats Börjesson,
MD, Assoc prof, Univ lecturer
Sahlgrenska University Hospital/Östra,
Göteborg, Sweden

Regular physical activity is associated with a lower risk for cardiovascular disease and mortality

➔

Therefore…Increased physical activity is a priority in cardiovascular prevention and rehabilitation

However…also risks in sport

JOY!

⇒

SCD!

ref: Corrado D, JACC, 2003

Journal of the American College of Cardiology
© 2003 by the American College of Cardiology Foundation
Published by Elsevier Inc.
Vol. 42, No. 11, 2003
ISSN 0735-1097/03/$30.00
doi:10.1016/j.jacc.2003.03.002

Does Sports Activity Enhance the Risk of Sudden Death in Adolescents and Young Adults?

Domenico Corrado, MD, PHD,* Cristina Basso, MD, PHD,† Giulio Rizzoli, MD,‡ Maurizio Schiavon, MD,§ Gaetano Thiene, MD†
Padua, Italy

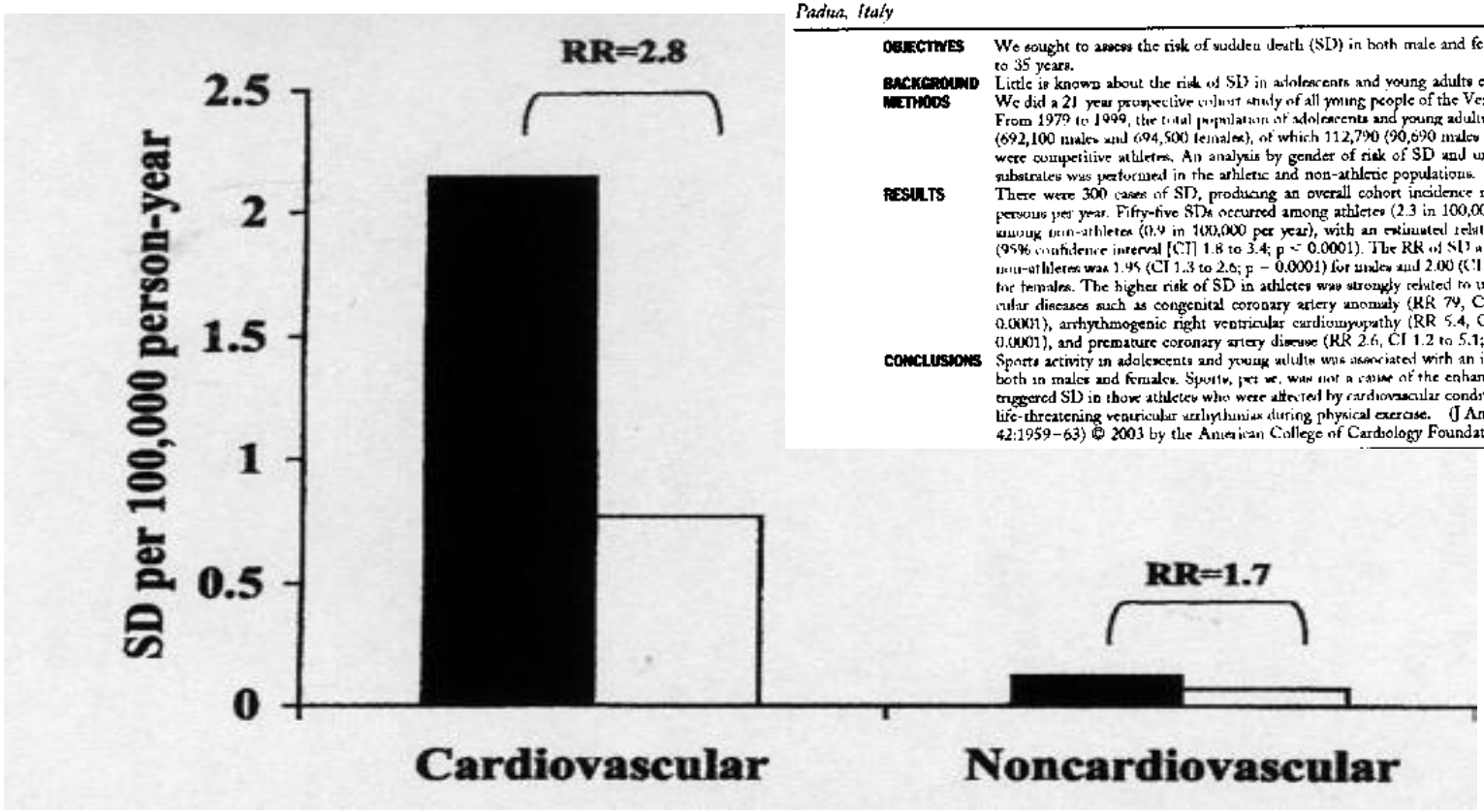
OBJECTIVES We sought to assess the risk of sudden death (SD) in both male and female athletes age 12 to 35 years.

BACKGROUND Little is known about the risk of SD in adolescents and young adults engaged in sports.

METHODS We did a 21 year prospective cohort study of all young people of the Veneto Region of Italy. From 1979 to 1999, the total population of adolescents and young adults averaged 1,386,600 (692,100 males and 694,500 females), of which 112,790 (90,690 males and 22,100 females) were competitive athletes. An analysis by gender of risk of SD and underlying pathologic substrates was performed in the athletic and non-athletic populations.

RESULTS There were 300 cases of SD, producing an overall cohort incidence rate of 1 in 100,000 persons per year. Fifty-five SDs occurred among athletes (2.3 in 100,000 per year) and 245 among non-athletes (0.9 in 100,000 per year), with an estimated relative risk (RR) of 2.5 (95% confidence interval [CI] 1.8 to 3.4; $p < 0.0001$). The RR of SD among athletes versus non-athletes was 1.95 (CI 1.3 to 2.6; $p = 0.0001$) for males and 2.00 (CI 0.6 to 4.9; $p = 0.15$) for females. The higher risk of SD in athletes was strongly related to underlying cardiovascular diseases such as congenital coronary artery anomaly (RR 79, CI 10 to 3,564; $p < 0.0001$), arrhythmogenic right ventricular cardiomyopathy (RR 5.4, CI 2.5 to 11.2; $p < 0.0001$), and premature coronary artery disease (RR 2.6, CI 1.2 to 5.1; $p = 0.008$).

CONCLUSIONS Sports activity in adolescents and young adults was associated with an increased risk of SD, both in males and females. Sports, per se, was not a cause of the enhanced mortality, but it triggered SD in those athletes who were affected by cardiovascular conditions predisposing to life-threatening ventricular arrhythmias during physical exercise. (J Am Coll Cardiol 2003; 42:1959–63) © 2003 by the American College of Cardiology Foundation



- Competitive athletes have a higher risk than the population at large (if underlying abnormality).

Middle aged athletes

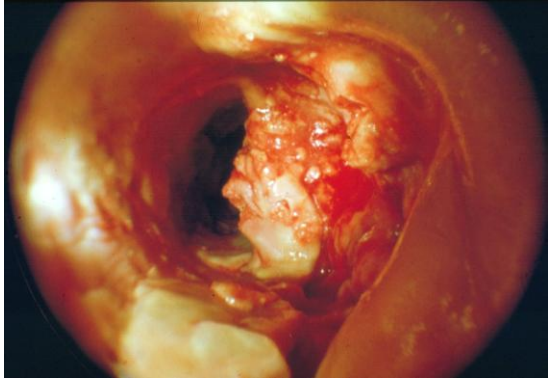
- ”Master athletes”: Defined as >35 years of age (40), may be significantly older
- Organized form of competitive sports, specifically designed for

  older athletes (over 50 sports:

  running, cycling, skiing..)

”..unique psychological and physiological stresses that competition places on such athletes, particularly those with cardio- vascular disease” : AHA 2001

Athletes and coronary artery disease



- SCD increases transiently during vigorous physical activity
- PA causes dilatation in normal coronaries, but may cause vasoconstriction in atherosclerotic segments **(Gordon, J Clin Invest -89)**
- Aggravating factors during exercise

  -catecholamine release

  -platelet adhesion/activation **(Cadroy, J Appl Phys -02)**

  -electrolyte disturbances (i.e. potassium)

  -heat/cold/altitude related complications **(O´Donnell,NEJM -72)**

  -doping/drugs **(Heesch, Heart -00, Kennedy, Med J Aust -93)**

TABLE 3. Physical Stress as a Trigger of Acute Cardiovascular Events During Vigorous Exertion*

Study	Effect Period	End Point	RR (95% CI)
Seattle study[5] (1984)	<1 h	Primary cardiac arrest	56 (23–131)†
Onset study[32] (1993)	1 h	Nonfatal MI	5.9 (4.6–7.7)
TRIMM study[31] (1993)	1 h	Nonfatal MI	2.1 (1.1–3.6)
Hartford Hospital AMI study[6] (1999)	1 h	Nonfatal MI	10.1 (1.6–55.6)
SHEEP study[40] (2000)	<15 min	Nonfatal MI	6.1 (4.2–9.0)
Physician's Health Study[7] (2000)	30 min	SCD	16.9 (10.5–27)

RR indicates relative risk and compares the risk of the cardiac event during exertion with that during sedentary activities; TRIMM, Triggers and Mechanisms of Myocardial Infarction Study; and SHEEP, Stockholm Heart Epidemiology Programme.

*Vigorous exertion is exercise intensity ≥6 METs (1 MET=3.5 mL · kg^{-1} · min^{-1}).

†This RR (56) is the exertion RR for habitually sedentary men. The RR (vs no prior vigorous exercise) for the most active men (≥140 min/wk vigorous exertion) was 5 (95% CI, 2 to 14).

Adapted from Mittleman,[41] with permission from Blackwell Publishing.

. (*Circulation.* 2007;115:2358-2368.)

Screening - one solution

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

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

Domenico Corrado[1*], Antonio Pelliccia[2], Hans Halvor Bjørnstad[3], Luc Vanhees[4], Alessandro Biffi[2], Mats Borjesson[5], Nicole Panhuyzen-Goedkoop[6], Asterios Deligiannis[7], Erik Solberg[8], Dorian Dugmore[9], Klaus P. Mellwig[10], Deodato Assanelli[11], Pietro Delise[12], Frank van-Buuren[10], Aris Anastasakis[13], Hein Heidbuchel[4], Ellen Hoffmann[14], Robert Fagard[4], Silvia G. Priori[15], Cristina Basso[19], Eloisa Arbustini[16], Carina Blomstrom-Lundqvist[17], William J. McKenna[18], and Gaetano Thiene[19]

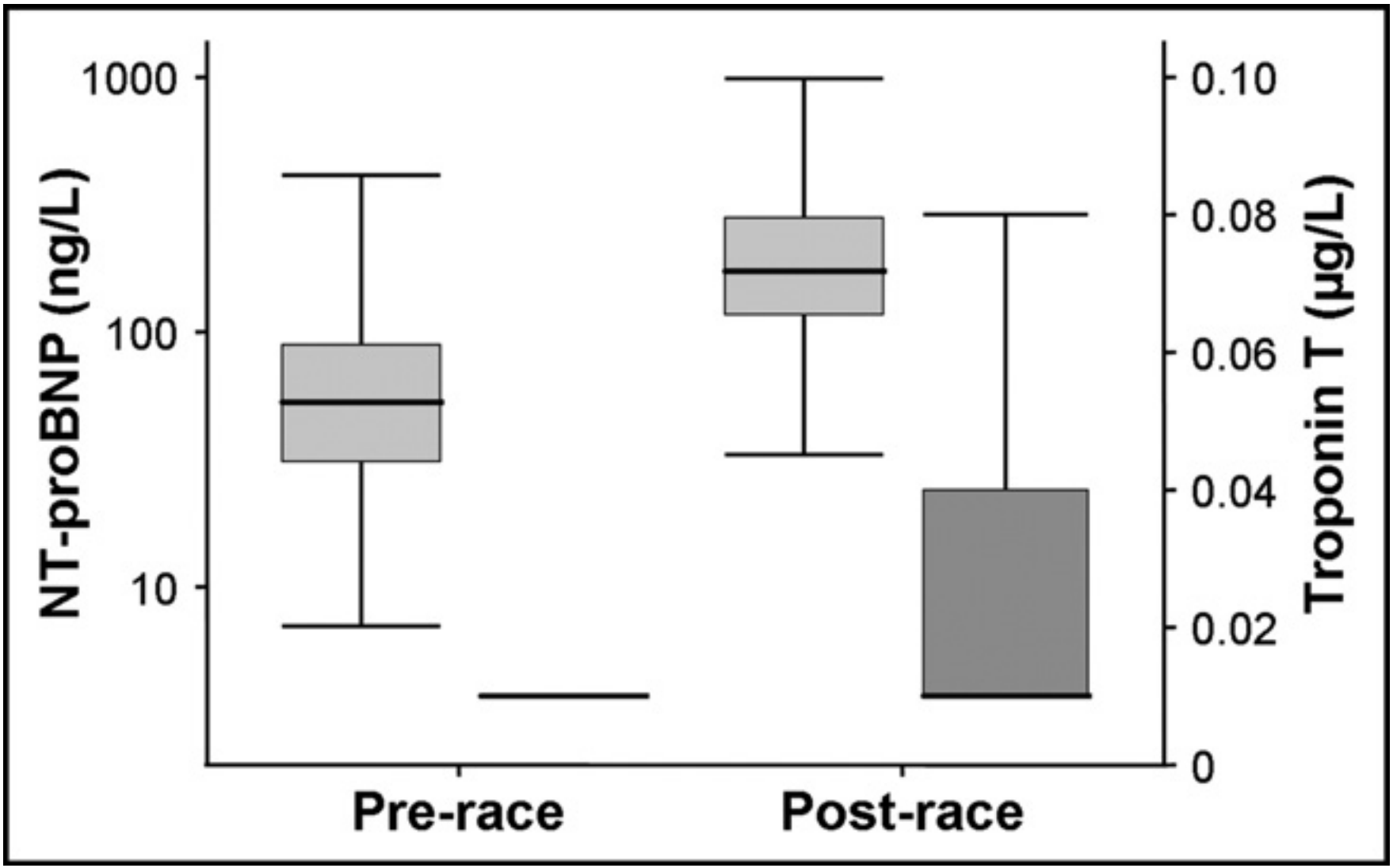
Some middle-aged athletes have severe CVdisease

Predisposing Factors and Consequences of Elevated Biomarker Levels in Long-Distance Runners Aged >55 Years

Anders Sahlén, MD[a,]*, Thomas P. Gustafsson, MSc, Lic Med Sc[b], Jan E. Svensson, MD, PhD[b], Tony Marklund, BSc[c], Reidar Winter, MD, PhD[d], Cecilia Linde, MD, PhD[a], and Frieder Braunschweig, MD, PhD[a]

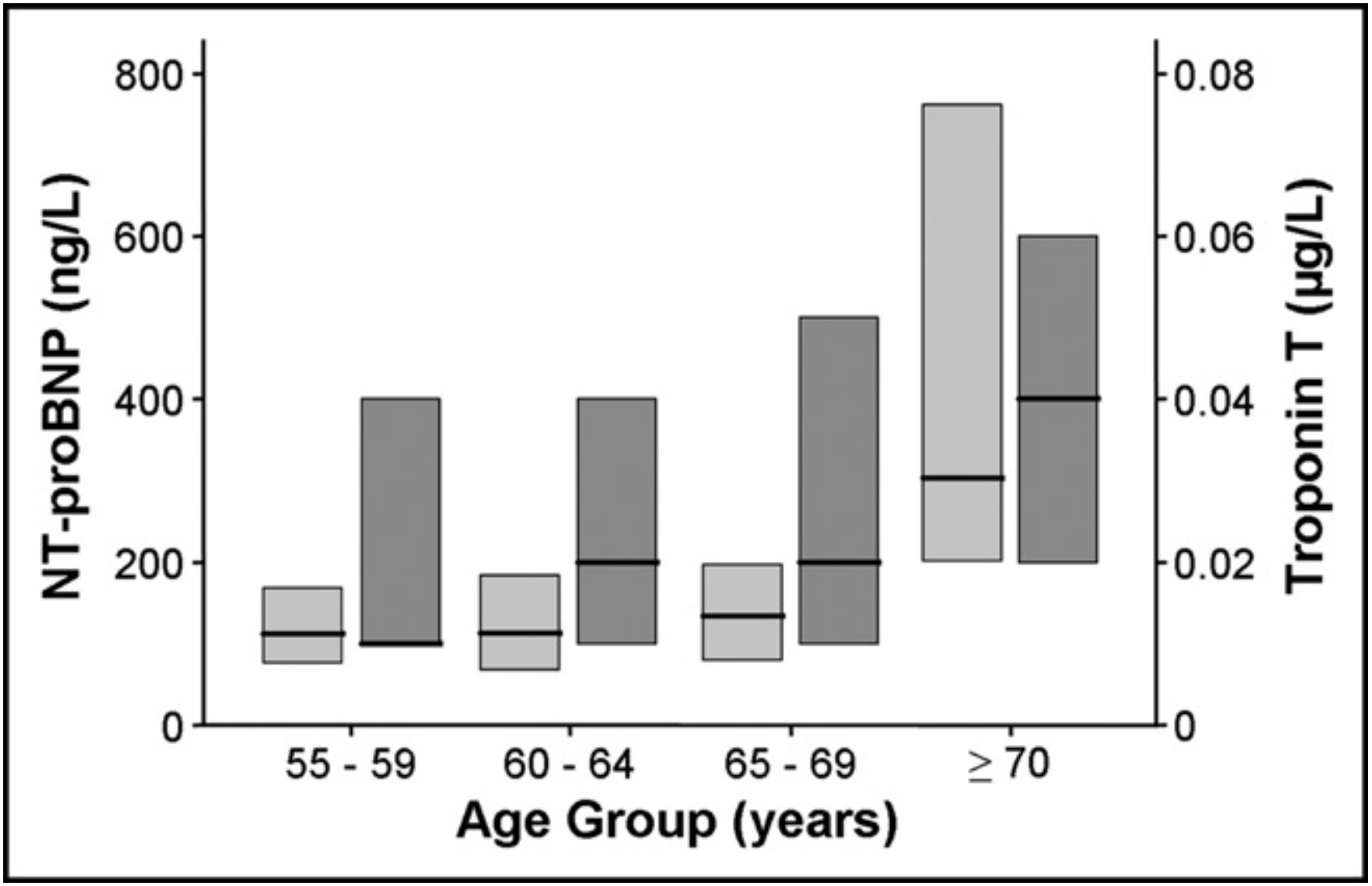
Cardiac biomarkers play an important role in the diagnosis of cardiovascular disease. Elevated levels can be seen in the context of strenuous exercise. We studied this phenomenon in senior endurance runners. We included 185 participants (61.1 5 years; 29% women) at a 30-km cross-country race who were self-reportedly in excellent health. Before and after the race, the creatinine, N-terminal pro-brain natriuretic peptide (NT-proBNP), and troponin T were analyzed, and participation in the number of previous races and the race duration were recorded. NT-proBNP increased from 53 ng/L (interquartile range 31 to 89) to 121 ng/L (interquartile range 79 to 184) and troponin T from undetectable to 0.01 g/L (interquartile range 0.01 to 0.04). The independent predictors of a large NT-proBNP increase were (1) greater levels present at baseline, (2) a greater increase in creatinine (both p <0.001), (3) older age (p 0.01), and (4) a longer race duration (p <0.05). Troponin T elevation was independently predicted by (1) older age (p 0.01), (2) a greater increase in creatinine, and (3) participation in fewer previous races (both p <0.05). Of the 15 runners with an elevated (>194 ng/L) baseline NT-proBNP level (8.1% of 185), 4 were found to have serious cardiovascular disease (2.2% of whole sample). Of these 4 patients, 1 died from sudden cardiac death within months after the race. In conclusion, biomarker elevation occurs commonly in senior runners. A high baseline NT-proBNP is predictive of a large release during exercise, suggesting that the factors that control the at rest levels also determine its release with exertion. Troponin T elevation was seen in less-experienced participants. A small group of very ill runners were identified by NT-proBNP analysis. (Am J Cardiol 2009;104:1434 –1440)

NT-proBNP and TnT before and after 30-km ra



Biomarker release stratified by age

(Sahlen A, Am J Cardiol 2009;104:1434-40)



AHA recommendations for screening of masters athletes (Circulation 2001;103:327-34)

- ALL master athletes should undergo screening by personal and family history and physical ex
- Standard 12-lead ECG for all >40 (men and women)
- Those >40 (men), >50 (women) with 1 more risk factor (lipids, HT, smoker, diabetes, pos fam history CAD) should undergo maximal exercise-testing
- Exercise-test in ALL >65 and in those with symptoms of CAD

The goal is to achieve all the benefits of PA
and avoid the negative effects at the same time

EACPR recommendations

”Cardiovascular evaluation of adult/senior individuals engaged in leisure-time or competitive sport activities”

Position Stand from the Sections of Sports Cardiology and Exercise Physiology, within the European Association for Cardiovascular Prevention and Rehabilitation (EACPR)

Borjesson M, Urhausen A, Kouidi E, Dugmore D, Sharma S, Halle M, Heidbuchel H, Bjornstad H, Gielen S, Mezzani A, Corrado D, Pelliccia A, Vanhees L- accepted for publ EJCPR 2010

Screening recommendations according to:

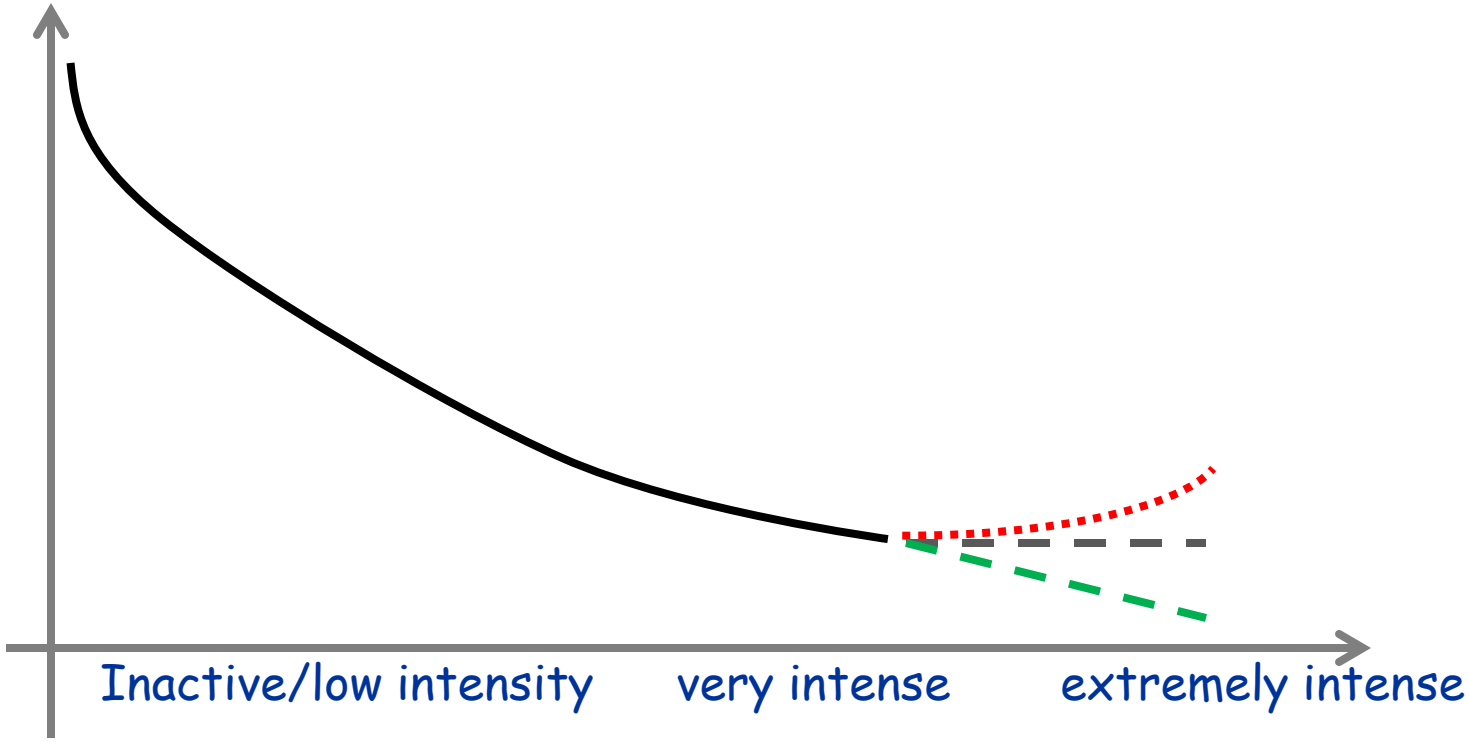
1 Intensity-level of intended PA;

2. Risk profile;

3. Habitual exercise

1.Intensity of activity vs risk

Risk for cardiovascular disease



Intensity-level of intended activity

Table 1 Classification of sports

	A. Low dynamic	B. Moderate dynamic	C. High dynamic
I. Low static	Bowling	Fencing	Badminton
	Cricket	Table tennis	Race walking
	Golf	Tennis (doubles)	Running (marathon)
	Riflery	Volleyball	Cross-country skiing (classic)
		Baseball[a]/softball[a]	Squash[a]
II. Moderate static	Auto racing[a,b]	Field events (jumping)	Basketball[a]
	Diving[b]	Figure skating[a]	Biathlon
	Equestrian[a,b]	Lacrosse[a]	Ice hockey[a]
	Motorcycling[a,b]	Running (sprint)	Field hockey[a]
	Gymnastics[a]		Rugby[a]
	Karate/Judo[a]		Soccer[a]
	Sailing		Cross-country skiing (skating)
	Archering		Running (mid/long)
			Swimming
			Tennis (single)
			Team handball[a]
III. High static	Bobsledding[a,b]	Body building[a]	Boxing[a]
	Field events (throwing)	Downhill skiing[a,b]	Canoeing, Kayaking
	Luge[a,b]	Wrestling[a]	Cycling[a,b]
	Rock climbing[a,b]	Snow boarding[a,b]	Decathlon
	Waterskiing[a,b]		Rowing
	Weight lifting[a]		Speed skating
	Windsurfing[a,b]		Triathlon[a,b]

Adapted and modified after Mitchell et al.[5]

[a]Danger of bodily collision.

[b]Increased risk if syncope occurs.

2. **Individual risk profile**

- **In asymptomatic subjects, the total IHD-risk level can be estimated from the presence of major risk factors, according to the SCORE (systematic coronary risk evaluation)-system**

  -blood pressure

  -age

  -sex

  -smoking

  -total cholesterol

  (Third Joint European Task Force for cardiovasc prevention)

- **In addition, diabetes and family history are added**

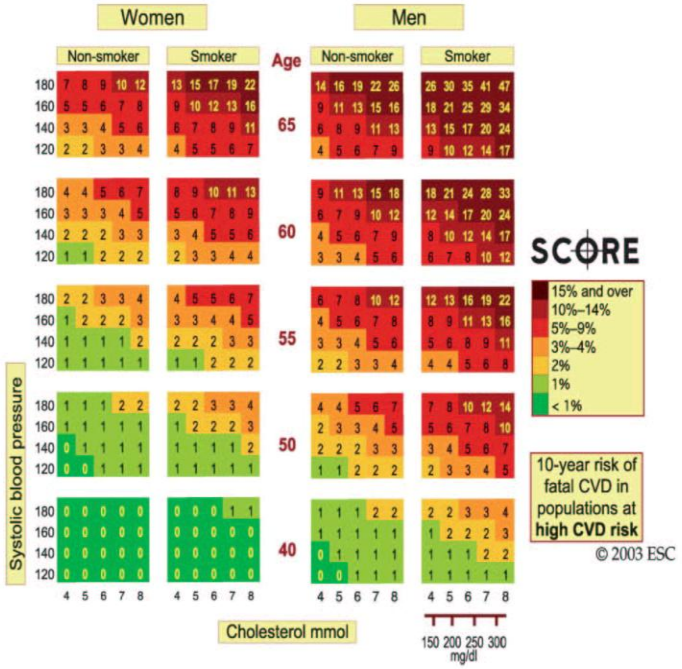


Fig. 1 Ten year risk of fatal CVD in high risk regions of Europe by gender, age, systolic blood pressure, total cholesterol and smoking status.

Individual risk profile

- Initially, by a self-evaluation
  - -AHA/ACSM questionnaire
  - -revised PAR-Q
- Secondarily, a risk stratification by a physician (if necessary)
  - -SCORE

First line self-assessment- alternative 1

American Heart Association (AHA)/American College of Sport Medicine (ACSM)
Health/Fitness facility preparticipation screening questionnaire

(adopted from Balady, Circulation 1998;97:2283-93)

Section I

History

You have had:

___a heart attack
___heart surgery
___cardiac catherization
___coronary angioplasty (PCI)
___pacemaker/implantable cardiac defibrillator/rhythm disturbance
___heart valve disease
___heart failure
___heart transplantation
___congenital heart disease

Symptoms

___you experience chest discomfort with exertion
___you experience unreasonable breathlessness
___you experience dizziness, fainting, blackouts
___you take heart medications

Other health issues

___you have musculoskeletal problems
___you have concerns about the safety of exercise
___you take prescription medication(s)
___you are pregnant

If you have marked any of the statements in section I, consult your healthcare provider before engaging in exercise. You may need t o use a facility with a medically qualified staff.

Continued..

Section II

Cardiovascular risk factors

___you are a man older than 45 years
___you are a woman older than 55 years or you have had a hysterectomy or you are postmenopausal
___you smoke
___your blood pressure is >140/90
___you don‹t know your blood pressure
___you take blood pressure medication
___your cholesterol level is >240 mg/dL
___you don‹t know your cholesterol level
___you have a close relative who had a heart attack before age 55 (father or brother) or age 65 (mother or sister)
___you are diabetic or take medicine to control your blood sugar
___you are physically inactive (i.e. you get <30 minutes of physical activity at least 3 days/week)
___you are >20 pounds overweight

If you have marked 2 or more of the statements in this section, consult your health care provider before engaging in exercise. You might benefit by using a facility with a professionally qualified exerc ise staff to guide your exercise program.

___none of the above (section 1 and 2) is true

You should be able to exercise safely without consulting your healthcare provider in almost any facility tha t meets your exercise program needs.

First line- self assessment, alternative 2

Table 2

Revised physical activity readinessquestionnaire(PAR-Q)

(adopted from Balady, Circulation 1998;97:2283-93)

1	Has a doctor ever said that you have a heart condition and recommended only medically supervised activity?	Yes/ No
2	Do you have chest pain brought on by physical activity?	Yes/ No
3	Have you developed chest pain in the past month?	Yes/ No
4	Have you on 1 or more occasions lost consciousness or fallen over as a result of dizziness?	Yes/ No
5	Do you have a bone or joint problem that could be aggra vated by the proposed physical activity?	Yes/ No
6	Has a doctor ever recommended medication for your blood pressure or a heart condition?	Yes/ No
7	Are you aware, through your own experience or a doctor‹s advice, of any other physical reason that would prohibit you from exercising without medical supervision?	Yes/ No

3.The fitness level adds info

Enhanced Risk Assessment in Asymptomatic Individuals With Exercise Testing and Framingham Risk Scores

Samia Mora, MD, MHS; Rita F. Redberg, MD, MSc; A. Richey Sharrett, MD, DrPH; Roger S. Blumenthal, MD

Background—National Cholesterol Education Program Adult Treatment Panel III (ATP III) guidelines recommend the use of Framingham risk scores (FRS) for cardiovascular assessment of asymptomatic individuals. We hypothesized that risk prediction could be improved with 2 non-ECG exercise test measures, exercise capacity (metabolic equivalents, or METs) and heart rate recovery (HRR).

Methods and Results—An asymptomatic cohort with baseline treadmill tests (n=6126; 46% women, FRS <20%) was followed up prospectively for 20 years. Individuals with low (median or less) HRR or METs experienced 91% of all cardiovascular disease (CVD) deaths (225/246). After FRS adjustment, low HRR and METs individually were highly significant predictors of CVD death, but low HRR and METs together were associated with substantially higher risk (adjusted hazard ratio compared with high HRR/high METs for women 8.51, 95% CI 3.65 to 19.84; for men, 3.53, 95% CI 2.03 to 6.15; $P<0.001$ for both). At 10-year follow-up, FRS-adjusted CVD death risk associated with low HRR/low METs was less than at 20 years but remained significant (women 3.83, 95% CI 1.09 to 13.47, and men 2.70, 95% CI 1.11 to 6.55). The application of HRR/METs information to FRS assessment identified those at high risk (>0.5% annual CVD mortality) in half of women with FRS 6% to 9% and 10% to 19% and just under half of men with FRS 10% to 19%. Low HRR/low METs was also associated with an increased relative risk of CVD death in individuals with low-risk FRS (FRS <6% in women and <10% in men), but absolute CVD mortality rates were low in this subgroup.

Conclusions—Exercise testing may be a useful adjunct for clinical risk assessment in asymptomatic women with FRS 6% to 19% and men with FRS 10% to 19%. (***Circulation*. 2005;112:1566-1572.**)

Key Words: exercise ■ prevention ■ prognosis ■ risk factors

Regular physical exercise diminish the acute risk

TRIGGERING OF SUDDEN DEATH FROM CARDIAC CAUSES BY VIGOROUS EXERTION

CHRISTINE M. ALBERT, M.D., M.P.H., MURRAY A. MITTLEMAN, M.D., DR.P.H., CLAUDIA U. CHAE, M.D., M.P.H., I.-MIN LEE, M.B., B.S., SC.D., CHARLES H. HENNEKENS, M.D., DR.P.H., AND JOANN E. MANSON, M.D., DR.P.H.

ABSTRACT

Background Retrospective and cross-sectional data suggest that vigorous exertion can trigger cardiac arrest or sudden death and that habitual exercise may diminish this risk. However, the role of physical activity in precipitating or preventing sudden death from cardiac causes has not been assessed prospectively in a large number of subjects.

Methods We used a prospective, nested case–crossover design within the Physicians' Health Study to compare the risk of sudden death during and up to 30 minutes after an episode of vigorous exertion [illegible]

idence to suggest that vigorous exertion simultaneously triggers and protects against sudden death.[1] However, the role of vigorous exertion in precipitating or preventing sudden death has not been assessed prospectively in a large number of subjects. The prospective data compiled in the Physicians' Health Study presented a unique opportunity to determine whether vigorous exertion triggers sudden death and whether habitual vigorous exercise diminishes the risk.

METHODS

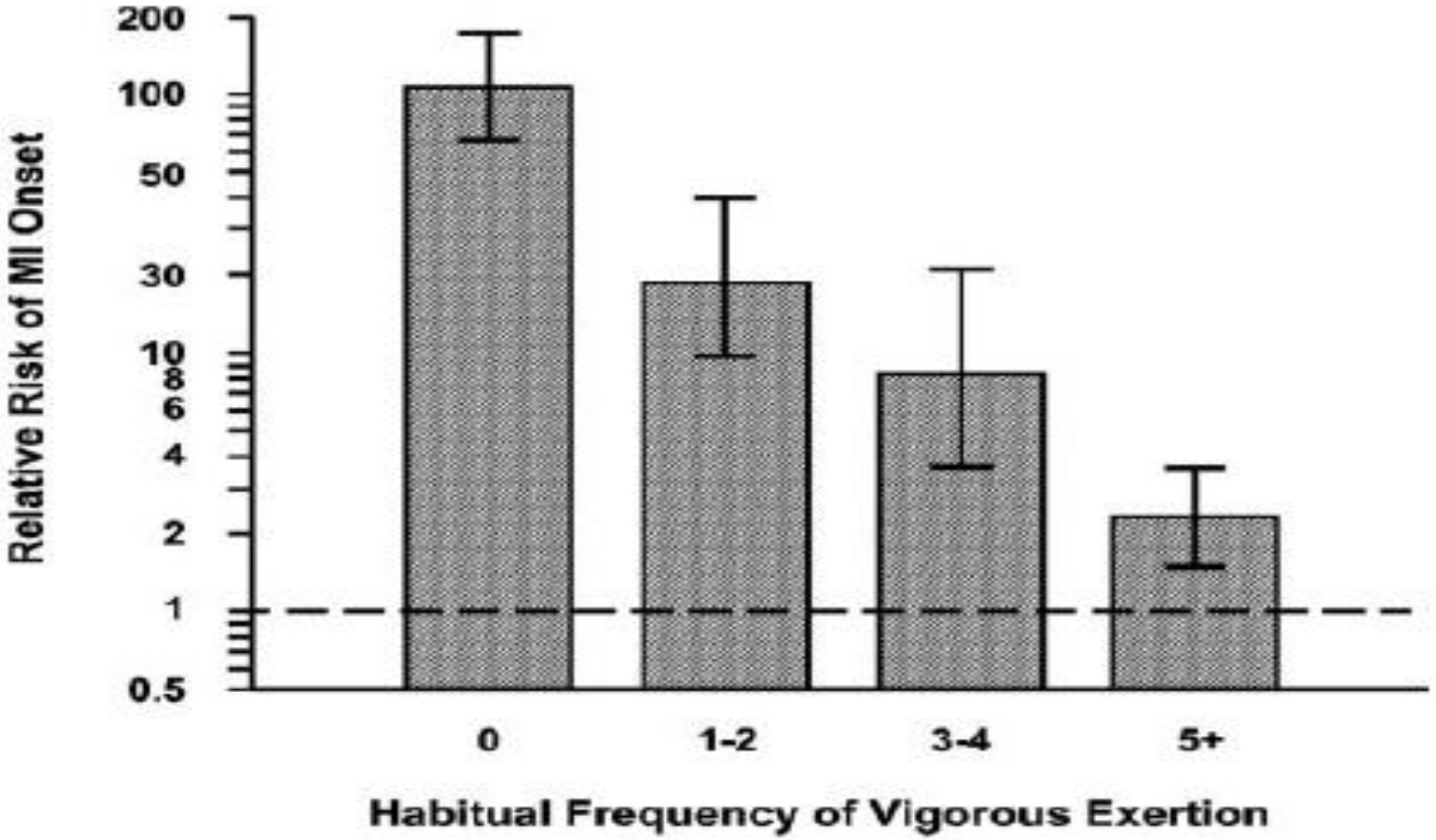


Figure 2. Relative risk of MI associated with vigorous exertion (≥6 METs) according to habitual frequency of vigorous exertion. The T bars indicate 95% confidence limits. The dotted line indicates risk of MI with no prior vigorous exertion. Adapted from Mittleman,[41] with permission from Blackwell Publishing.

. (*Circulation*. 2007;115:2358-2368.)

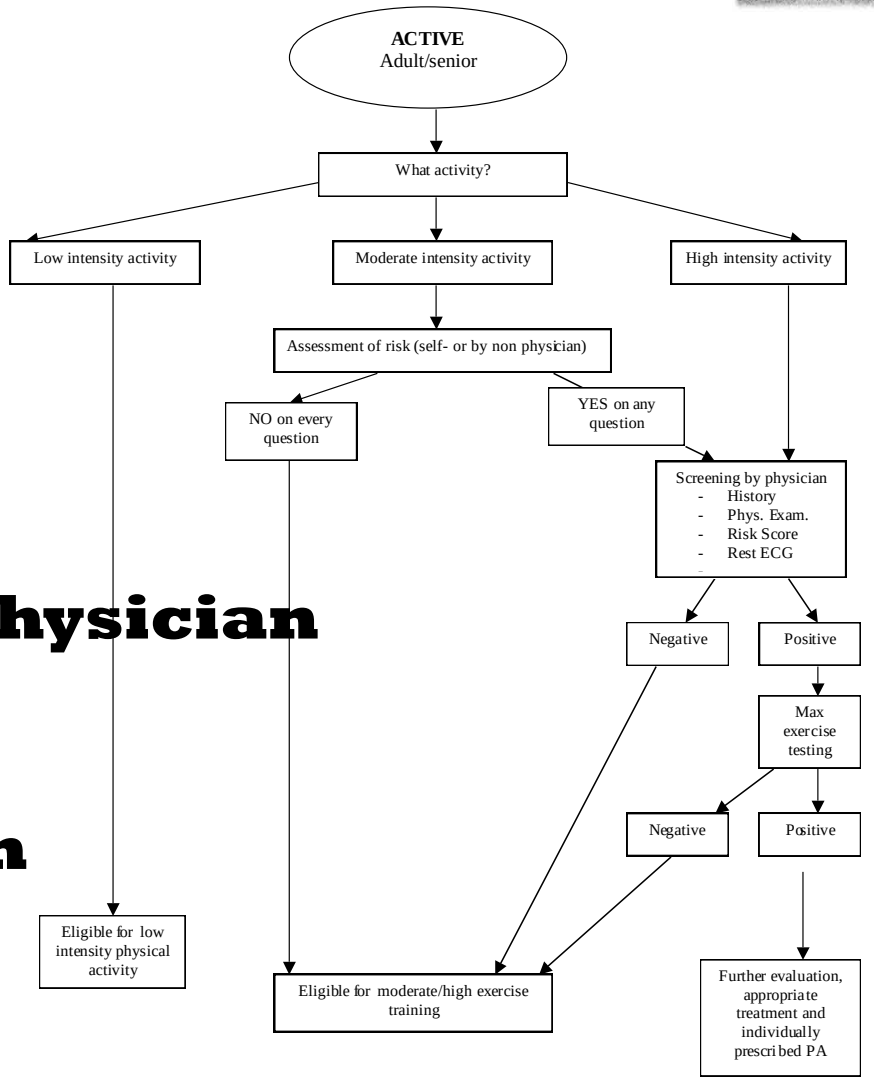
Evaluation protocol for asymptomatic sedentary adult/senior individuals

What activity intended?

Low: self assessment

NO- eligible
YES- screening by physician

Moderate-high: screening by physician



Borjesson et al, EJCPR 2010, acc

Evaluation protocol for asymptomatic active adult/senior individuals

What activity intended?

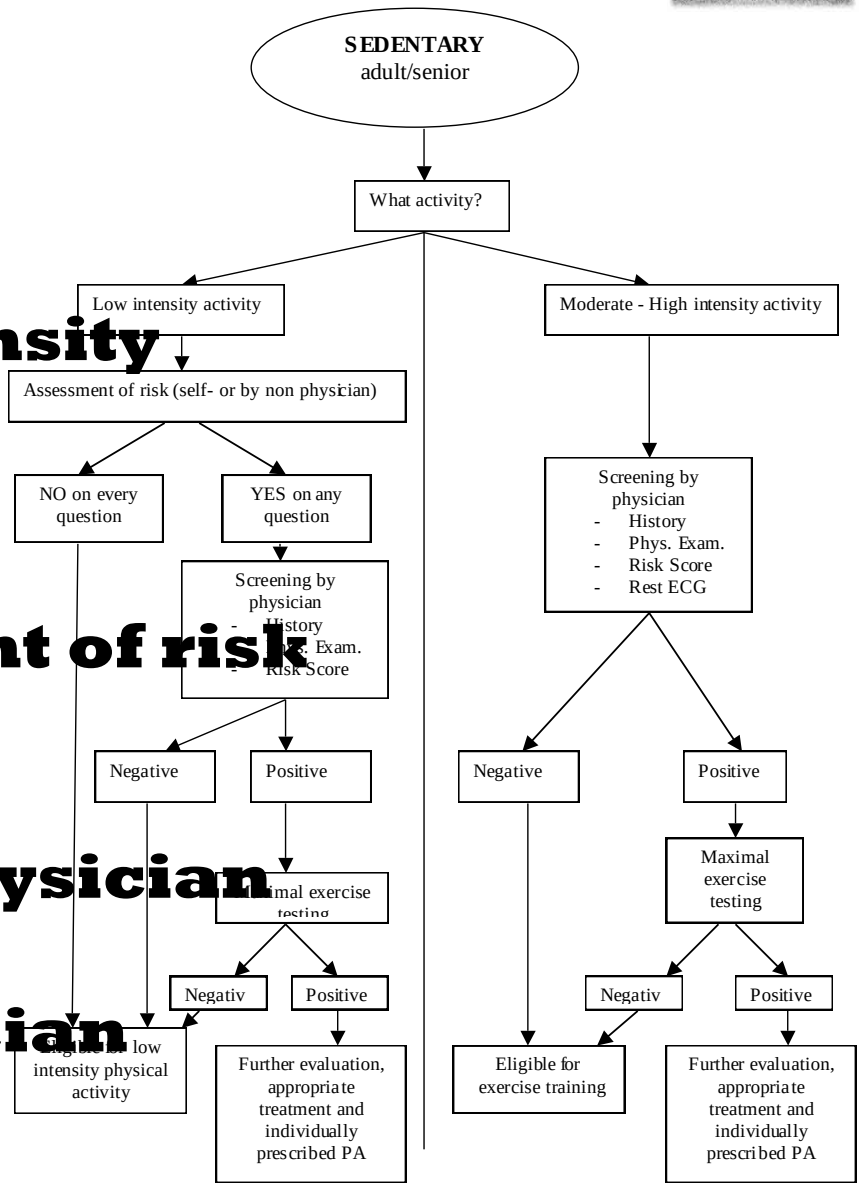
low- moderate- high intensity

***Low*: eligible**

***Moderate*: self-assessment of risk**

NO: eligible
YES: screening by physician

***High*: screening by physician**



.0

Borjesson et al, EJCPR 2010, acc

Lippincott
Williams & Wilkins
a Wolters Kluwer business

EUROPEAN
SOCIETY OF
CARDIOLOGY

Position Paper

ESC Study Group of Sports Cardiology: recommendations for participation in leisure-time physical activity and competitive sports for patients with ischaemic heart disease

Mats Börjesson[a], Deodato Assanelli[b], François Carré[c], Dorian Dugmore[d], Nicole M. Panhuyzen-Goedkoop[e], Christian Seiler[f], Jeff Senden[g] and Erik E. Solberg[h]

[a]Department of Medicine, Sahlgrens University Hospital/Östra,Göteborg, Sweden, [b]Department of Medicine, University of Brescia, Italy, [c]Unité Biologie et Médecine du Sport, Hôpital Pontchaillou, Rennes, France, [d]Wellness Medical Center, Stockport, UK, [e]Heart Centre Radboud University Hospital Nijmegen and Cardiac Rehabilitation and Department of Sportscardiology St Maartenskliniek, Nijmegen, The Netherlands, [f]Department of Cardiology, University Hospital, Bern, Switzerland, [g]Department of Cardiology, Meander Medisch Centrum, Amersfoort, The Netherlands and [h]Department of Medicine, Diakonhjemmet Hospital, Oslo, Norway.

Received 29 July 2005 **Accepted** 1 December 2005

Ref: Börjesson M et al, EJCPR 2006; 13: 137-49.

High risk profile-SCORE>5%

- **FIRST, try to rule out silent ischemia by maximal exercise testing (limitations)**
- **THEN…separate**

1. *Negative X-test:* The absolute risk is considered low

2. *Positive X-test:* The risk for future cardiac events is increased *(ref: MRFIT 15x/5x, Seattle Heart Watch,30x)*

⇒Further evaluation by stress echo/ myocardial scintigraphy and/or coronary angiography to rule out/confirm the presence of IHD is needed

- **Cardiac CT and/or cardiac MRI may be alternative!**

The middle aged athletes of Vasaloppet ?

1970-2005: 698.000 racers,
13 SCD (expected 1,7) -1/50.000 racers

73500 competitors in Vasaloppet 1989-98, mean 4 year follow-up

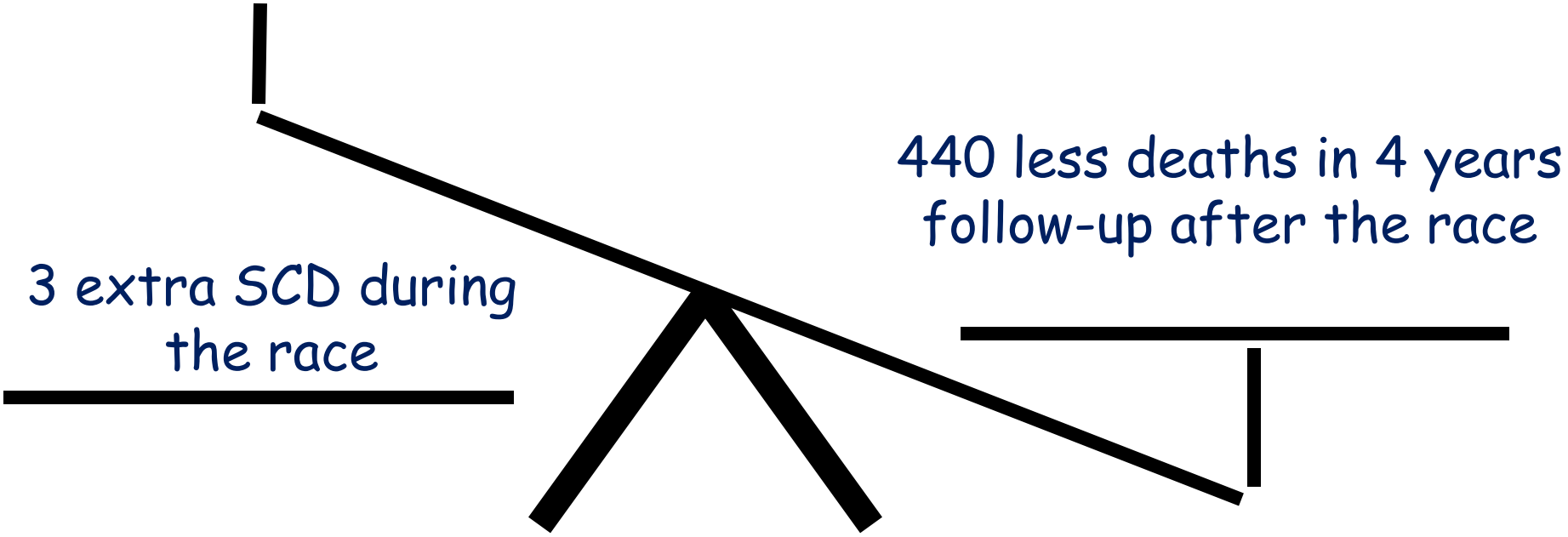
Table 2 Standardized mortality ratios (SMR) and 95% confidence intervals (CI) of all causes of death amongst men

	Number of deaths			
	Observed	Expected	SMR	95% CI
All	339	692.4	0.49	0.44–0.54
Age (years)				
16–30	31	50.1	0.62	0.42–0.88
31–40	30	66.1	0.45	0.31–0.65
41–50	82	142.6	0.57	0.46–0.71
51+	196	433.5	0.45	0.39–0.52
Successful races (*n*)				
1	181	353.5	0.51	0.44–0.59
2–3	102	195.9	0.52	0.42–0.63
4–5	34	74.1	0.46	0.32–0.64
6+	22	68.9	0.32	0.20–0.48

Journal of Internal Medicine 2003; **253**: 276–283

Vasaloppet- net effect. . .

73.500 skiers
1989-98



Screening is no substitute for proper cardiovascular safety at sports events and arenas…

Yes,
Individualized PPE may play a role in middle aged athletes!