Rythmologie et sport

Sport et arythmie atriale

Laurent Fauchier
Cardiologie. Pôle Cœur Thorax Vaisseaux
Centre Hospitalier Universitaire Trousseau,
Tours. France

Liens d’intérêt

Laurent Fauchier:	
Orateur ou Consultant:	AstraZeneca, Bayer, BMS Pfizer, Boehringer Ingelheim, Boston Scientific, Medtronic, Novo Nordisk, Zoll

Risk factors for AF

Comprehensive risk reduction in patients with atrial fibrillation: emerging diagnostic and therapeutic options - a report from the 3rd AFNET/EHRA consensus conference

Table X: Risk factors for AF

Validated risk factors	Published HR range	Validated risk factors	Published HR range
Age	1.03 / year - 5.9	Heart Failure	1.4 - 7.7
Male gender	1.5 - 2.7	Diabetes	1.4 - 2.1
Hypertension	1.1 - 2.2	Coronary artery disease (often history of myocardial infarction)	1.4 - 3.6
Valve disease	1.8 - 3.2	Genetic factors: Family history or genomic associations	1.1 - 1.9
Less validated risk factors and risk markers	**Published HR range**	**Less validated risk factors and risk markers**	**Published HR range**
Obesity/BMI	1.03 (per BMI) - 2.0	Smoking	1.3 - 1.5
Blood pressure/pulse pressure	1.1 - 2.2	Coffee	?
Height	1.03 (per 10 cm) - 16.5	PR interval	1.1 - 2.7
Sleep apnea syndrome	2.2 - 3.0	Murmur	1.9 - 2.4
Subclinical hyperthyroidism	1.9 - 3.1	ANP or BNP	1.2 - 4.0
Alcohol consnumption (often excessive)	1.3 - 1.5	CRP (and IL1 / TNF-alpha)	0.9 - 2.2
Chronic kidney disease	1.4 - 1.9	Birth weight	1.7
Excessive endurance sports	1.7 - 22.8	Troponin T	1.2
Chronic obstructive lung disease	1.5 - 2.0	Preclinical atherosclerosis	1.6 - 2.1
		Psychological determinants	?

Europace 2012

Risk factors for AF

Table 16 Factors associated with incident AF

Demographic factors	Age[1149–1151]
	Male sex[1149–1152]
	European ancestry[1149,1150]
	Lower socioeconomic status[1150]
Lifestyle behaviours	Smoking/tobacco use[1149–1151]
	Alcohol intake[1149,1150]
	Physical inactivity[1149,1150]
	Vigorous exercise[1153–1156]
	Competitive or athlete-level endurance sports[1151,1157]
	Caffeine[1158–1160]

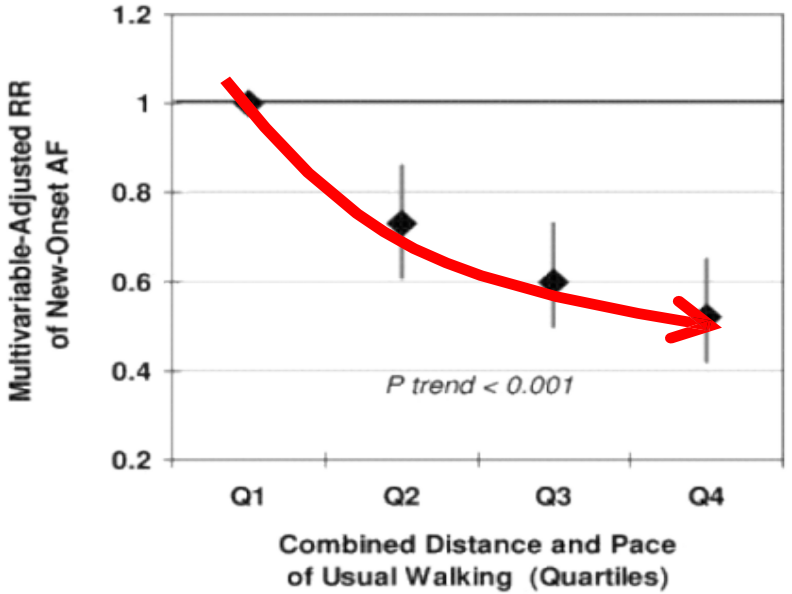
ESC European Society of Cardiology

AF ESC Guidelines, *Eur Heart J* 2024

AF, ageing and physical activity

- Moderate physical activity reduces AF-risk in aged (>65 years) individuals.

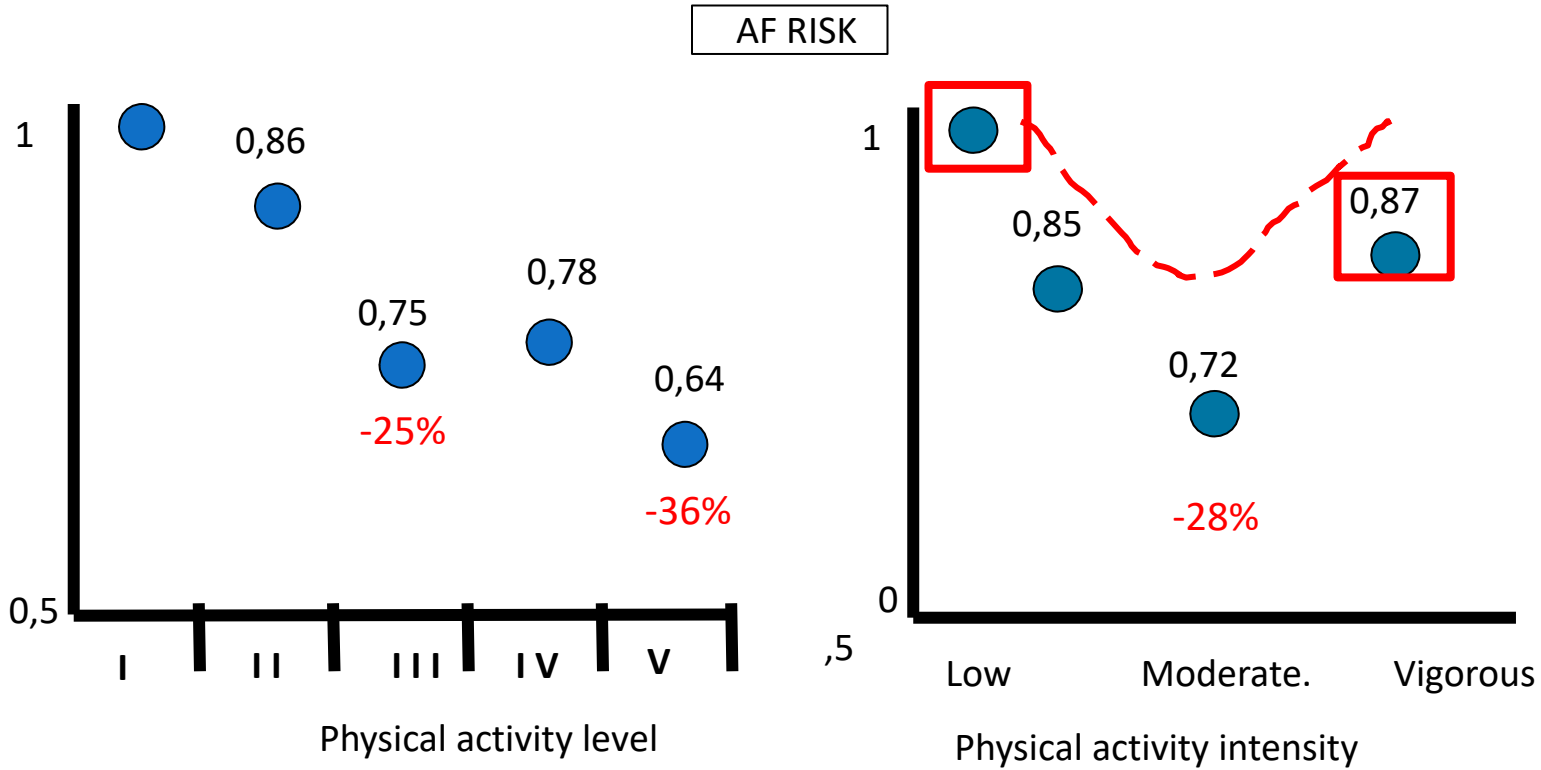
n= 5446 ≥ 65 yo, FU 12 years,
1061 AF, 22.4/1000 patients-year



The Cardiovascular Health Study. Mozzafarian D, *Circulation* 2008

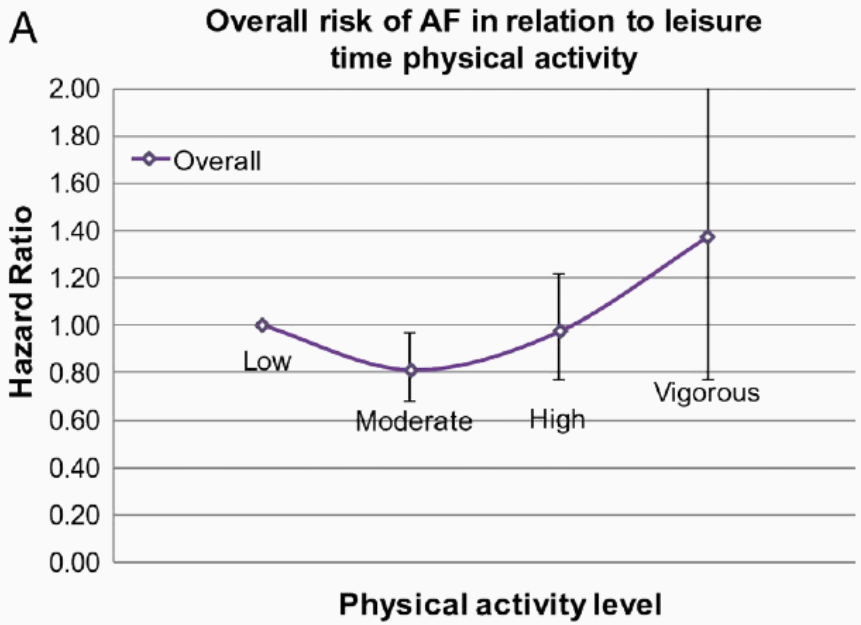
Moderate and regular physical activity decreases the risk of AF

n= 5446 ≥ 65 yo, FU 12 years, 1061 FA, 22.4/1000 patients-year



The Cardiovascular Health Study. Mozzafarian D, *Circulation* 2008

Physical activity and risk of AF



AF risk reduction by *moderate* physical activity

Cardiovascular Health Study (n=5446) **28%** ↓
Mozzafarian D, Circulation 2008

Tromsø Study (n=20,484) **19%** ↓
Morseth B, Eur Heart J 2016

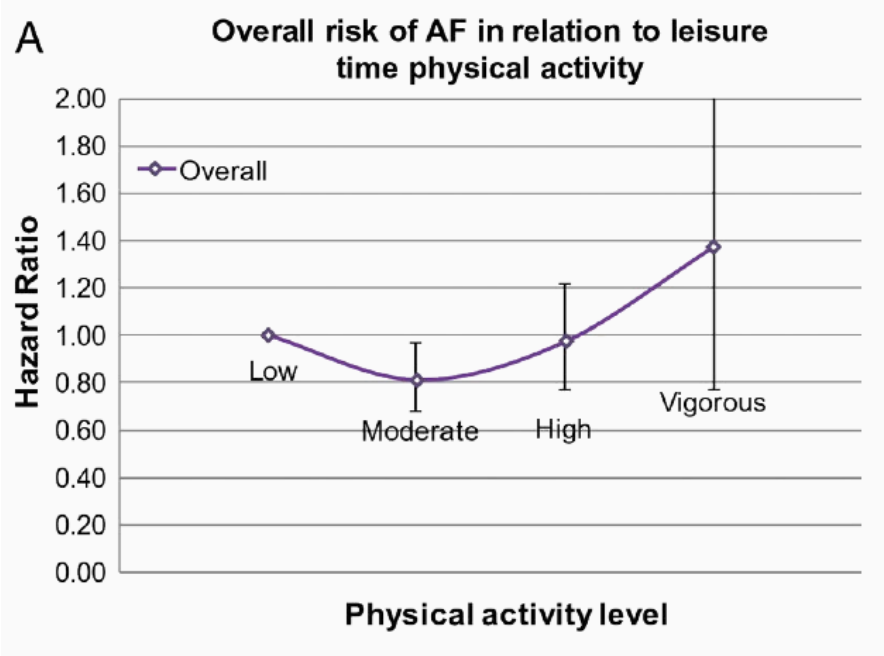
HUNT Study (n=39,844) **31-47%** ↓
Garnvik LE, Med Sci Sports Exerc 2019

UK biobank (n=402,406) **10-20%** ↓
Elliott A, Eur Heart J 2020

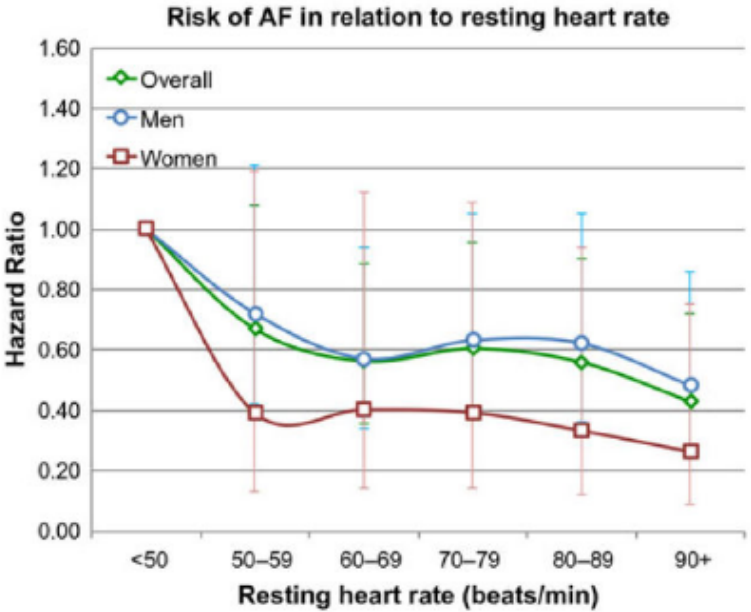
Meta-analysis (n=656,750) **9-19%** ↓
Mohanty S, J Cardiovasc Electrophysiol 2016

Morseth B. *Eur Heart J* 2016;37:2307–13

Physical activity and risk of AF

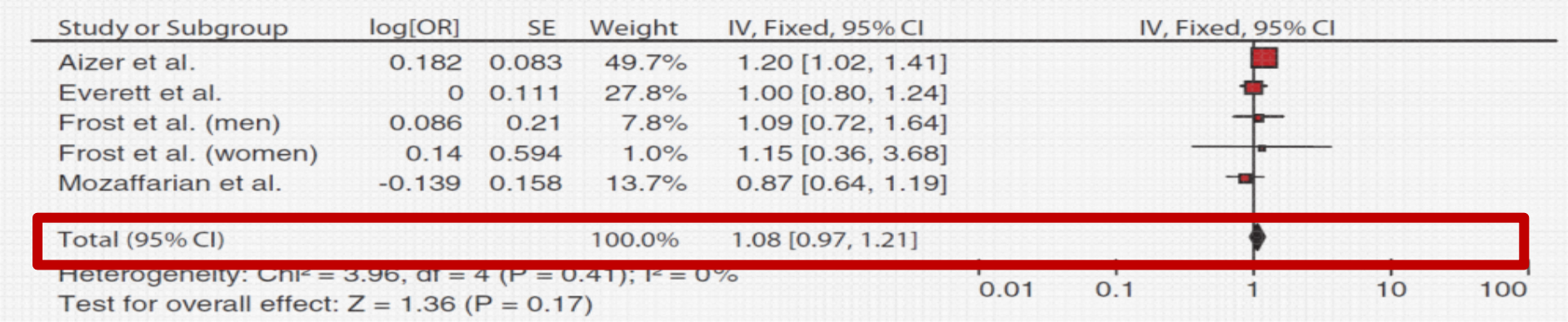


Finding suggesting low HR at rest a risk factor for AF



Morseth B. *Eur Heart J* 2016;37:2307–13

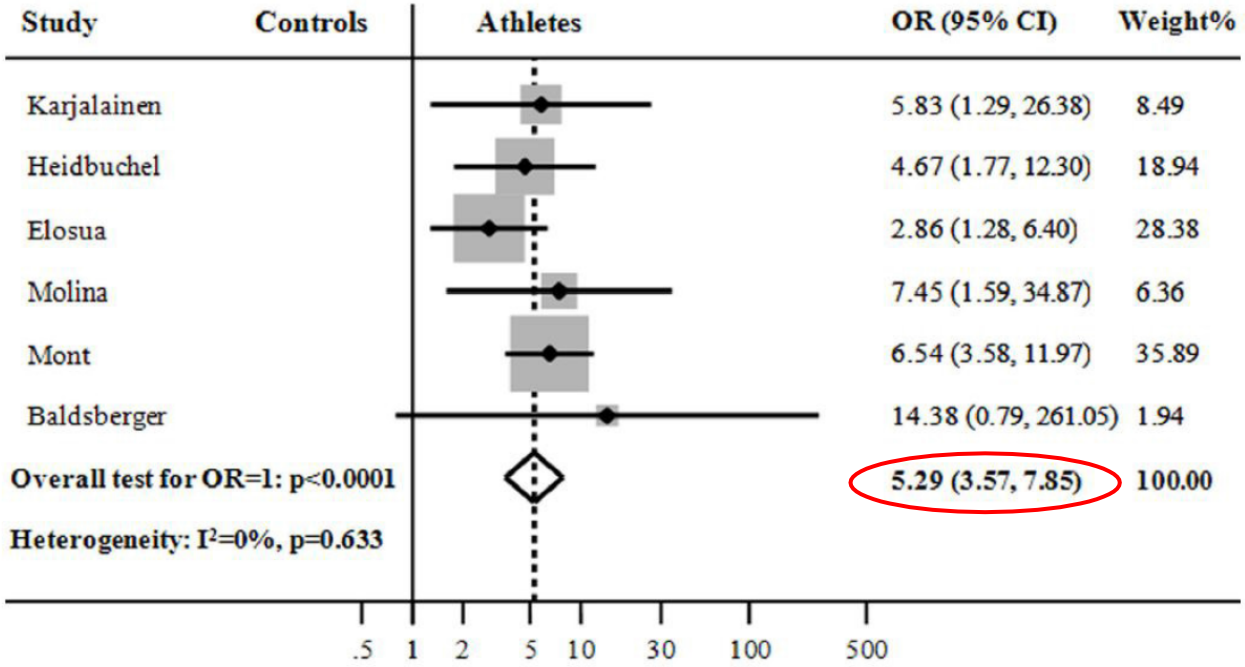
Regular physical activity and risk of AF. A review and Metanalysis



Exercise does not modify AF incidence in the general population

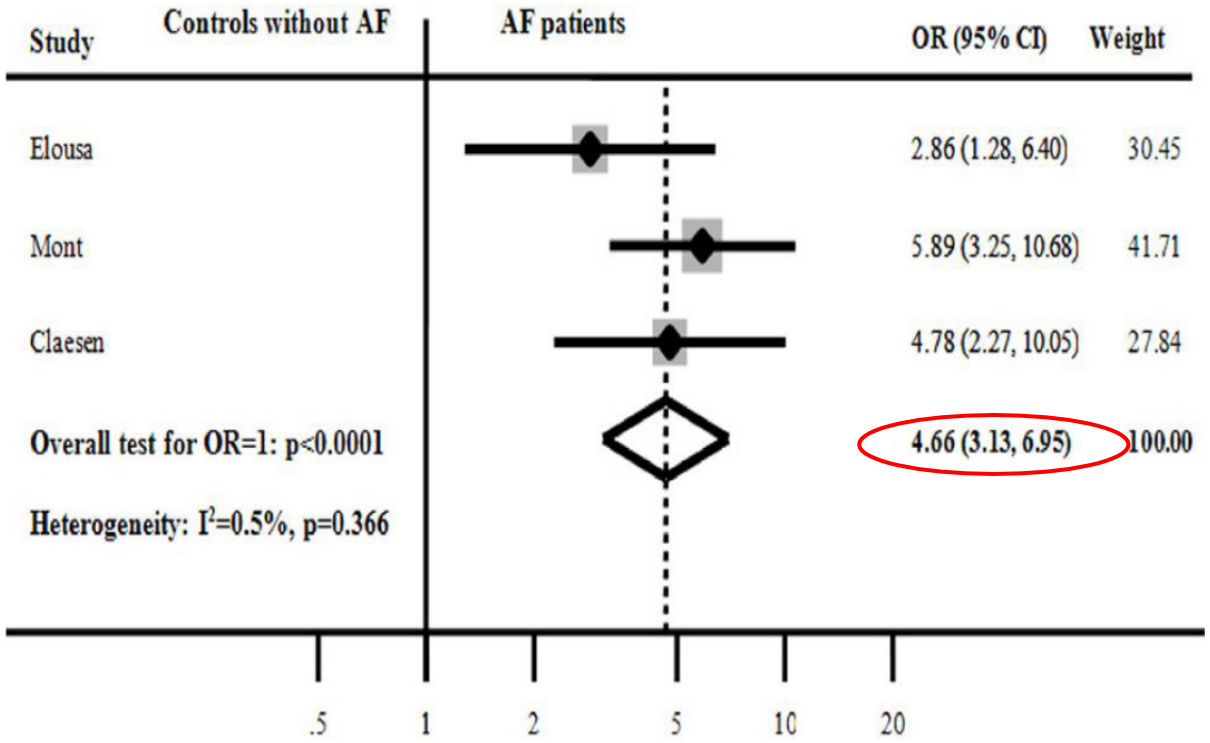
Ofman P et al. *Circ Arrhythm Electrophysiol.* 2013

Lone AF Risk in Athletes Compared with Non-Athletes



Nielsen JR.
J Atr Fibrillation. 2013

Athletes in Populations with AF Versus Matched Controls without AF

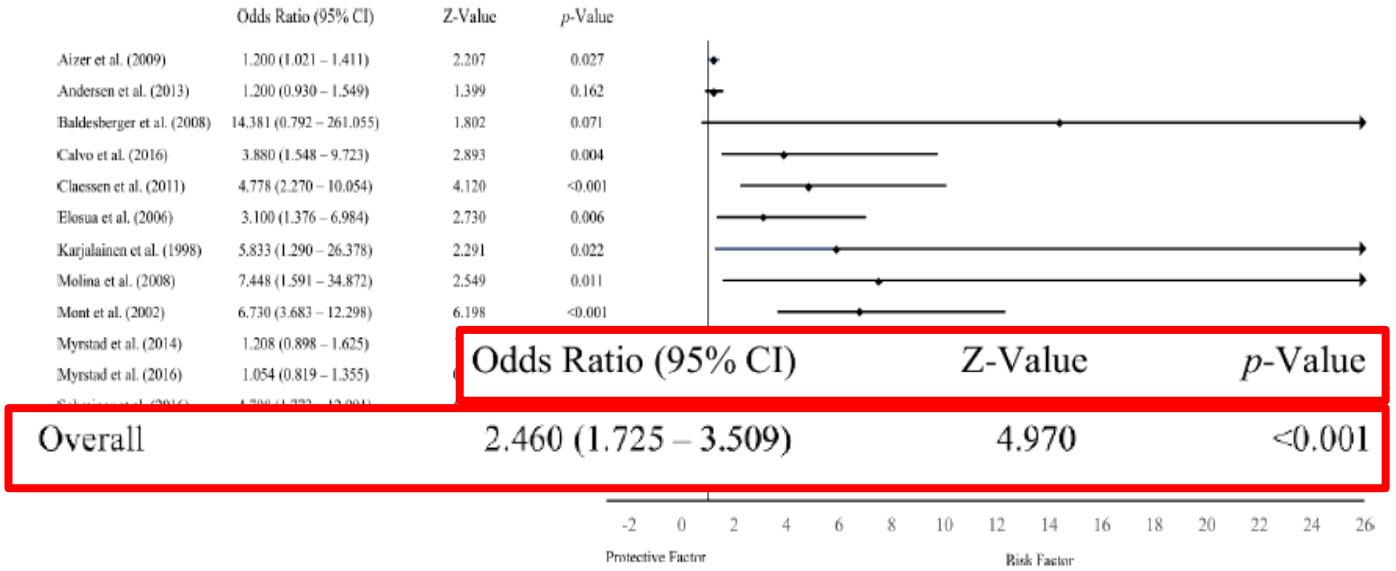


Nielsen JR.
J Atr Fibrillation. 2013

Meta-analysis of AF risk in athletes vs controls

Table 1 Characteristics of studies included

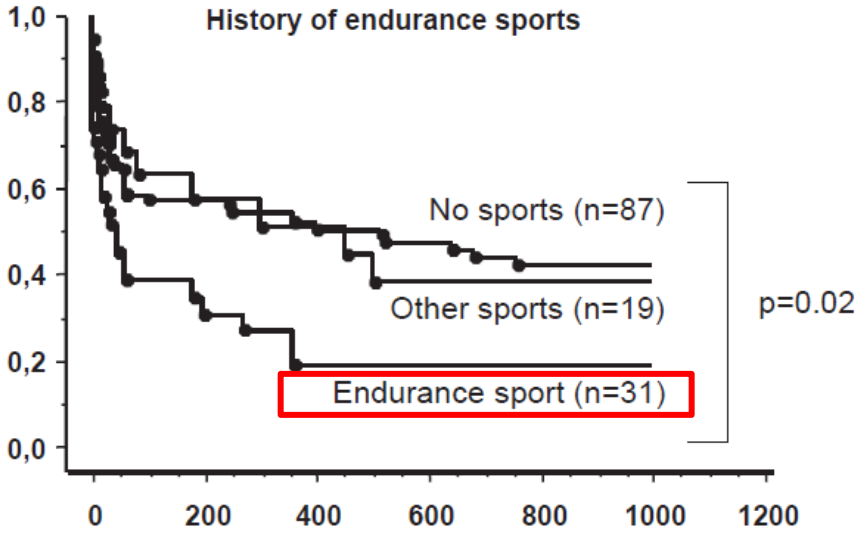
Author	Year	Country	Sample size	Average age (years)	Sport type	Study design	Risk of bias*
Aizer *et al*	2009	America	8448	52	Mixed and Endurance†	Cohort	2
Andersen *et al*	2013	Sweden	52 755	57	Nordic Skiing	Cohort	2
Baldesberger *et al*	2008	Switzerland	124	67	Cycling	Cohort	2
Calvo *et al*	2016	Spain	172	46	Mixed and Endurance‡	Case–control	1
Claessen *et al*	2011	Belgium	156	52	Mixed and Endurance§	Case–control	2
Elosua *et al*	2006	Spain	160	43	Mixed and Endurance¶	Case–control	1
Karjalainen *et al*	1998	Finland	440	46	Orienteering	Cohort	1
Molina *et al*	2008	Spain	473	39	Running	Cohort	1
Mont *et al*	2002	Spain	216	44	Mixed and Endurance**	Case–control	2
Myrstad *et al*	2014	Norway	2376	69	Nordic Skiing	Cohort	2
Myrstad *et al*	2016	Norway	4952	69	Nordic Skiing	Cohort	2
Schreiner *et al*	2016	America	149	72	Swimming	Case–control	3
Van Buuren *et al*	2012	Germany	57	57	Handball	Case–control	2



Newman W et al.
BMJ 2021

Physical activity practice and AF, type of sport

Risk of AF
<u>after ablation</u>
<u>for atrial flutter</u>



At risk	d0	d360	d720
No sports	87	40	24
Other sports	19	7	4
Endurance sports	31	7	4

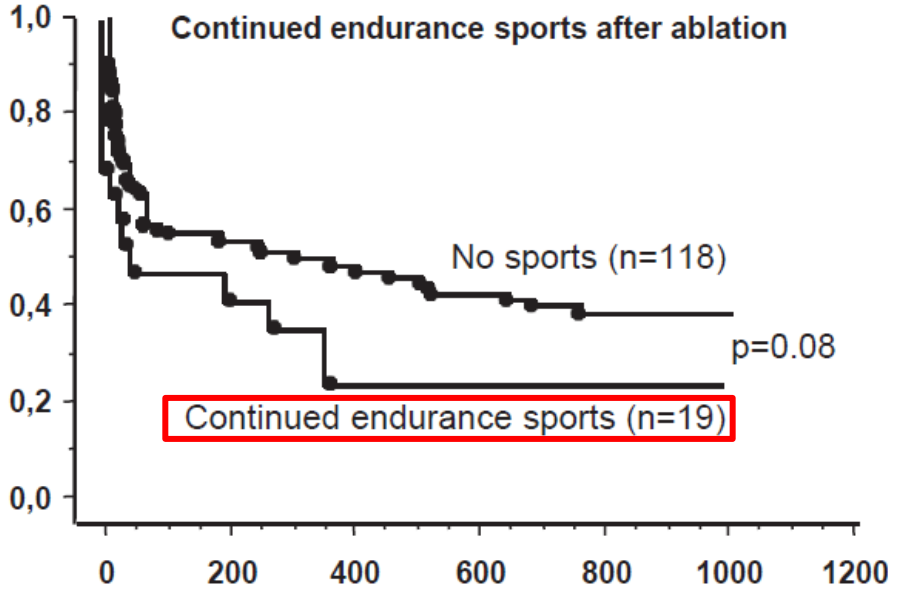
Fig. 1. Patients with a history of endurance sports before ablation (n=31) developed significantly more AF than controls or those with a history of other type of sports activity.

Heidbuchel H et al.
Int J Cardiol 2006.

Physical activity practice and AF

Risk of AF
<u>after ablation</u>
<u>for atrial flutter</u>

'Errare humanum est, perseverare diabolicum'



At risk	d0	d360	d720	Time (days)
No sports	118	49	29	
Cont'd Endurance	19	6	3	

Fig. 2. Kaplan-Meier curves showing development of AF in 19 patients who continued endurance sports after ablation, vs. 118 patients who did not.

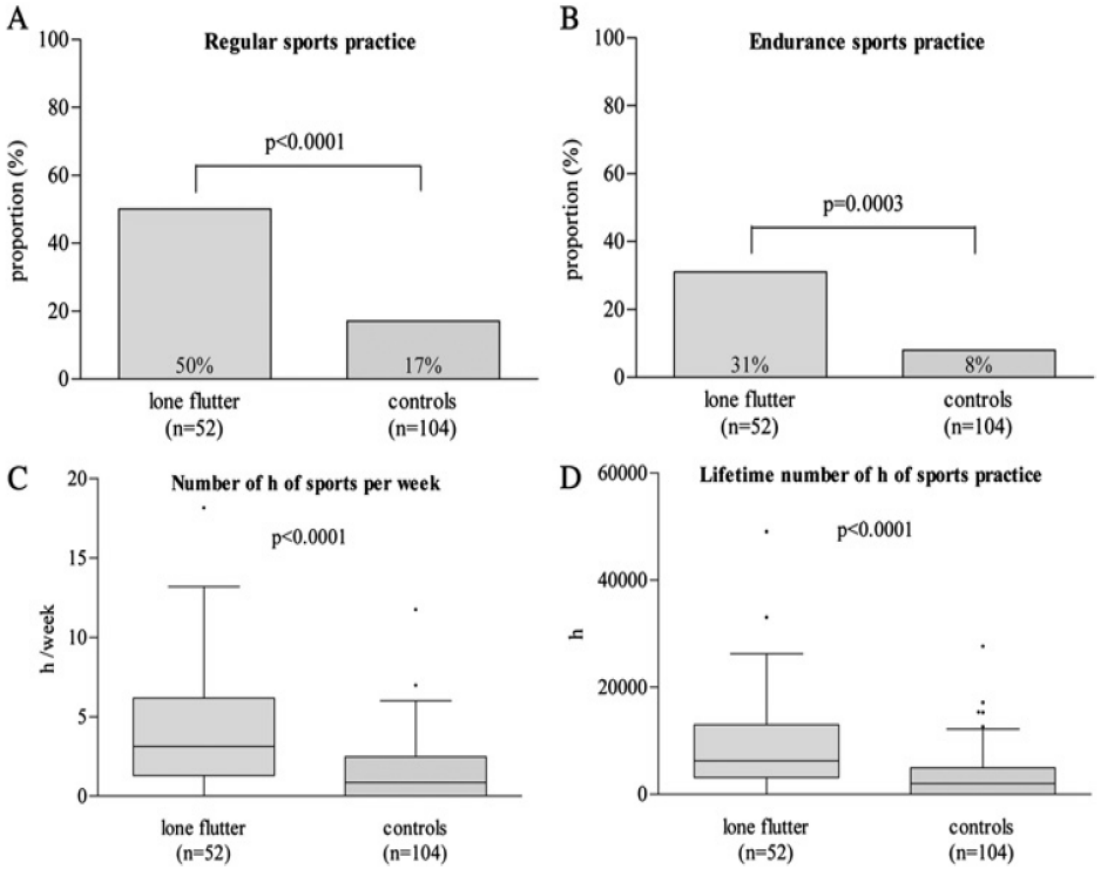
Heidbuchel H et al.
Int J Cardiol 2006.

Risk for atrial flutter in individuals practising endurance sports

Table 2 Echocardiographic data in men with lone atrial flutter

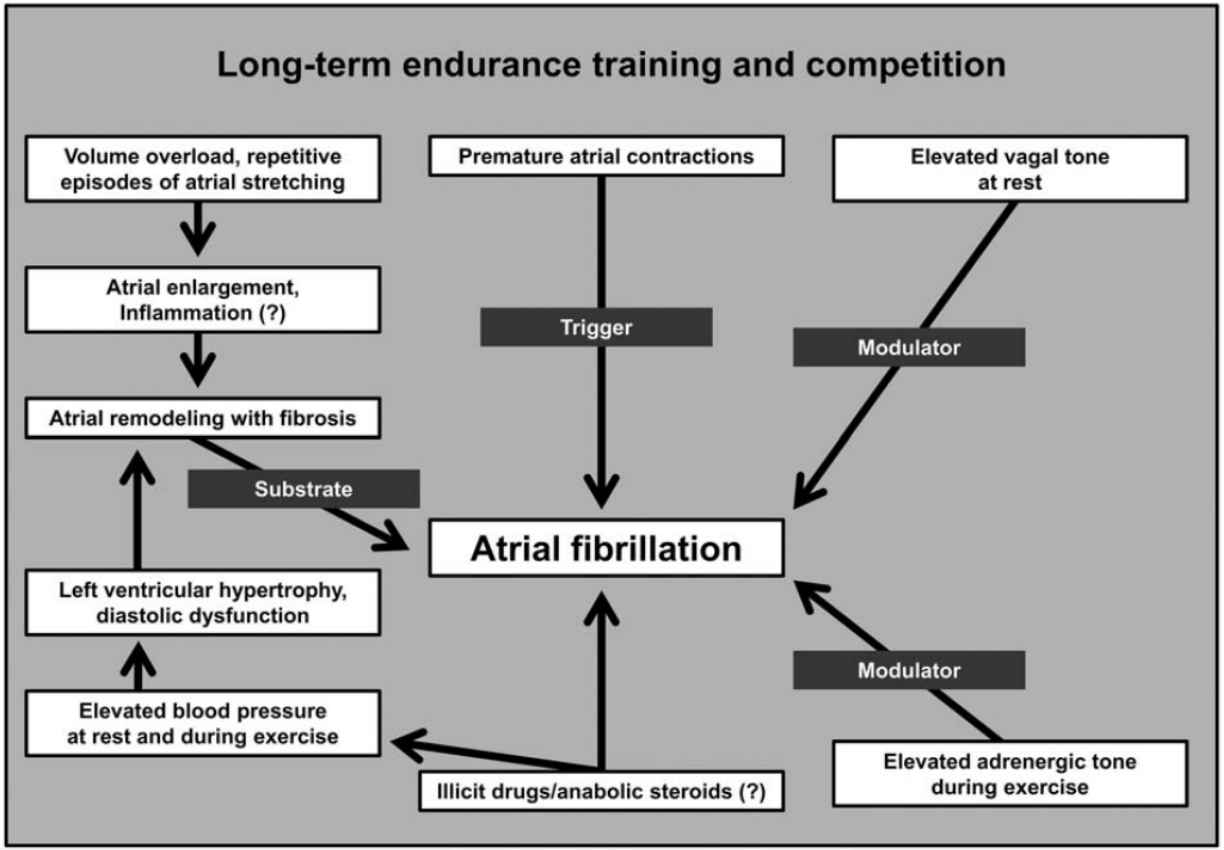
	All sports (n=19)	Endurance sports (n=12)	Non-endurance sports (n=7)	No sports (n=23)	p Value by one-way ANOVA
LVEDD (mm)	50.3±5	50.8±6	49.5±4	50.4±7	0.9
LA diameter (mm)	39.4±5	41.1±5	36.4±5	36.7±4	0.04*
IVS (mm)	11.6±2	11.7±2	11.4±2	10.5±1	0.05
PWT (mm)	10.7±2	10.5±1	11.0±4	10.0±1	0.45
EF (%)	64±6	65±5	62±6	63±8	0.49
LVMI (g/m^2)	109±33	110±22	109±48	97±22	0.31

‘A history of endurance sports and subsequent left atrial remodelling may be a risk factor for the development of atrial flutter.’



Claessen G et al. *Heart* 2011

Factors influencing the development of AF in athletes.



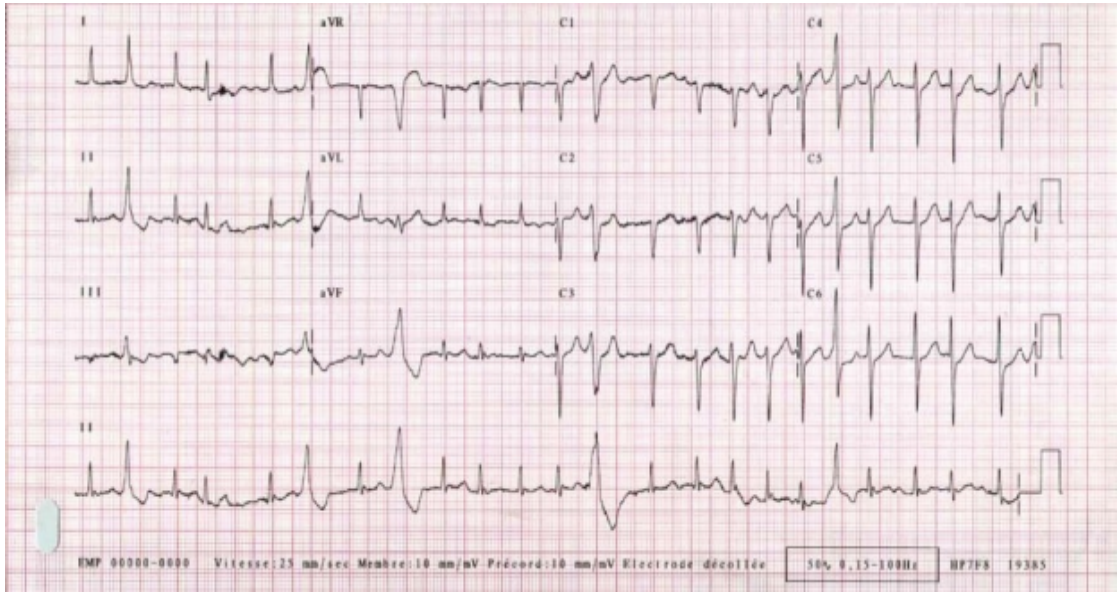
Whilelm M.
Eur J Prev Cardiol. 2014

Doping and atrial fibrillation

Licit or Illicit drugs:

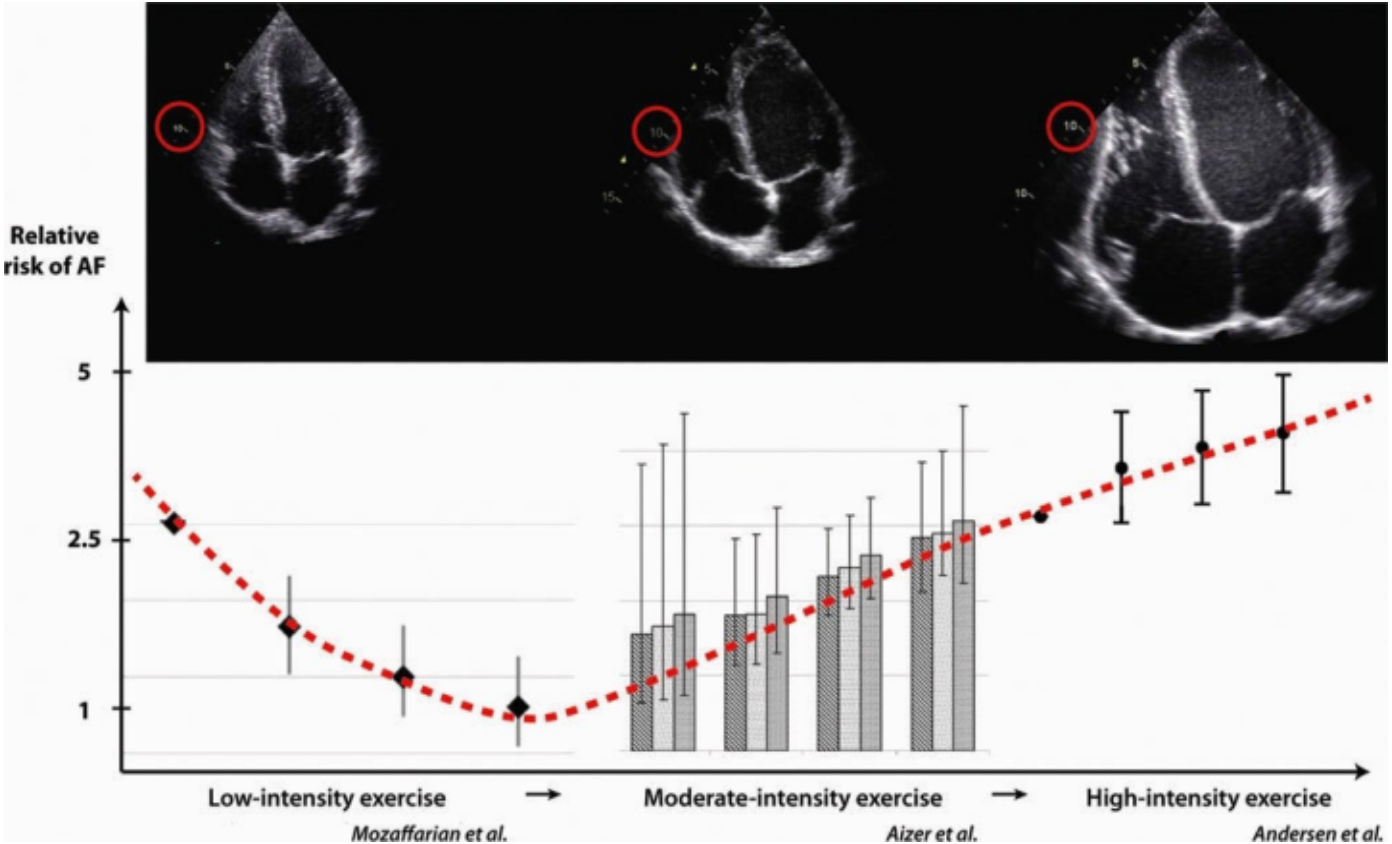
Beta 2 agonists, amphetamines, ephedrine, anabolic steroid, cocaine

Furlanello F . *EJCPR* 2007;14(4): 487-94 *Ital Heart J* 2003;4(12)829-37



Cyclist: amphetamins and corticoïds

Relationship between exercise dose and the risk of developing AF.



The echocardiograms and relative scale (10 cm marker highlighted) demonstrating the increase in heart and atrial size with training

J-shaped relationship between exercise dose and the risk of developing AF.

La Gerche A et al. *Eur Heart J* 2013; 34: 3599–602

Vigorous Exercise and Risk of AF

- Frequency of vigorous exercise was associated with an increased risk of developing AF in young men and joggers.

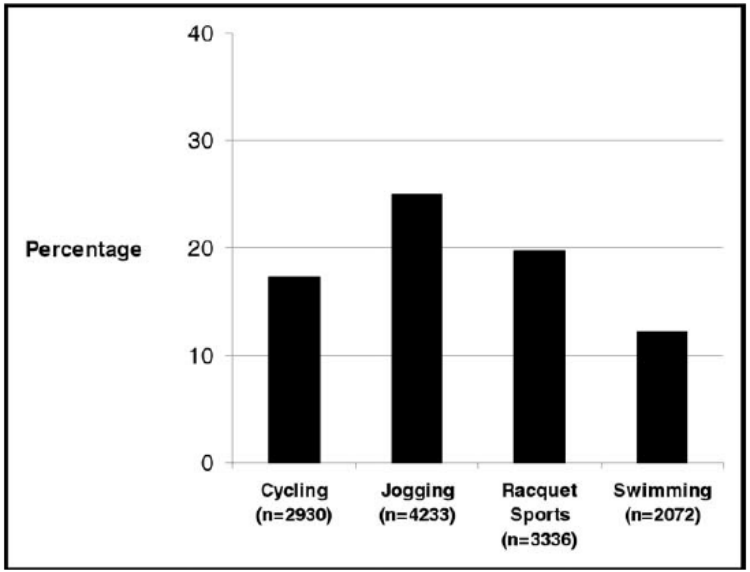


Figure 2. Frequency of participation in different sports activities.

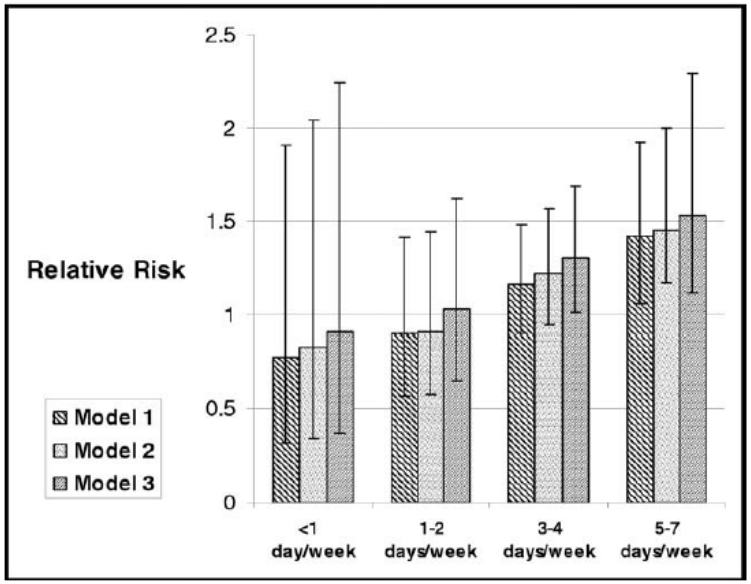


Figure 3. RR of AF according to jogging frequency at 3 years.

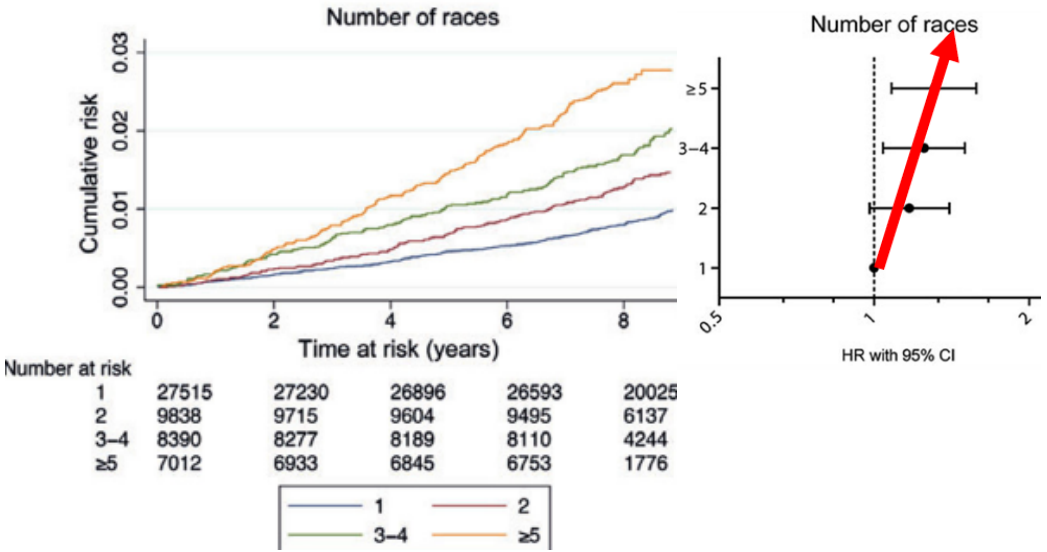
- This risk decreased as the population aged and was offset by known beneficial effects of vigorous exercise on other AF risk factors.

Aizer A et al. *Am J Cardiol* 2009

Intensity, duration, type of sport and AF

. 52,000 Swedish **long-distance skiers** in a 90 km endurance race (1989-98), followed up to 2005

. AF occurred in 681 skiers: **annual incidence of 0.13%/Yr**



Andersen K et al. *Eur Heart J.* 2013

. Norway, men in **long-distance cross-country ski race** and men from the general population: 3,545 men ≥ 53 yo.

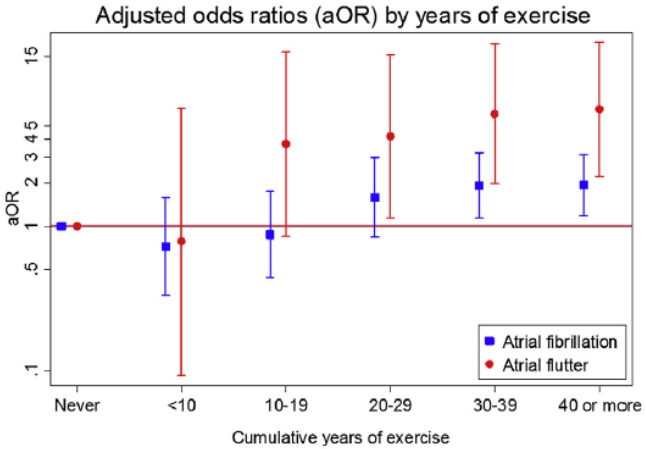
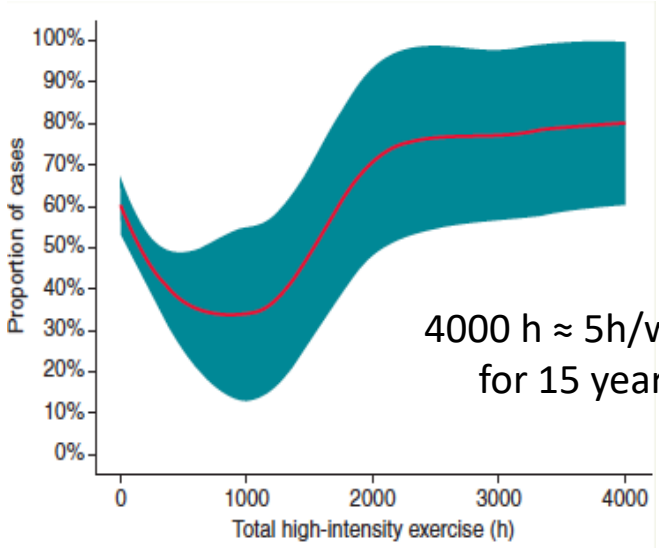


Figure 2. Adjusted odds ratios with 95% CIs for AF (n = 219) and atrial flutter (n = 52) by categories of exercise years, men aged 53 to 92 years (n = 3,545). Adjusted for age, height, heart disease, hypertension, diabetes mellitus, high-intensity exercise during the previous 12 months, and cohort affiliation.

Myrstad M et al. *Am J Cardiol* 2014

Risks factors for lone AF in endurance athletes

	Univariate analysis			Multivariate analysis
	OR (95% CI)	*P*-value	Stand. β	OR (95% CI)
Age at beginning vigorous exercise (per year)	0.96 (0.93–0.99)	0.01	−0.504	
Lifetime-accumulated vigorous exercise (per 100 h)	1.02 (1.0069–1.032)	0.003	1.22	1.041 (1.013–1.07)
Hours of vigorous exercise per year (per 10 h)	1.023 (1.005–1.042)	0.015	0.588	



4000 h ≈ 5h/week
for 15 years

Calvo N et al. *Europace* 2016

Common features in strenuous endurance exercise (SEE)-associated atrial fibrillation (AF).

Common characteristics
1. Starts as paroxysmal AF
2. Gender = men
3. Age ≤ 60 years (most frequently in middle-aged people: 40–60 years)
4. Prolonged practice of SEE (≥6 to 8 h/week with intensity greater than 60% of maximum heart rate, for at least 6 months but commonly during years
5. AF occurs with no structural heart damage, usually in people showing parameters compatible with the 'Athlete's heart'
6. Body mass index ≤25 kg/m^2, nonhypertensive (at rest), nonsmoker, nondiabetic
7. Refusing to cease or reduce exercise intensity or volume

Sanchis Gomar F et al. *Int J Cardiol* 2017

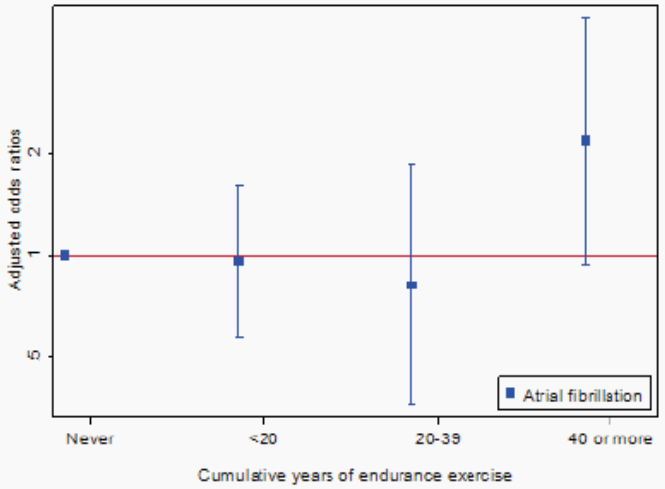
Sex and AF in endurance athletes

Table 1 Characteristics of the study populations

	Veteran skiers without AF $n = 2304$ Mean (median, range)	Veteran skiers with confirmed AF $n = 140$ Mean (median, range)	Veteran skiers with self-reported AF $n = 185$ Mean (median, range)	General population with AF $n = 118$ Mean (median, range)
Age (years)	64.0 (63, 53–85)	68.5 (69, 53–85)	64.9 (65, 53–85)	69.8 (71, 56–73)
Body mass index (kg/m^2)	24.1 (23.9, 14.4–40.0)	24.4 (24.2, 19.9–32.4)	24.5 (24.0, 19.4–35.2)	26.2 (25.8, 18.8–43.2)
Education (years)	14.1 (15, 0–30)	13.9 (15, 0–24)	14.2 (15, 0–26)	14.6 (15, 0–31)
Completed Birkebeiner races	13.8 (12, 1–57)	17.3 (15, 1–49)	14.3 (13, 1–45)	–
	n (% of 2304)	*n* (% of 140)	*n* (% of 185)	*n* (% of 118)
Females	274 (12 %)	2 (1 %)	7 (4 %)	35 (30 %)

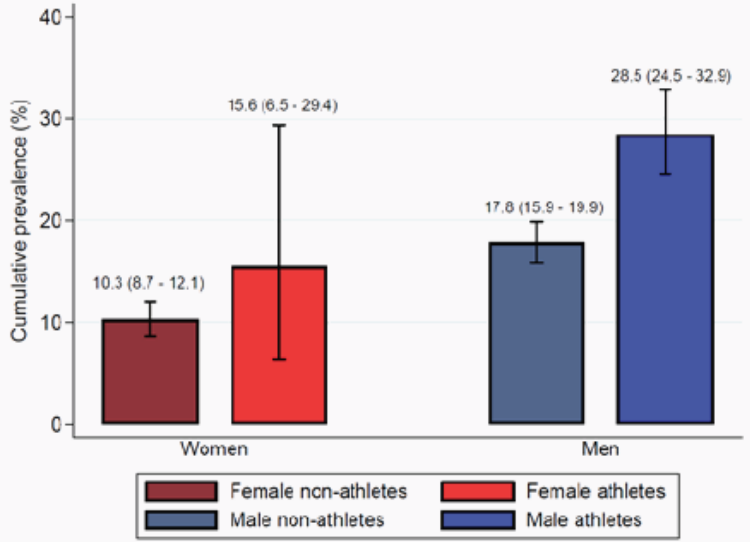
Myrstad M et al. *Clin Res Cardiol* 2015

AF in female endurance athletes



278 female XC-skiers and 1178 non-athletes, mean age 63 years

Myrstad M. Int J Cardiol 2015



46 female XC-skiers and 1375 non-athletes, mean age 68 years

Myrstad M. Eur J Prev Cardiol 2023

AF in female endurance athletes

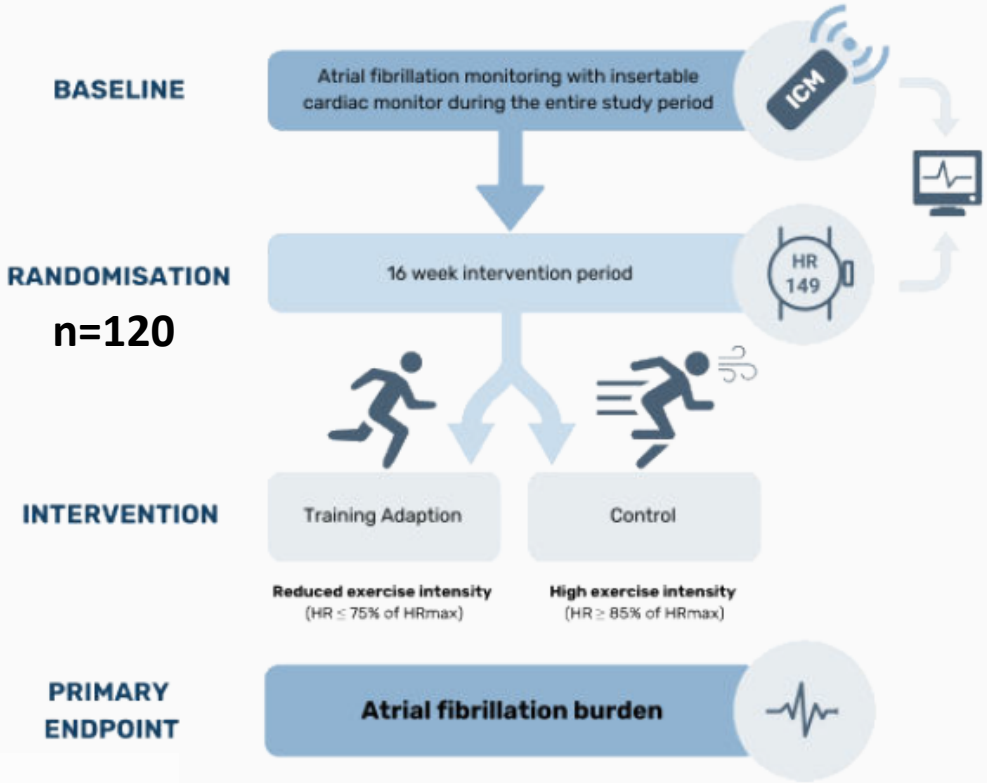
Table 2 Relative hazards of atrial fibrillation in athletes and reference population

	Age-adjusted HR	Multivariable HR*	Multivariable HR†
Reference population	1.00	1.00	1.00
Female athletes	2.56 (1.22 to 5.37)	3.67 (1.71 to 7.87)	3.63 (1.56 to 8.41)
P value	0.013	0.001	0.001

*Adjusted for age and hypertension.
†Adjusted for age, hypertension, ischaemic heart disease, valvular heart disease and post-secondary education.

Drca N. Br J Sports Med 2023

Effects of Training Adaption in Endurance Athletes with Atrial Fibrillation



Training adaption:

. HR ≤75% of the individual maximum HR (HR max)
. Total duration of weekly training ≤80% of the self-reported average before the study.

Apelland T. BMJ Open Sport Exerc Med 2023;9:e001541

ESC 2024: AF-CARE

"C" Comorbidity and risk factor management:

Setting individual targets for comorbidities and risk factors

Central for success of effective AF management

Key targets

Integrated management	Identify and actively manage all risk factors and comorbidities (Class I)
Hypertension	Blood pressure treatment with target 120–129 mmHg / 70–79 mmHg in most adults (or as low as reasonably achievable) (Class I)
Heart failure	Optimize with diuretics to alleviate congestion appropriate, medical therapy for reduced LVEF, and SGLT2 inhibitors for all LVEF (Class I)
Diabetes	Effective glycaemic control with diet/medication(s) (Class I)
Obesity	Weight loss programme if overweight /obese, with 10% or more weight loss (Class I)
Sleep apnoea	Management of obstructive sleep apnoea to minimize apnoeic episodes (Class IIb)
Physical activity	Tailored exercise programme aiming for regular moderate/vigorous activity (Class I)
Alcohol intake	Reduce alcohol consumption to 3 or less standard drinks per week (Class I)

2024 ESC Guidelines for the management of atrial fibrillation
(European Heart Journal; 2024 – doi: 10.1093/eurheartj/ehae176)

Treatment of AF in athlete

'Pill-in-the pocket' approach with class I drugs ?

Ablation:
Paroxysmal crisis
Young athlete ++
Master athlete +/-
Need to decrease physical training

If not lone AF: adapted treatment to disease

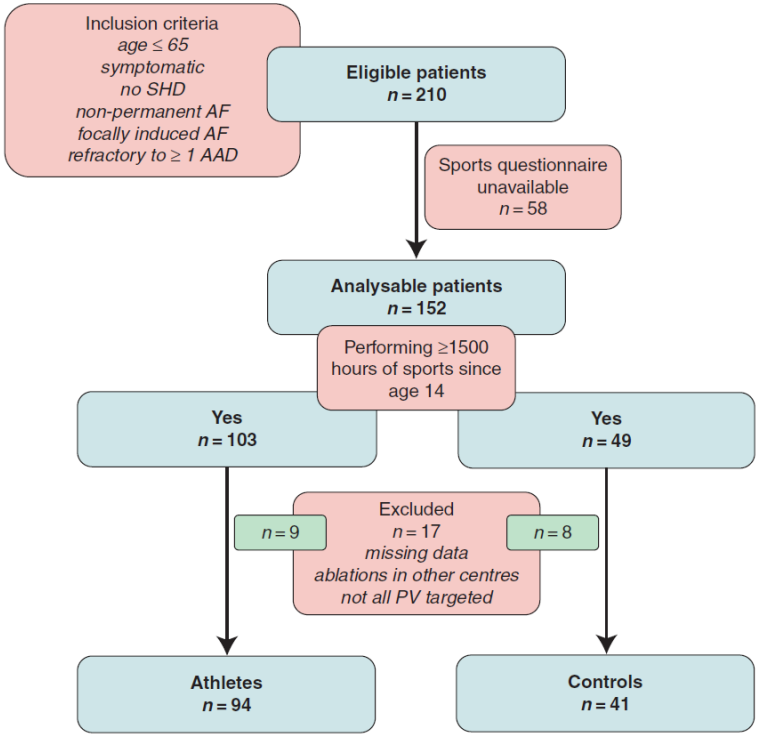
No specific anticoagulation indication
No increased risk of thromboembolic events in athletes

Recommendations	Class[a]	Level[b]	Ref.[c]
When a 'pill-in-the-pocket' approach with sodium channel blockers is used, sport cessation should be considered for as long as the arrhythmia persists, and until 1–2 half-lives of the antiarrhythmic drug used have elapsed.	IIa	C	
Isthmus ablation should be considered in competitive or leisure-time athletes with documented atrial flutter, especially when therapy with flecainide or propafenone is intended.	IIa	C	
Where appropriate, AF ablation should be considered to prevent recurrent AF in athletes.	IIa	C	
When a specific cause for AF is identified in an athlete (such as hyperthyroidism), it is not recommended to continue participation in competitive or leisure time sports until correction of the cause.	III	C	
It is not recommended to allow physical sports activity when symptoms due to haemodynamic impairment (such as dizziness) are present.	III	C	

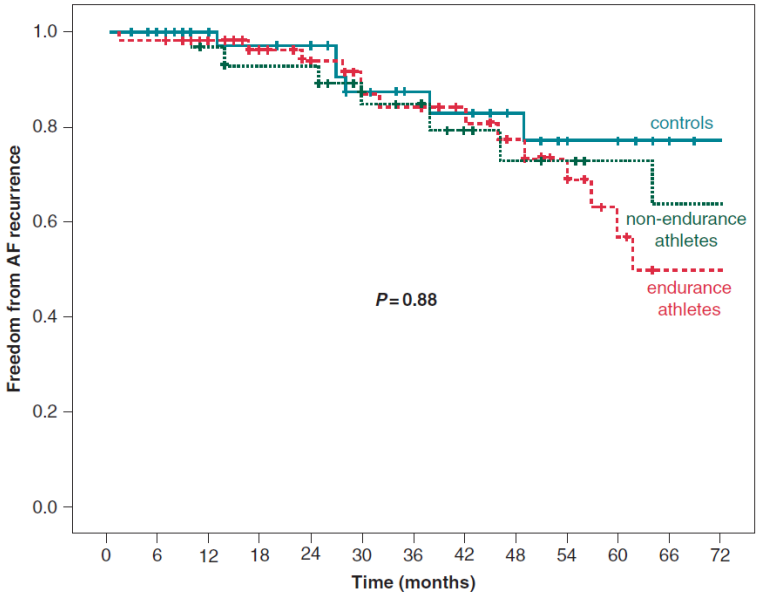
Camm JA et al. *Eur Heart J* 2010;31:2369–429

AF ablation in athletes

Flow chart:



Final outcome after multiple ablations, on or off drugs:



Number of patients at risk

controls	41	36	32	20	14	10
endurance	59	55	42	33	20	10
non-endurance	35	28	25	18	10	8

Koopman P et al. Europace 2011

Conclusion

- Une activité physique modérée et régulière a un effet neutre ou peut diminuer le risque de fibrillation atriale (FA) dans la population générale, tant chez les hommes que chez les femmes.
- Chez les hommes d'âge moyen, un exercice d'endurance intense et de longue durée peut augmenter le risque de FA isolée (principalement de type vagal) d'un facteur de 3 à 5, sans effet sur la mortalité.
- Les modifications morphologiques et fonctionnelles des oreillettes, associées aux modifications de l'équilibre vago-sympathique peuvent expliquer ce risque accru de FA