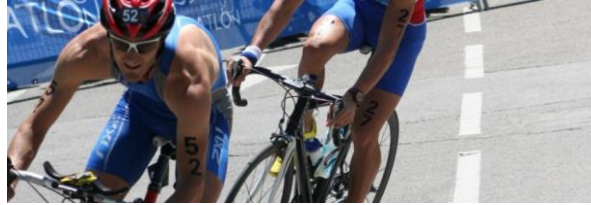




FORUM EUROPÉEN CŒUR, EXERCICE & PRÉVENTION



Cardiopathie hypertrophique et sport : une stratification du risque difficile

Christophe HEDON

CHU Montpellier



www.forumeuropeen.com



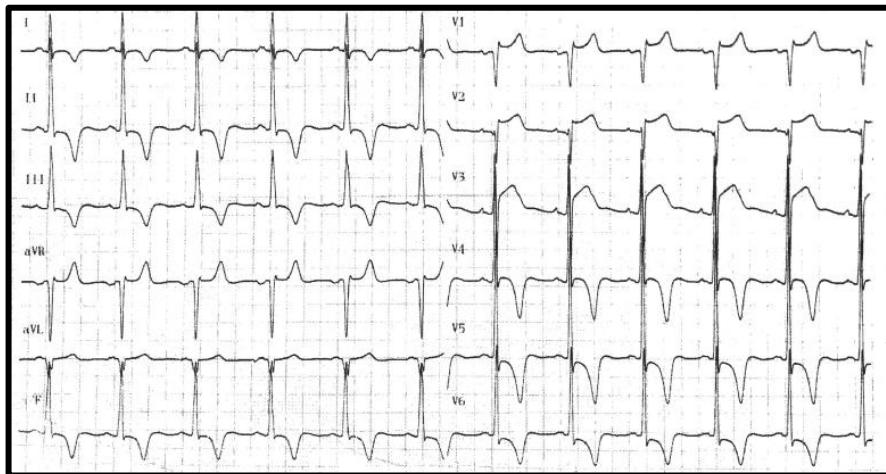
Conflits d'intérêts

aucun



Cas Num 1

Homme 62 ans, tennis en compétition



CMH apicale
16mm
Pas de fibrose en IRM
Génétique négative



Risk of Sudden Cardiac Death at 5 years

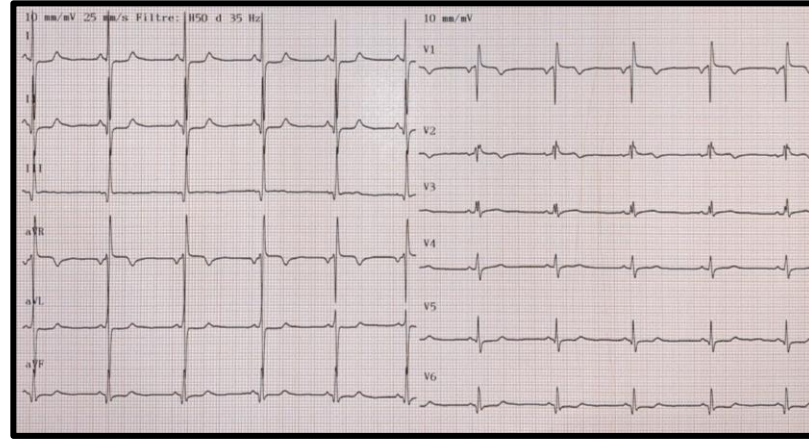
1.08%

ESC Recommendation

ICD generally not indicated



Femme 26 ans, sport haut niveau, VTT en compétition, cyclisme 15h/sem



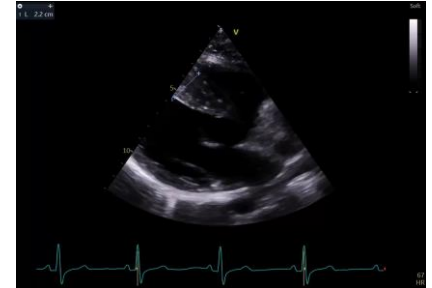
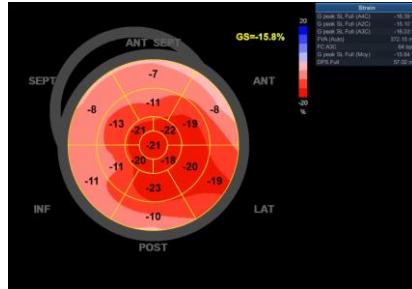
CMH septale
22mm
Fibrose en IRM
MYH7

Risk of Sudden Cardiac Death at 5 years

2.74%

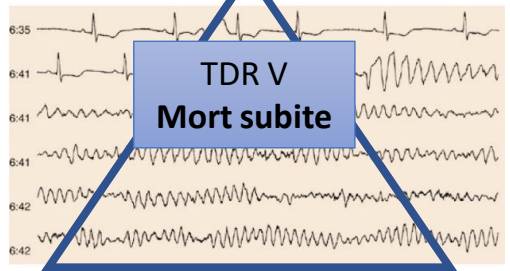
ESC Recommendation

ICD generally not indicated



CMH et sport, principaux enjeux

CM sous jacente
Fibrose

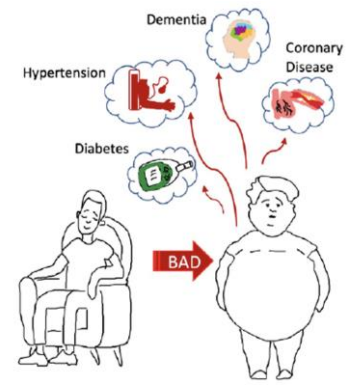


Gâchette/ESV

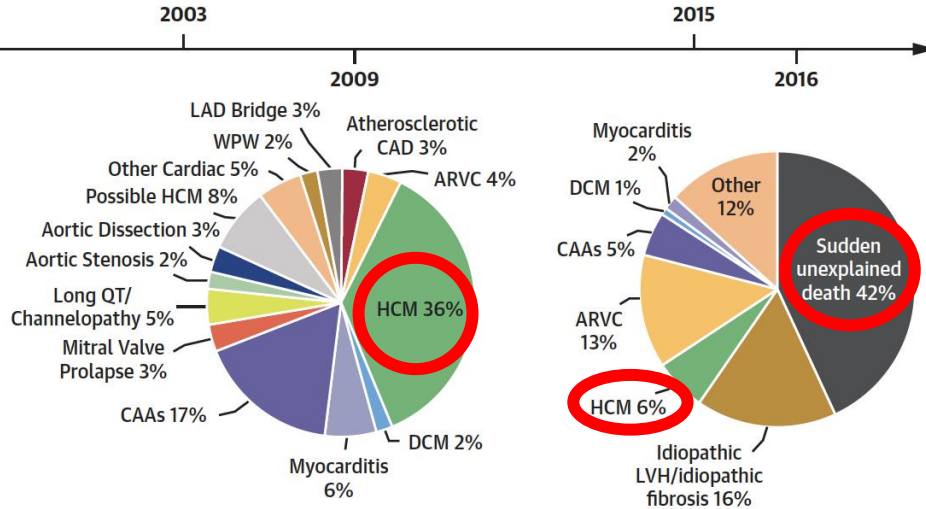
Environnement lié au sport



- Progression de la cardiopathie
- Aggravation phénotype
- Aggravation pronostic



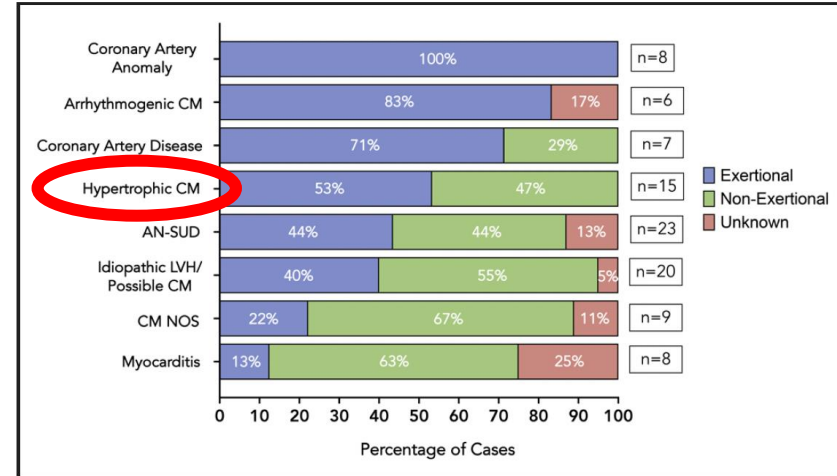
Mort subite chez l'athlète jeune



Maron et al

Finocchiaro et al. JACC 2024

Finocchiaro et al



Exertional status at time of death by common causes of sudden cardiac death.

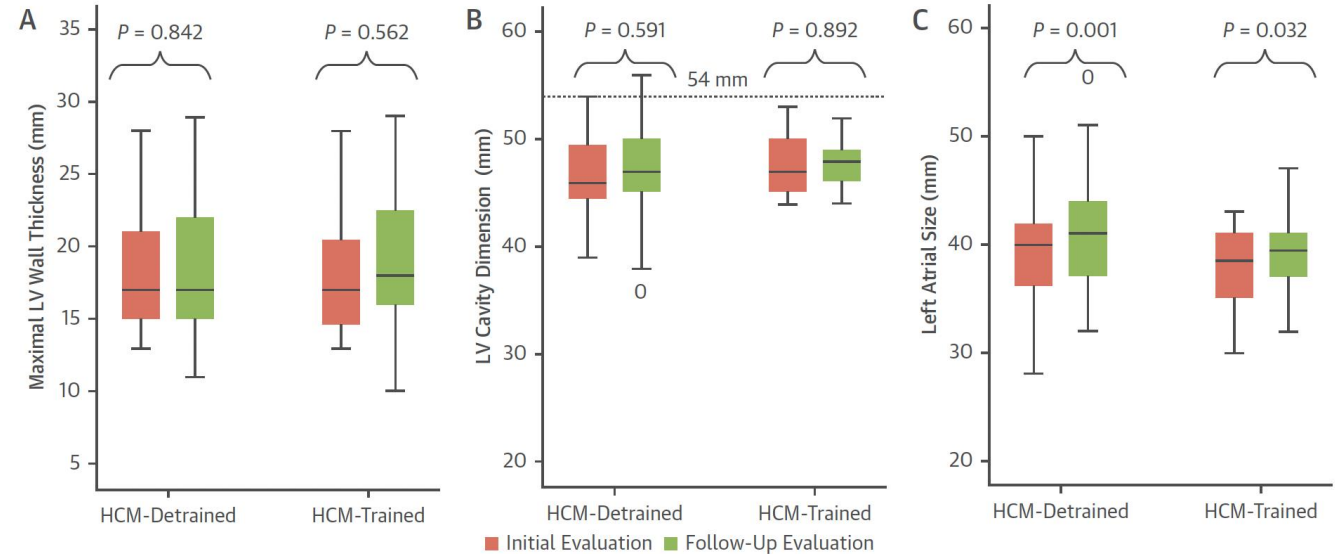
Petek et al. Sudden Cardiac Death in National Collegiate Athletic Association Athletes: A 20-Year Study. Circulation. 2023



Progression de la maladie avec le sport ?

CMH, n=60

FIGURE 1 Cardiac Changes in Patients With HCM According to Continued (HCM-Trained) or Interrupted Participation (HCM-Detrained) in Exercise and Sport



Box plot representation of the mean, SD, and 5% and 95% limits of left ventricular (LV) maximal wall thickness (A), LV cavity end-diastolic diameter (B), and left atrial diameter (C) at initial and most recent evaluations. HCM = hypertrophic cardiomyopathy.

Pelliccia A, et al. Neither athletic training nor detraining affects LV hypertrophy in adult, low-risk patients with HCM. JACC CV imaging. 2022.

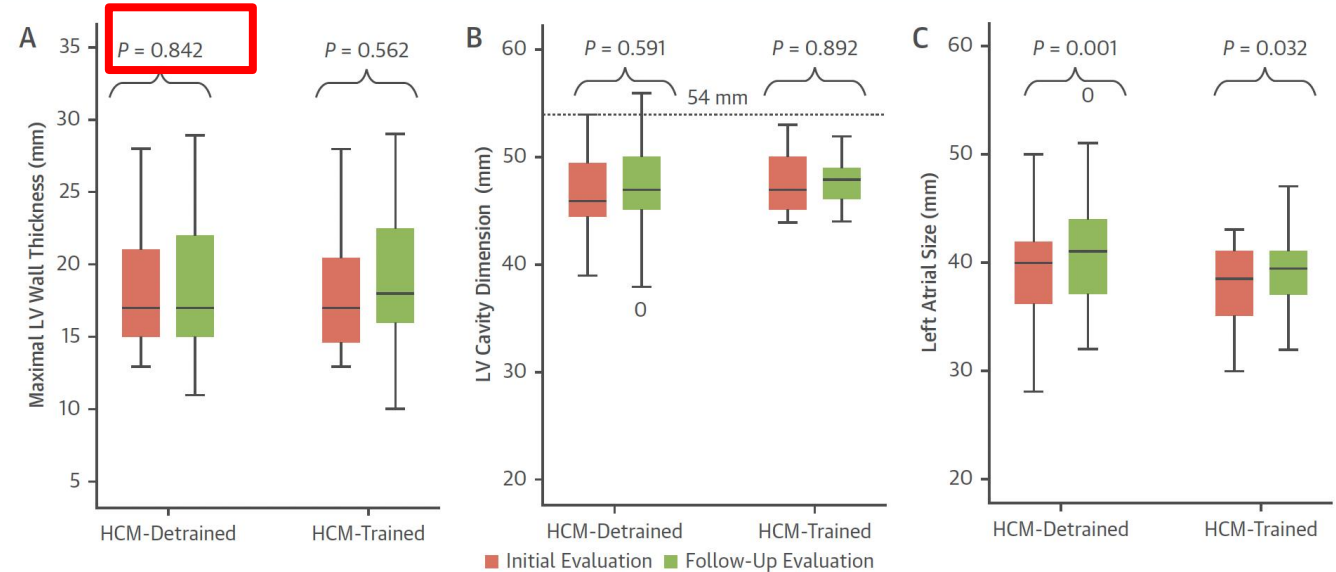


Progression de la maladie avec le sport ?

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Désentraînement :
pas de régression de l'HVG

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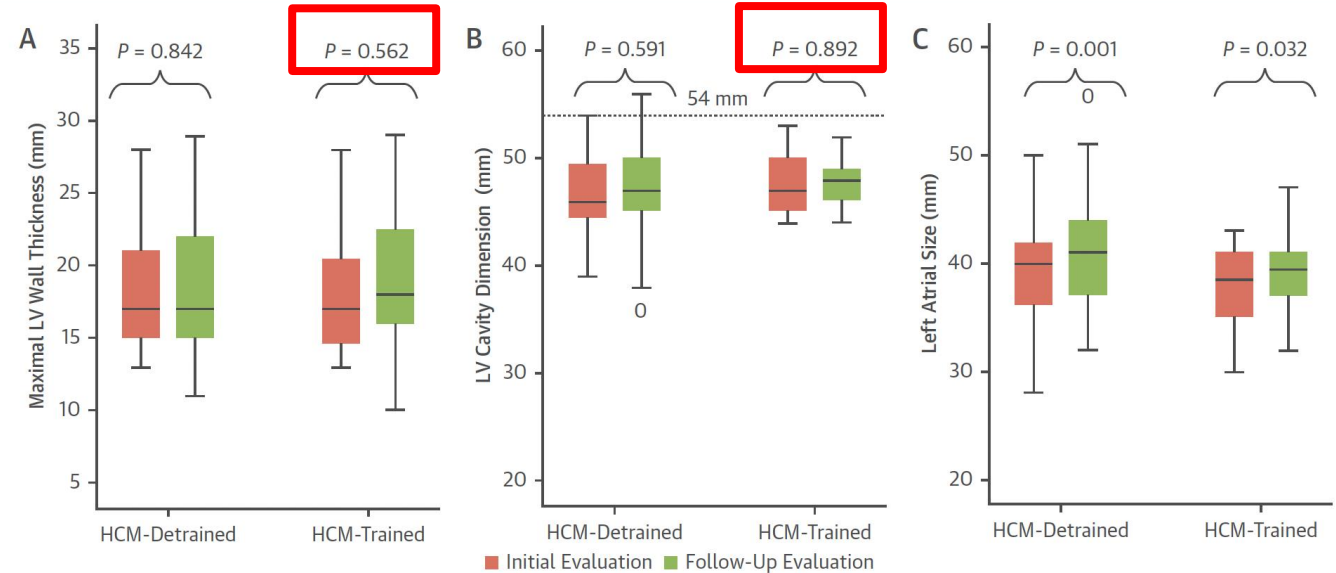
Progression de la maladie avec le sport ?

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pas de régression de l'HVG

Poursuite de la pratique
sportive :
pas de remodelage VG
significatif

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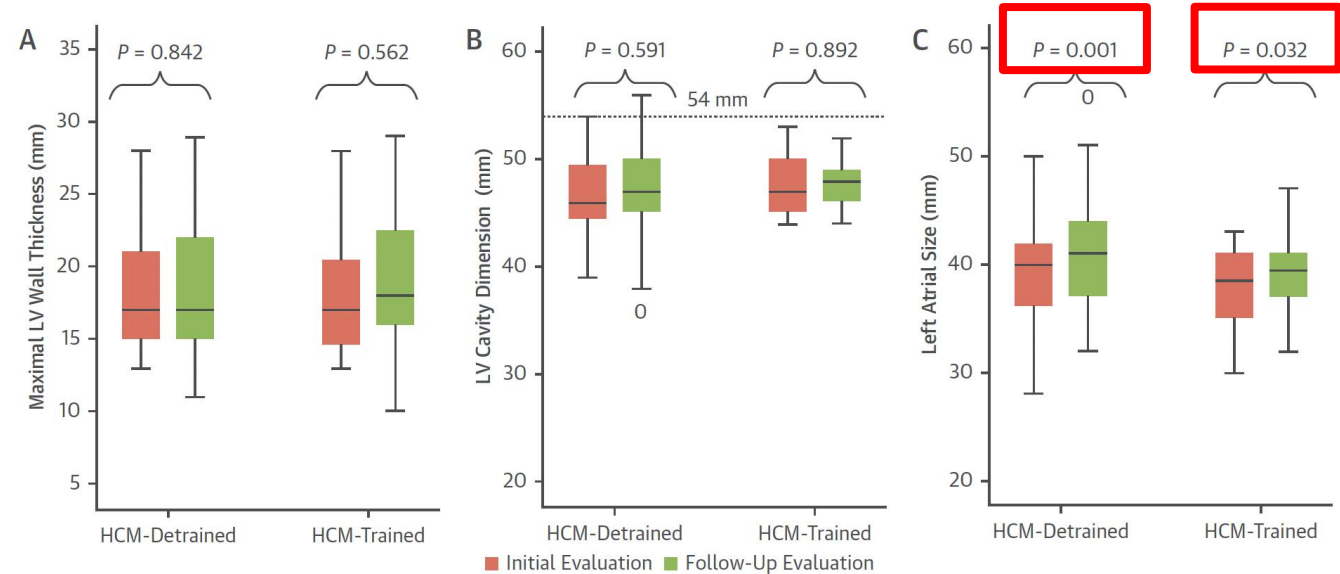
CMH, n=60

Désentraînement :
pas de régression de l'HVG

Poursuite de la pratique sportive :
pas de remodelage VG
Significatif

Dans tous les cas :
discrète dilatation atriale
avec le temps

FIGURE 1 Cardiac Changes in Patients With HCM According to Continued (HCM-Trained) or Interrupted Participation (HCM-Detrained) in Exercise and Sport

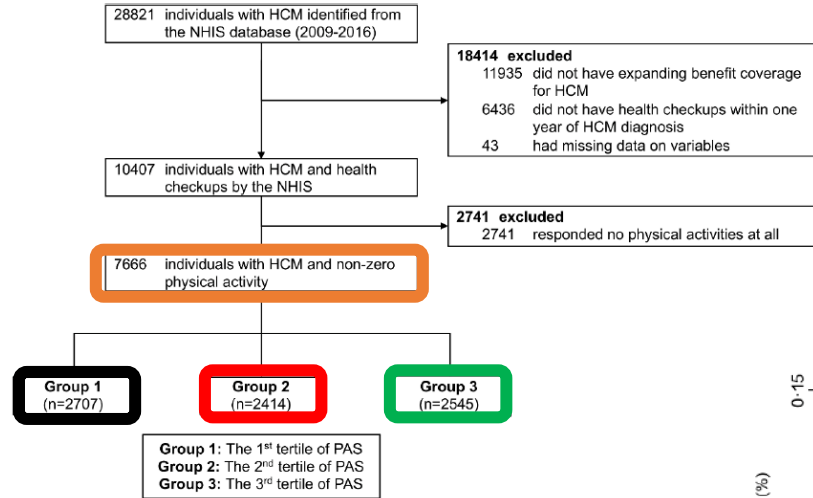


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CMH et niveau d'activité physique, pronostic ?



Age moyen: 59 ans

Score activité physique :

Groupe 1 : 1.4 ± 0.6 METs/jour

Groupe 2 : 3.4 ± 0.7

Groupe 3 : 8.4 ± 3.1

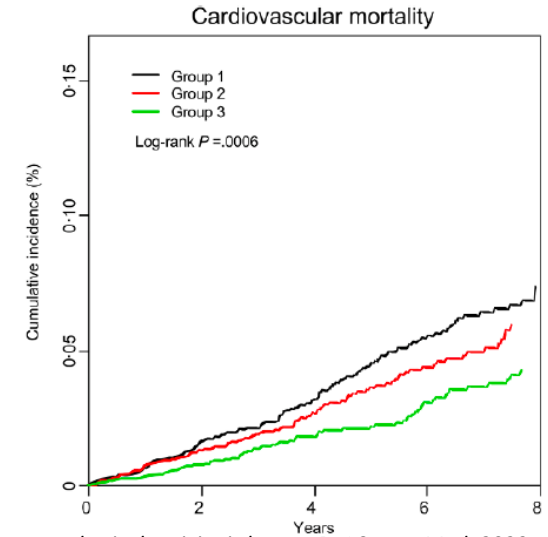
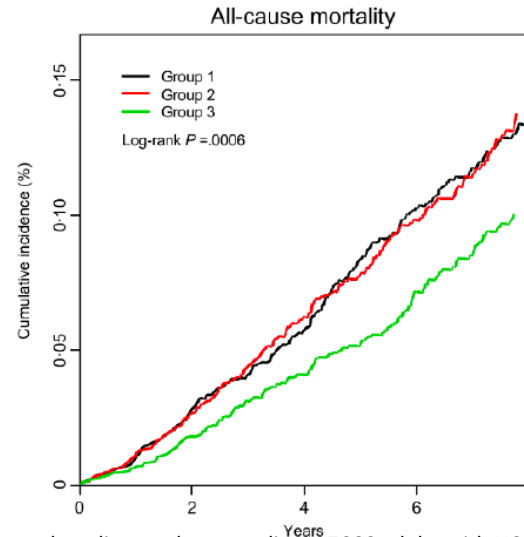
Suivi de 5.3±2.0 années

624 décès (8.1%)

Taux de mortalité toute cause : 9.1%, 8.9%, 6.4% groupes 1, 2 et 3

289 décès d'origine CV (3.8%)

Taux de mortalité CV : 4.7%, 3.8% and 2.7%



Kwon S, et la. Association of physical activity with all-cause and cardiovascular mortality in 7666 adults with HCM: more physical activity is better. Br J Sports Med. 2020.



Effets bénéfiques activité physique et CMH

- ↗ Pic de VO₂
- ↗ Fonction diastolique
- ↘ Symptômes
- ↗ Qualité de vie
- ↘ Mortalité
- Arythmie
- Gradient

Table 1 Summary of key studies investigating the effect of exercise in patients with HCM

First author	Year	Type of study	Individual characteristics	Exercise programme	Summary of findings
Klempfner ²⁹	2015	Single-centre study	<ul style="list-style-type: none"> ▶ 20 patients with HCM. ▶ Mean age 62±13 years old. ▶ Symptomatic in NYHA class II or III. 	<ul style="list-style-type: none"> ▶ 2x 60 min supervised exercise sessions at an HRR of 85%. ▶ Completed 41±8 hours of aerobic exercise. 	<ul style="list-style-type: none"> ▶ Increase in functional capacity of 2.5 METS (pVO₂ 8.75 mL/kg/min). ▶ Improvement in NYHA class. ▶ No adverse events.
Saber ²⁸	2017	Randomised clinical trial	<ul style="list-style-type: none"> ▶ 67 patients with HCM. ▶ 69 controls with HCM. ▶ Mean age 50.4±13.3 years old. ▶ Asymptomatic. 	<ul style="list-style-type: none"> ▶ 16-week home-based exercise programme. ▶ 4-7x 60 min at HRR=70%. 	<ul style="list-style-type: none"> ▶ Modest increase in pVO₂ (1.25 mL/kg/min). ▶ Improved quality of life scores. ▶ No adverse events.
Kwon ³⁰	2020	Clinical observation study	<ul style="list-style-type: none"> ▶ 7666. ▶ Mean age 59.5 years. ▶ Follow-up 5.3±2 years. 	<ul style="list-style-type: none"> ▶ Self-reported exercise volume in quartiles. ▶ Low 1.46±0.46 METS/day. ▶ Intermediate 3.4±0.7 METS/day. ▶ High 8.4±3 METS/day. 	<ul style="list-style-type: none"> ▶ Reduction in all-cause mortality.

HCM, hypertrophic cardiomyopathy; HRR, heart rate reserve; METS, metabolic equivalents; NYHA, New York Heart Association; pVO₂, peak oxygen consumption.

Table 2 Summary of key studies investigating athletes with HCM

First author	Year	Type of study	Individual characteristics	Exercise programme	Summary of findings
Sheikh ³⁴	2015	Clinical observational study	<ul style="list-style-type: none"> ▶ 106 asymptomatic athletes competing at regional level or above. ▶ 102 patients with HCM. ▶ Mean age 24.3±6.9 years old. 	<ul style="list-style-type: none"> ▶ 81% competing at regional, national or international level. 	<ul style="list-style-type: none"> ▶ Compared with patients with HCM, 96% of athletes with HCM exhibited: <ul style="list-style-type: none"> ▶ Milder LVH (36% confined to the apex). ▶ Large LVEDD. ▶ Superior indices of diastolic function.
Dejgaard ³⁵	2018	Clinical observational study	<ul style="list-style-type: none"> ▶ 187 asymptomatic patients with HCM (44 athletes). ▶ Mean age 49±16 years old. 	<ul style="list-style-type: none"> ▶ >6 METS: vigorous exercise. ▶ >4 hours/week for >6 years (in the athletic range). 	<ul style="list-style-type: none"> ▶ Exercise associated with: <ul style="list-style-type: none"> ▶ Larger LV volumes. ▶ Superior diastolic function. ▶ Larger stroke volume. ▶ No change in LVOT gradient. ▶ No increase in VA.
Pelliccia ³⁶	2020	Clinical observational study	<ul style="list-style-type: none"> ▶ 88 asymptomatic athletes with HCM. ▶ Median age 31 years. ▶ ESC 5-year SCD risk 2.2%. ▶ Follow-up 7±5 years. 	<ul style="list-style-type: none"> ▶ 27 (31%) continued competitive sport. ▶ 61 (69) stopped competitive sport. 	<ul style="list-style-type: none"> ▶ No adverse events in the HCM trained athletes. ▶ 2 SCA in the HCM detrained group. ▶ No difference in annual prevalence of new symptoms (1.3%).

ESC, European Society of Cardiology; HCM, hypertrophic cardiomyopathy; LV, left ventricle; LVEDD, left ventricular end-diastolic dimension; LVH, left ventricular hypertrophy; LVOT, left ventricular outflow tract; METS, metabolic equivalents; SCA, sudden cardiac arrest; SCD, sudden cardiac death; VA, ventricular arrhythmia.

Gati S, et al. Exercise prescription in individuals with hypertrophic cardiomyopathy: what clinicians need to know. Heart 2022.



Reco antérieures :

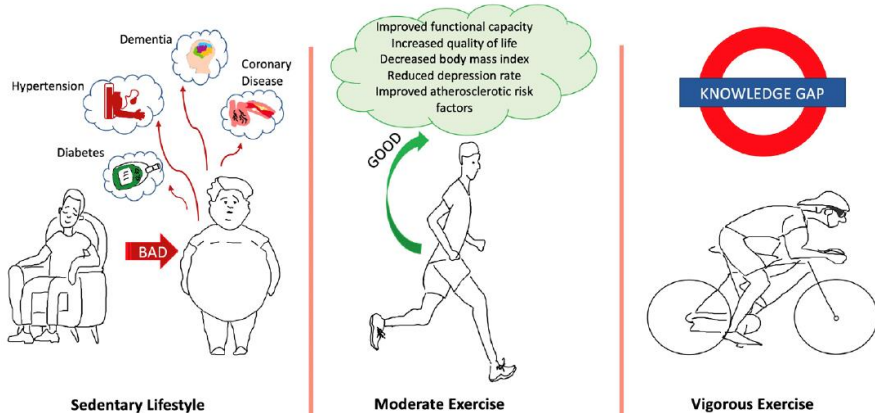
Cardiopathie hypertrophique = Pas de sport de compétition

Reco 2020 :

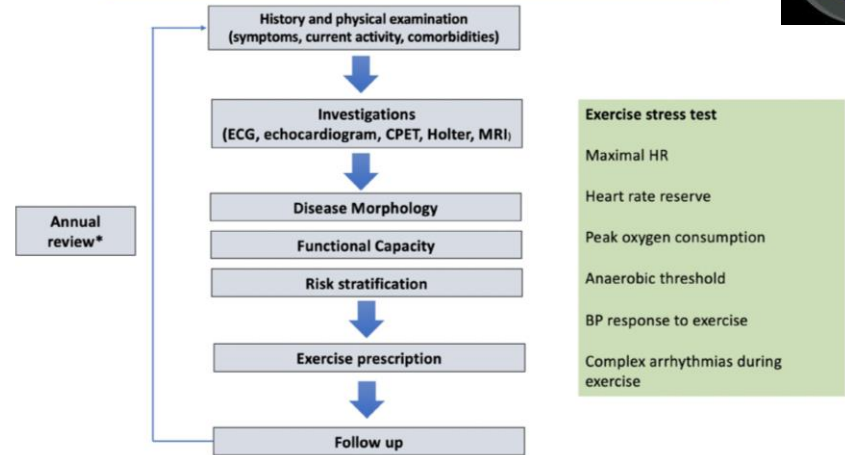
Cardiomyopathie hypertrophique = Stratification du risque



Relationship Between Exercise and Hypertrophic Cardiomyopathy



Comprehensive Clinical Evaluation and Risk Stratification for Sudden Cardiac Death


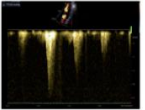







Gati S, et al. Exercise prescription in individuals with hypertrophic cardiomyopathy: what clinicians need to know. Heart 2022.



Stratification du risque

ESC Guidelines for Exercise in HCM

Symptoms / Past Medical History	Asymptomatic Good Functional Capacity	Symptoms attributed to HCM with no clear association with exercise	History of cardiac arrest History of unexplained syncope Exercise induced symptoms												
 HCM Risk-SCD Calculator  LVOT Gradient  BP Response to Exercise  Exercise induced Arrhythmia Intensity of Exercise	Low Risk No/mild LVOT gradient at rest or exercise (<30mmHg) Normal No Arrhythmia ↓ When all applicable High Intensity 	Moderate risk Moderate LVOT gradient at rest or exercise (30-49mmHg) Attenuated (<20mmHg increase in systolic BP) Exercise induced PVCs ↓ When ≥1 parameters applicable AND no parameter falls within the low intensity column Moderate intensity 	High risk High LVOT gradient at rest or exercise (≥50mmHg) Systolic BP drop Exercised induced non-sustained or sustained ventricular tachycardia ↓ When ≥1 parameters applicable Low intensity 												
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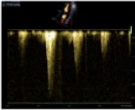







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HCM Risk-SCD Calculator

Age of evaluation:

Maximum LV wall thickness: Trans-thoracic Echocardiographer measurement

Left atrial size: Left atrial diameter determined by M-Mode or 2D echocardiography in the parasternal long axis plane at time of evaluation.

Max LVOT gradient: The maximum LV outflow gradient determined at rest and with maximal provocation (irrespective of current medical treatment) using pulsed and continuous wave Doppler from the apical three and five chamber views. Peak outflow tract gradients should be determined using the modified Bernoulli equation: $Gradients \propto V^2$, where V is the peak aortic outflow velocity.

Family History of SCD: No Yes History of sudden cardiac death in 1 or more first degree relatives under 40 years of age or SCD or a first degree relative with confirmed HCM at any age (past or ante mortem diagnosis).

Non-sustained VT: No Yes ≥ 3 consecutive ventricular beats at a rate of 120 beats per minute and <30s in duration on Holter monitoring (minimum duration 24 hours) at or prior to evaluation.

Unexplained syncope: No Yes History of unexplained syncope at or prior to evaluation.

Risk of SCD at 5 years (%):

ESC recommendation:

© 2014 ESC Guidelines on Diagnosis and Management of Hypertrophic Cardiomyopathy (Eur Heart J 2014; 35(10):1050-1061) | 1000eurheartjpln284
© Mahoney C et al. Eur Heart J 2014; 35(10):2010-2020


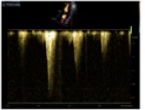





HCM Risk-SCD should not be used in:
 • Pacemaker patients (<16 years)
 • Electrosensitive athletes
 • HCM associated with metabolic diseases (e.g. Anderson-Fabry disease), and syndromes (e.g. Noonan syndrome).
 • Patients with a previous history of aborted SCD or sustained ventricular arrhythmia who should be treated with an ICD for secondary prevention.

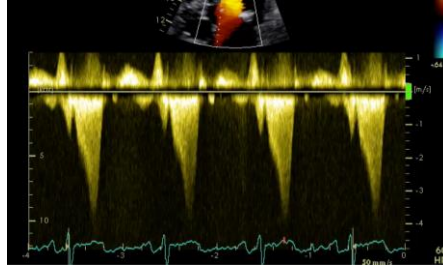
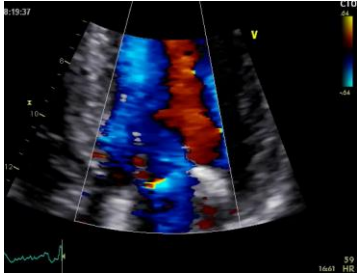
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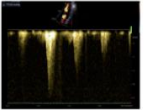





Gati S, et al. Exercise prescription in individuals with hypertrophic cardiomyopathy: what clinicians need to know. Heart 2022.



Stratification du risque

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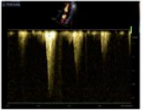







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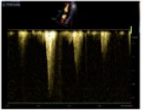







Gati S, et al. Exercise prescription in individuals with hypertrophic cardiomyopathy: what clinicians need to know. Heart 2022.



Stratification du risque

ESC Guidelines for Exercise in HCM

Symptoms / Past Medical History	Asymptomatic Good Functional Capacity	Symptoms attributed to HCM with no clear association with exercise	History of cardiac arrest History of unexplained syncope Exercise induced symptoms												
	 HCM Risk-SCD Calculator  LVOT Gradient  BP Response to Exercise  Exercise induced Arrhythmia	<p>Low Risk</p> <p>No/mild LVOT gradient at rest or exercise (<30mmHg)</p> <p>Normal</p> <p>No Arrhythmia</p>	<p>Moderate risk</p> <p>Moderate LVOT gradient at rest or exercise (30-49mmHg)</p> <p>Attenuated (<20mmHg increase in systolic BP)</p> <p>Exercise induced PVCs</p>	<p>High risk</p> <p>High LVOT gradient at rest or exercise (≥ 50mmHg)</p> <p>Systolic BP drop</p> <p>Exercise induced non-sustained or sustained ventricular tachycardia</p>											
Intensity of Exercise	<p>When all applicable</p> <p>High Intensity</p>	<p>When ≥ 1 parameters applicable AND no parameter falls within the low intensity column</p> <p>Moderate intensity</p>	<p>When ≥ 1 parameters applicable</p> <p>Low intensity</p>												
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Sport et CMH : Recommandations

2020 ESC Guidelines on sports cardiology and exercise in patients with cardiovascular disease

Recommendations for exercise and sports participation in individuals with hypertrophic cardiomyopathy

Recommendations	Class ^a	Level ^b
Exercise recommendations		
Participation in high-intensity exercise/competitive sports, if desired (with the exception of those where occurrence of syncope may be associated with harm or death), may be considered for individuals who do not have any markers of increased risk ^c following expert assessment.	IIb	C
Participation in low- or moderate-intensity recreational exercise, if desired, may be considered for individuals who have any markers of increased risk ^c following expert assessment.	IIb	C
Participation in all competitive sports, if desired, may be considered for individuals who are gene positive for HCM but phenotype negative.	IIb	C
Participation in high-intensity exercise (including recreational and competitive sports) is not recommended for individuals who have ANY markers of increased risk ^c .	III	C

Stratification du risque

Individualisation des conseils / décision partagée

Absence de marqueur de risque :

- 1/ Pas de symptôme cardiaque ou antécédent d'arrêt ou syncope inexplicée
- 2/ Score de risque ESC < 4% à 5 ans
- 3/ Gradient < 30mmHg au repos
- 4/ Réponse normale de la PA à l'exercice
- 5/ Pas d'arythmie induite par l'exercice

Sports très intenses et/ou compétition possibles



Sport et CMH : Recommandations

2020 ESC Guidelines on sports cardiology and exercise in patients with cardiovascular disease

Recommendations for exercise and sports participation in individuals with hypertrophic cardiomyopathy

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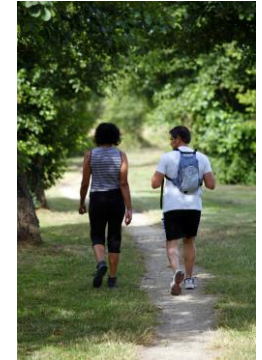
Stratification du risque

Individualisation des conseils / décision partagée

Marqueurs de risques :

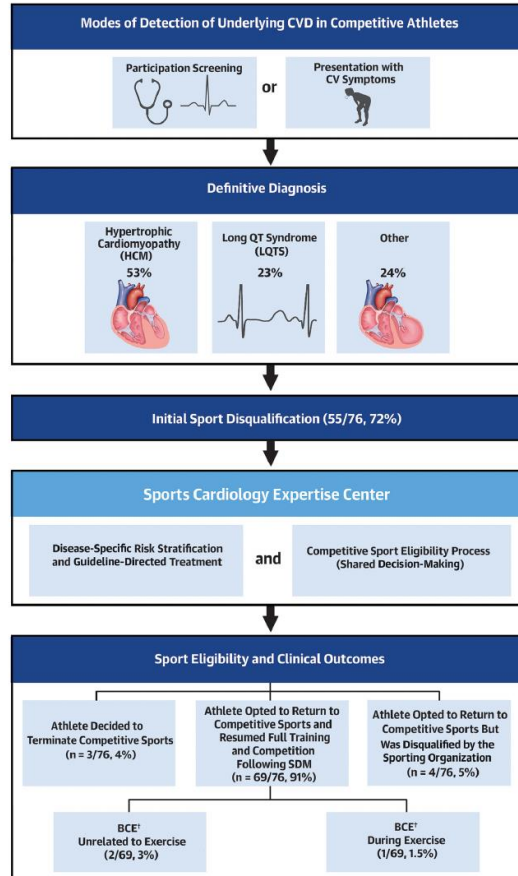
- 1/ Symptômes cardiaques ou antécédents d'arrêt ou syncope inexpliquée
- 2/ Score de risque ESC > 4% à 5 ans
- 3/ Gradient > 30mmHg au repos
- 4/ Réponse anormale de la PA à l'exercice
- 5/ Arythmies induites par l'exercice

Sports à intensité faibles ou modérées, de loisirs



Retour au sport ?

CENTRAL ILLUSTRATION Return-to-Play Among Elite Athletes With Genetic CVD



Return-to-Play for Elite Athletes With Genetic Heart Diseases Predisposing to Sudden Cardiac Death.
Martinez et al. JACC 2023.

76 athletes élités
63% asymptomatiques

53% CMH

72% interdits au sport

91% ont finalement repris
après expertise cardiologie
du sport et decision
médicale partagée

FU 7 ± 6 ans
1 événement pendant sport (QT long)

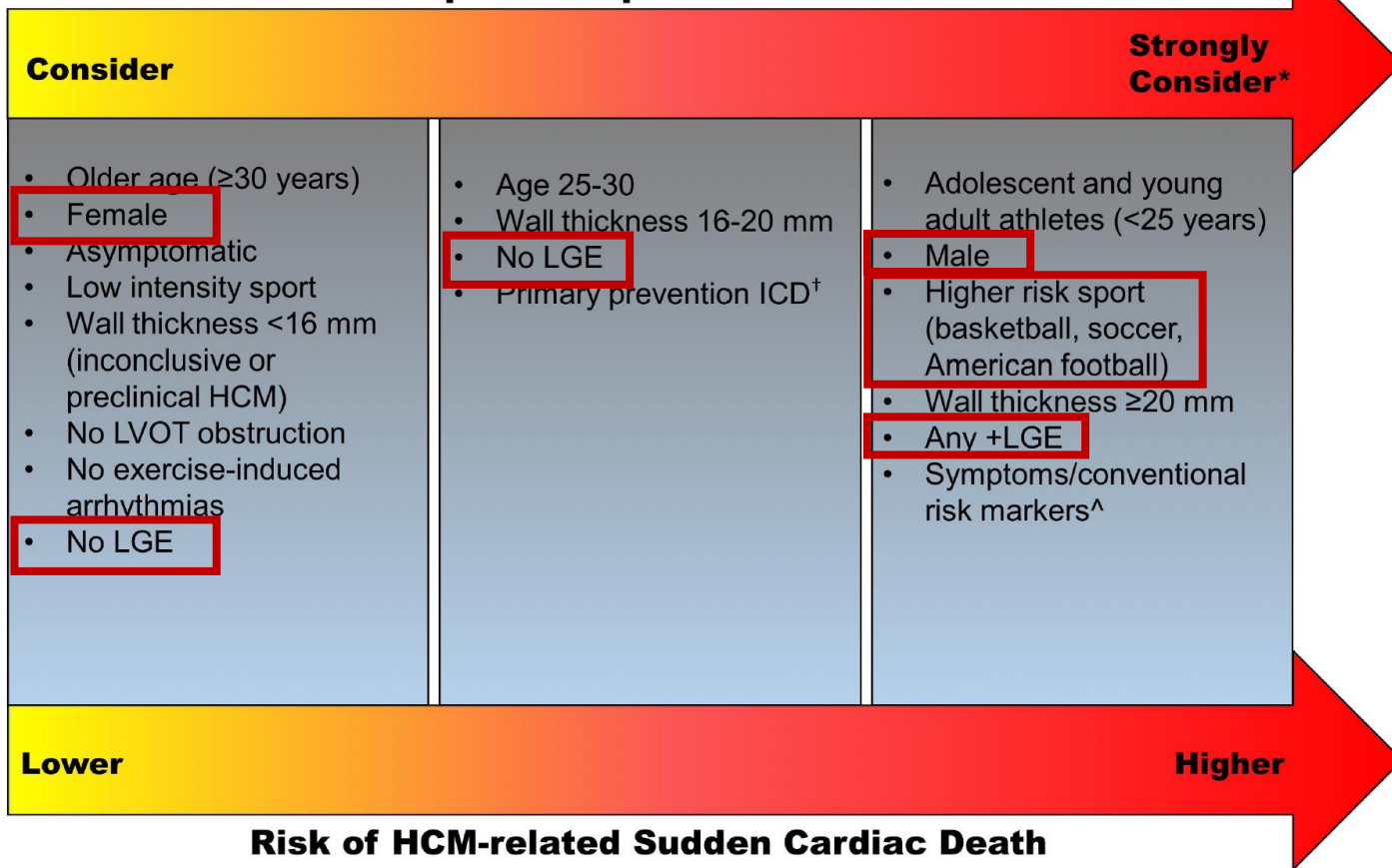


Return to play with hypertrophic cardiomyopathy: are we moving too fast? A critical review

Drezner al. Br J Sports Med 2021;55:1041–1047.

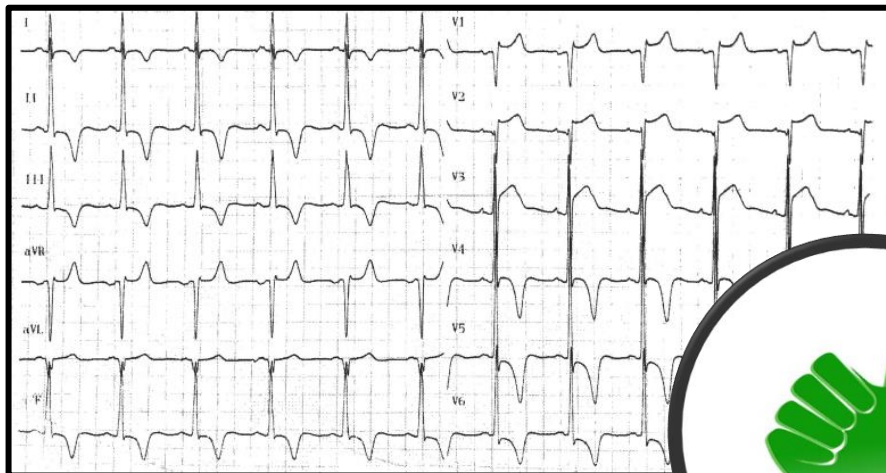
Jonathan A Drezner ¹,
 Anil Malhotra ¹,
 Kimberly G Harmon ¹,
 Irfan M Aslam ¹,
 Sanjay Sharma ⁴

Competitive Sports Restriction

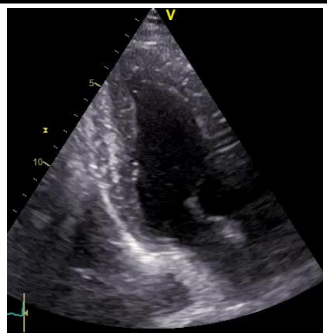


Cas Num 1

Homme 62 ans, tennis en compétition



CMH apicale
16mm
Pas de fibrose en IRM
Génétique négative

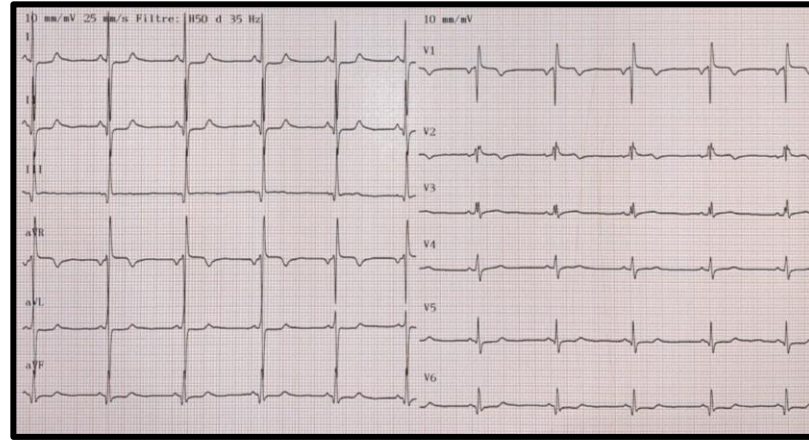


Risk of Sudden Cardiac Death at 5 years
1.08%

ESC Recommendation
ICD generally not indicated



Femme 26 ans, sport haut niveau, VTT en compétition, cyclisme 15h/sem



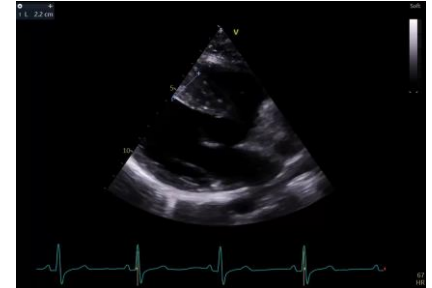
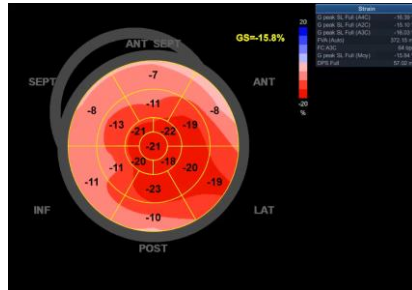
CMH septale
22mm
Fibrose en IRM
MYH7

Risk of Sudden Cardiac Death at 5 years

2.74%

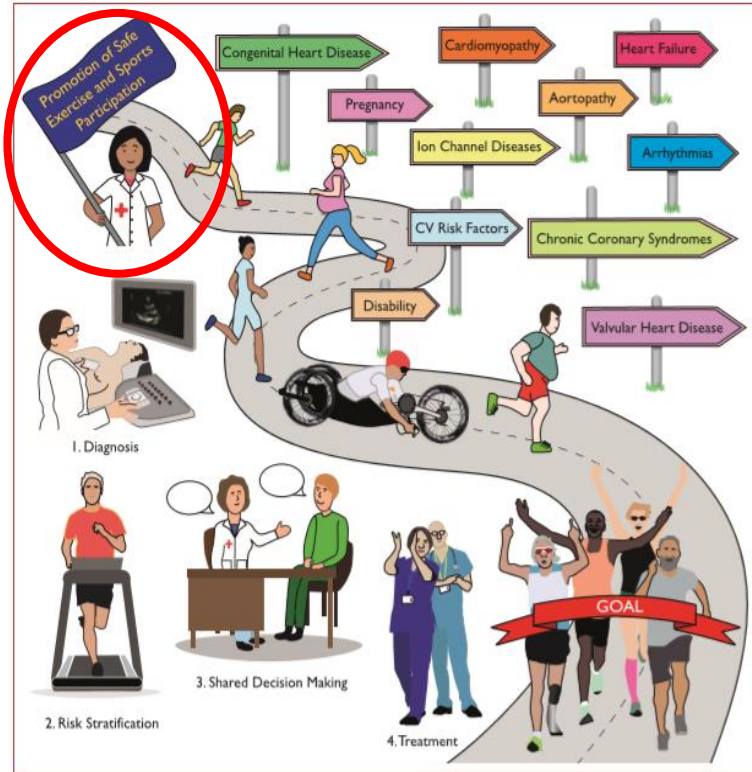
ESC Recommendation

ICD generally not indicated

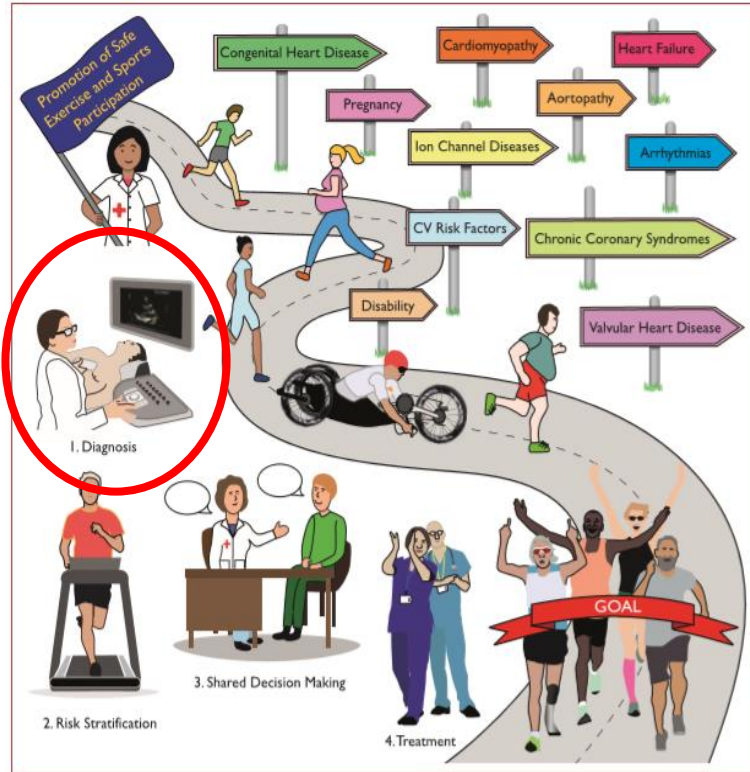


Conclusion

- Bénéfices à une activité physique régulière



Conclusion



- Bénéfices à une activité physique régulière
- **Difficultés diagnostiques : analyse multiparamétrique**



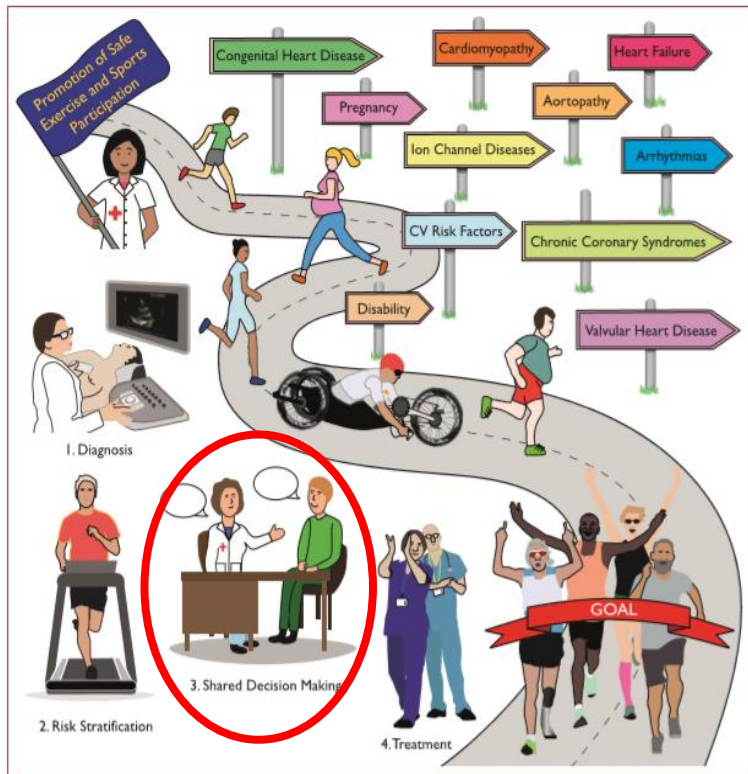
Conclusion



- Bénéfices à une activité physique régulière
- Difficultés diagnostiques : analyse multiparamétrique
- **Stratification du risque : Analyse multiparamétrique (Clinique – ECG – ETT – IRM; évaluation à l’effort (VO₂, Echo Effort, Holter ECG))**
- **Pas d’aggravation de la CMH avec la pratique sportive**



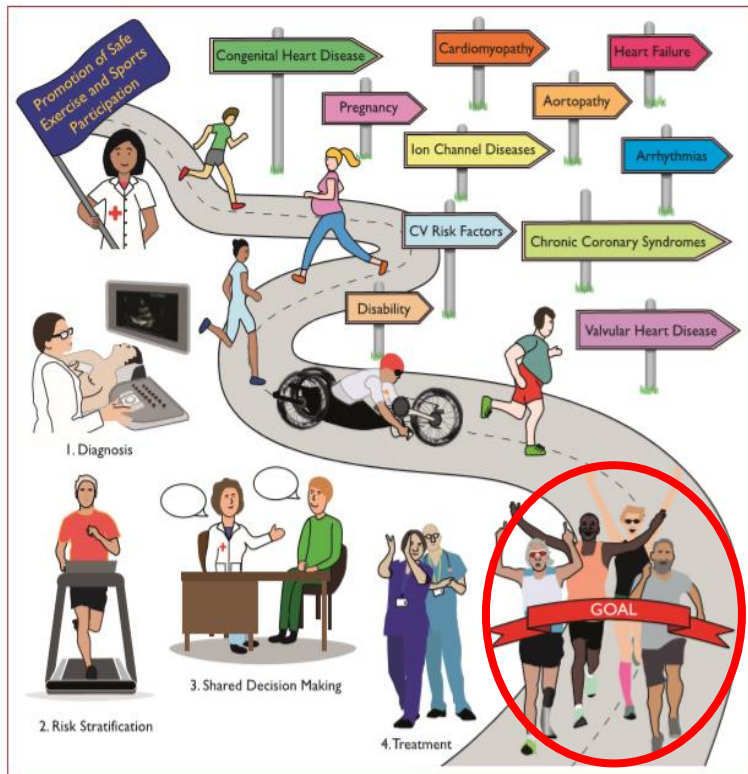
Conclusion



- Bénéfices à une activité physique régulière
- Difficultés diagnostiques : analyse multiparamétrique
- Stratification du risque : Analyse multiparamétrique (Clinique – ECG – ETT – IRM; évaluation à l'effort (VO₂, Echo Effort, Holter ECG)
- Pas d'aggravation de la CMH avec la pratique sportive
- **Sport intense et CMH : des restrictions de moins en moins importantes**



Merci !



- Bénéfices à une activité physique régulière
- Difficultés diagnostiques : analyse multiparamétrique
- Stratification du risque : Analyse multiparamétrique (Clinique – ECG – ETT – IRM; évaluation à l’effort (VO₂, Echo Effort, Holter ECG)
- Pas d’aggravation de la CMH avec la pratique sportive
- Sport intense et CMH : des restrictions de moins en moins importantes

