

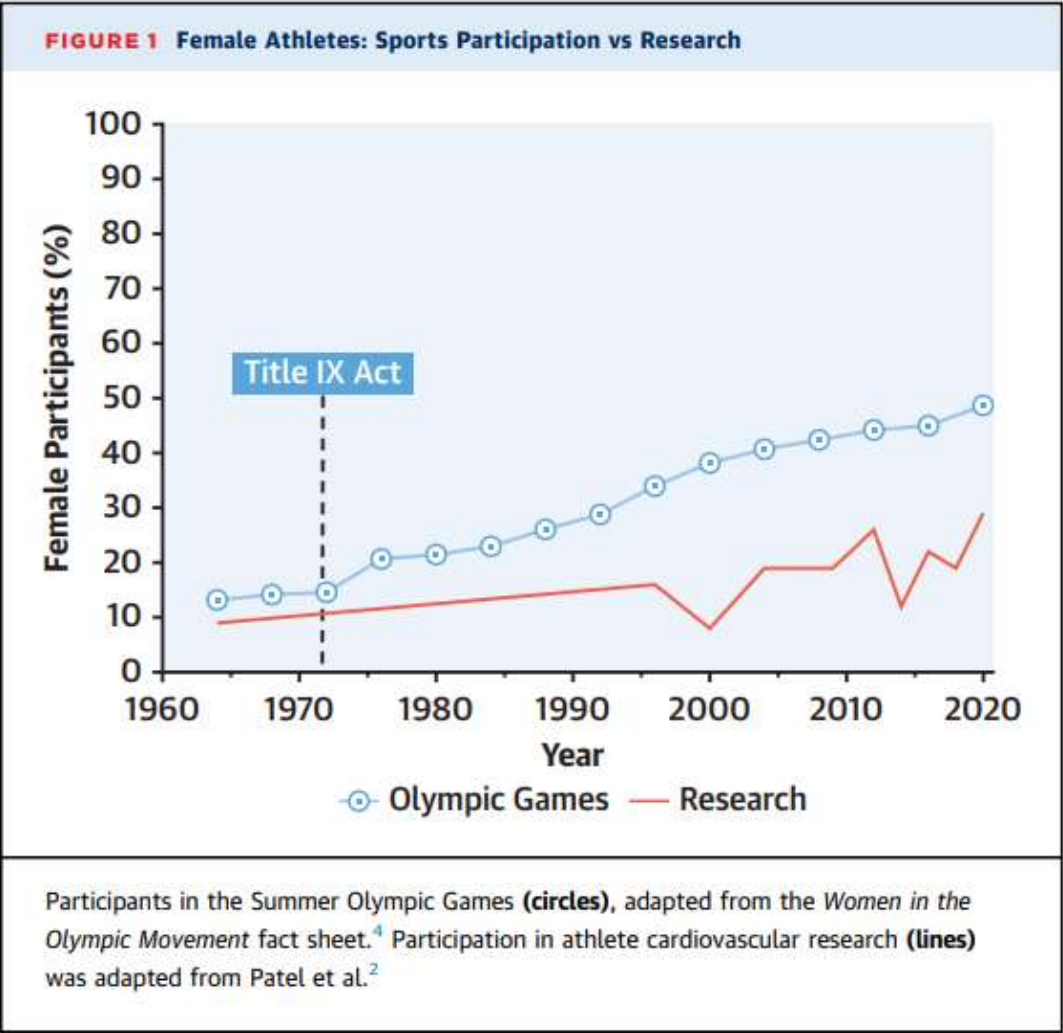
Cœur de femme

27 mars 2024

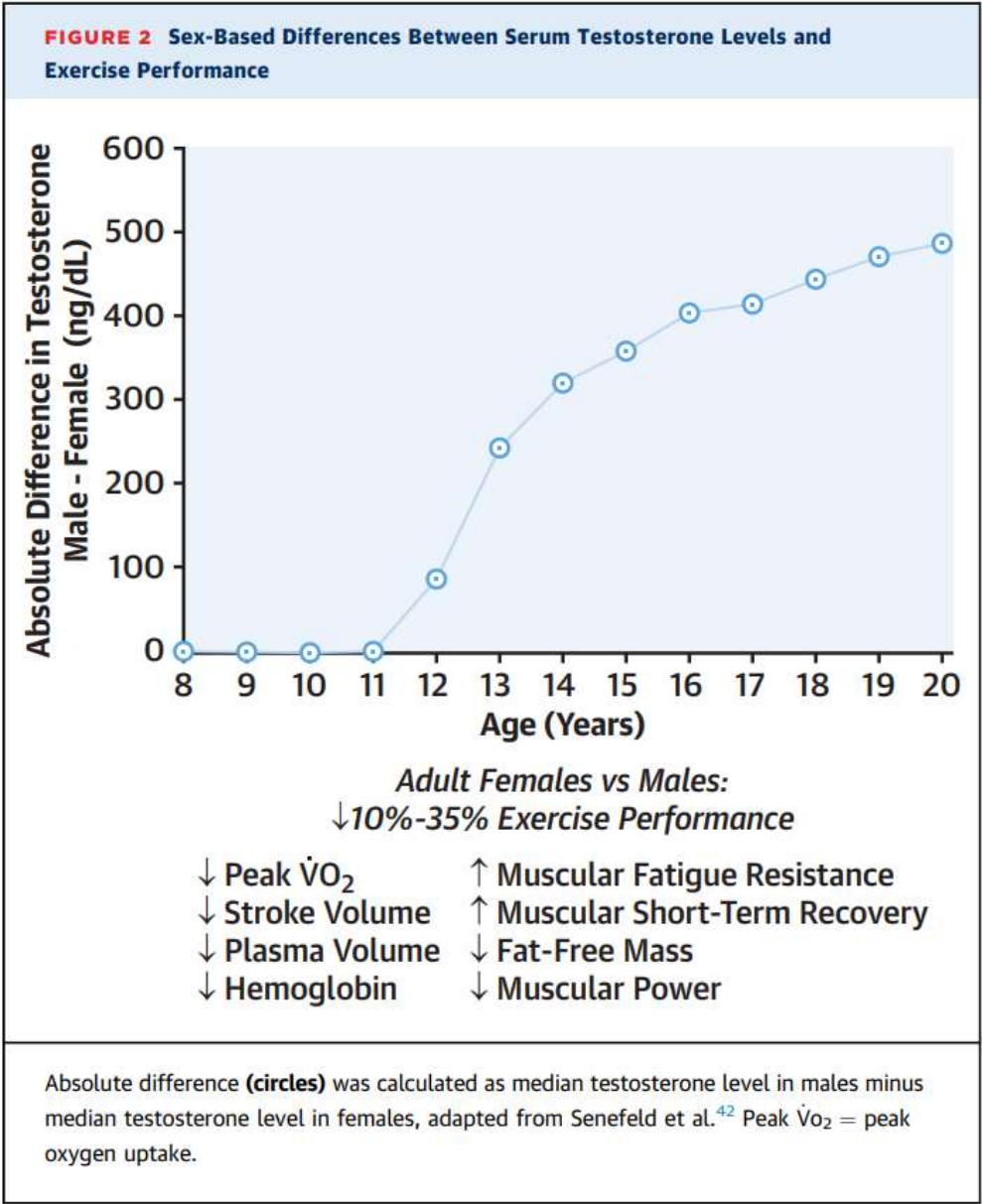
frederic.chague@chu-dijon.fr

Merci au Pr Yves Cottin

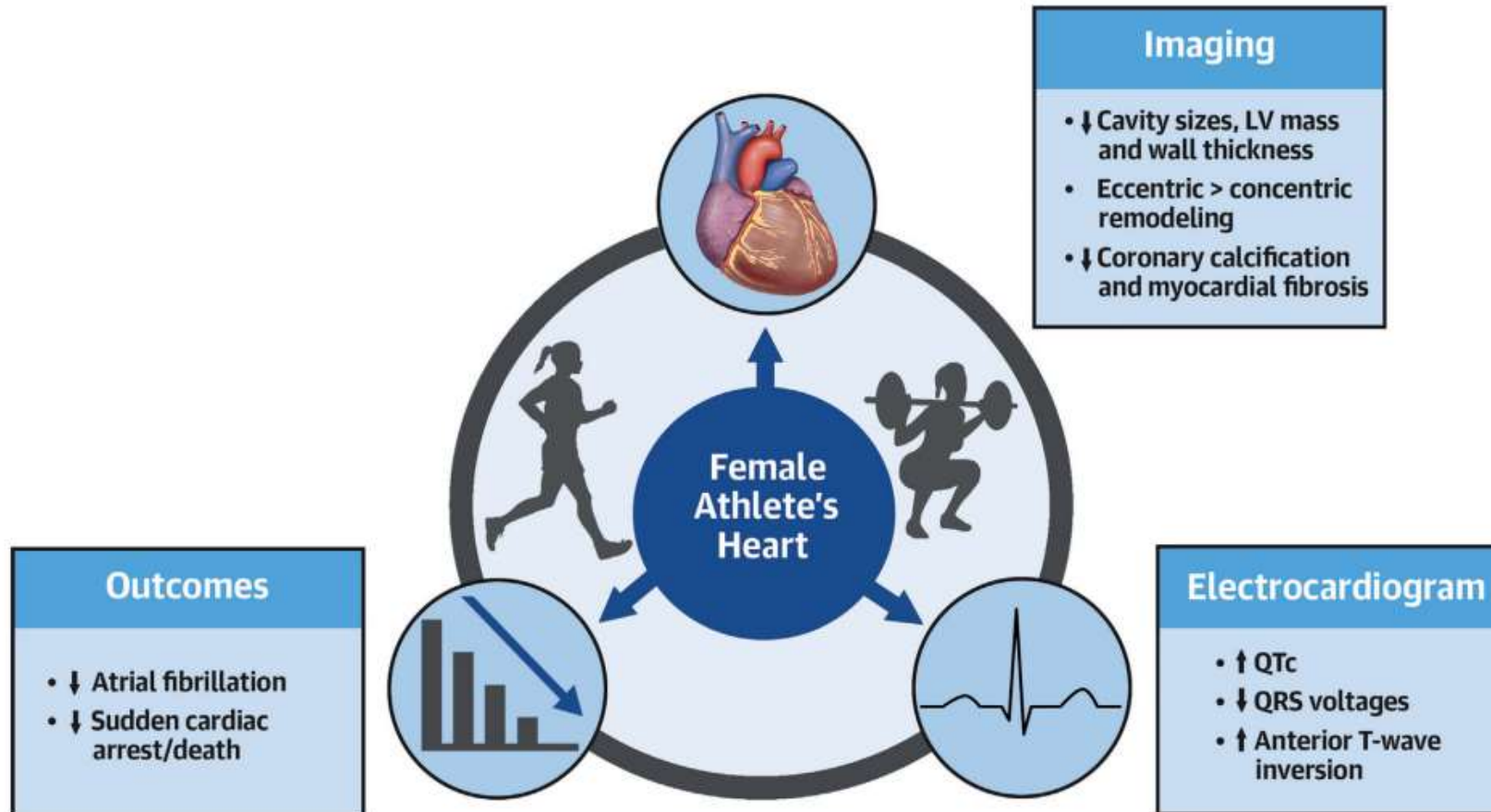
La femme athlète



Petek BJ. Et al, J Am Coll Cardiol 2023



CENTRAL ILLUSTRATION Sex-Based Differences in Exercise-Induced Cardiac Remodeling and Outcomes



Petek BJ, et al. *J Am Coll Cardiol.* 2023;82(10):1030-1038.

This review focuses on sex-based differences between female compared to male athletes in 3 domains: the electrocardiogram, cardiovascular imaging, and outcomes. LV = left ventricular.

La femme athlète

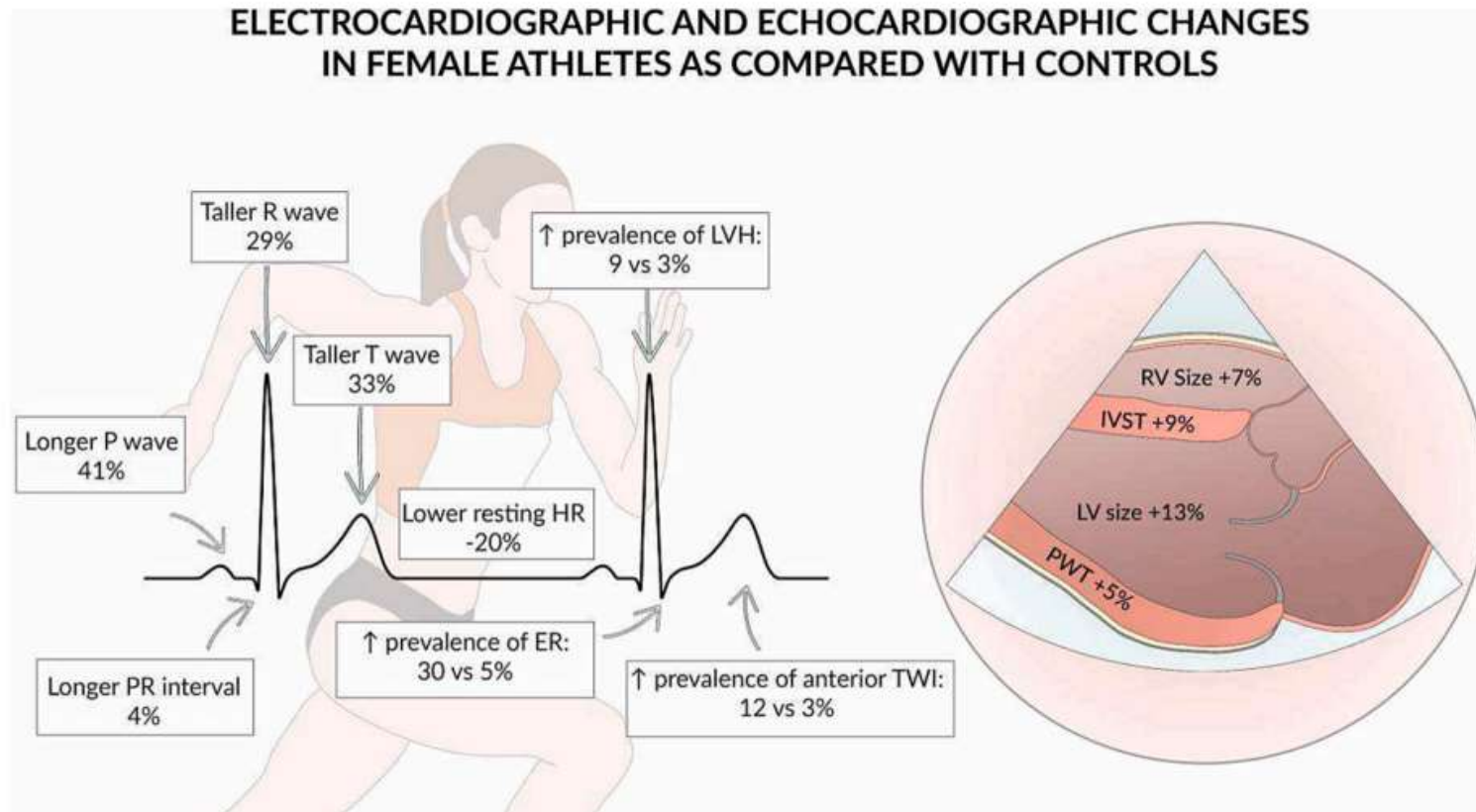
TABLE 2 Key Sex-Related Differences Among Athletes in Sex Hormone Levels, Athletic Performance, Cardiovascular Structure, and Exercise-Related Cardiovascular Sequelae

Characteristics	Female vs Male Athletes ^a
Sex hormone levels	<ul style="list-style-type: none"> ↑ Estrogen and progesterone ↓ Testosterone
Athletic performance	<ul style="list-style-type: none"> ↓ Peak $\dot{V}O_2$ ↓ Muscular strength ↑ Muscular fatigue resistance
Electrocardiogram	<ul style="list-style-type: none"> ↓ QRS intervals and voltages → ↓ LVH and RVH criteria ↓ Early repolarization ↑ QTc ↑ Anterior T-wave inversions
Cardiovascular imaging	<ul style="list-style-type: none"> ↓ Absolute LV and RV size, ↑ / ↔ BSA-indexed LV and RV dimensions ↓ LV wall thickness, LV mass, and BSA-indexed LV mass ↓ Relative wall thickness ↓ Coronary artery calcification ↓ Myocardial fibrosis
Exercise-related cardiovascular sequelae	<ul style="list-style-type: none"> ↓ Exercise-related cardiac arrest and death ↓ Atrial fibrillation

^aAssumes female athletes are premenopausal and eumenorrheic; see [Figure 2](#) for more details on athletic performance.

BSA = body surface area; LV = left ventricle; LVH = left ventricular hypertrophy; RV = right ventricle; RVH = right ventricular hypertrophy; $\dot{V}O_2$ = oxygen uptake.

La femme athlète



D'Ascenzi F. et al, Int J Cardiol 2024

WOMEN AND CARDIOVASCULAR HEALTH COMPENDIUM

Pregnancy and Reproductive Risk Factors for Cardiovascular Disease in Women

Anna C. O’Kelly, Erin D. Michos¹, Chrisandra L. Shufelt, Jane V. Vermunt, Margo B. Minissian, Odayme Quesada, Graeme N. Smith², Janet W. Rich-Edwards³, Vesna D. Garovic⁴, Samar R. El Khoudary⁵, Michael C. Honigberg⁶

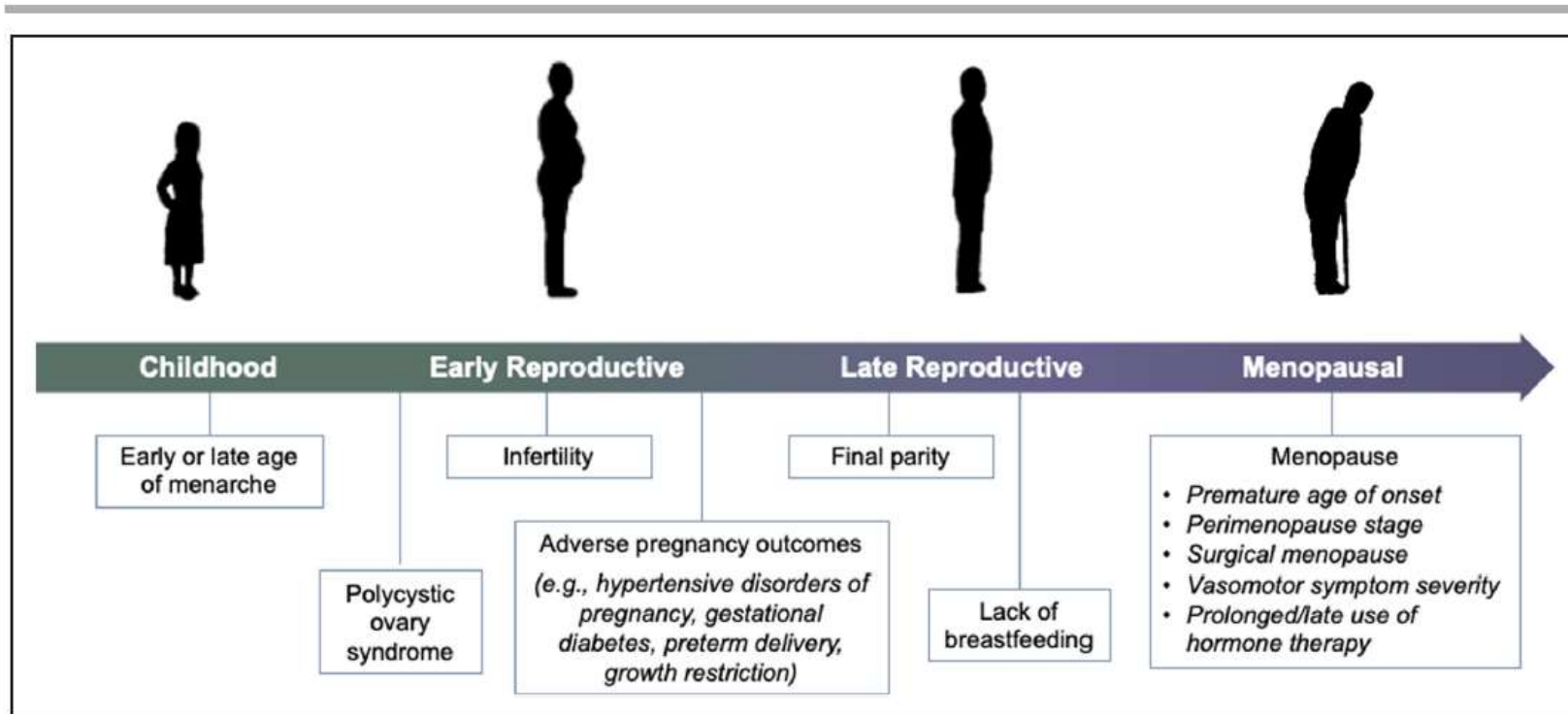


Figure 1. Key reproductive exposures associated with future risk of cardiovascular disease in women.



Childhood

Early Reproductive

Late Reproductive

Menopausal

Puberté précoce

SOPC

Infertilité

Contraception

Grossesse

Allaitement

Ménopause

Obésité
Syndrome MB
HTA
Diabète

RRx1,15 Maladies CV

Courbe en U...

Obésité
HTA
Dyslipidémie
Ins-Résistance
EMI
CAC
Maladies CV

Diabète
HTA
Obésité

Traitement

Causalité ?

Dose
oestrogène

MTE
AVC
IDM

DHG*
Diabète
Accouchement
prématuré
RCIU
PPN
Multiparité

HTA et Mies CV

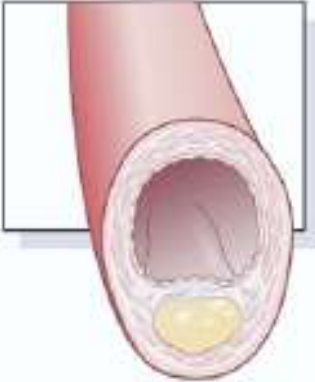
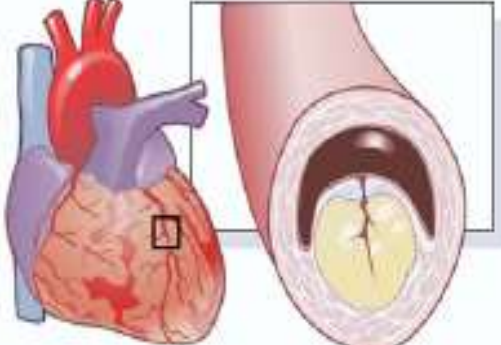
Bénéfices

HTA
Diabète
Mies CV

Précocité
Périménopause
Spontanée
(RR Mies CVx1,36)
(RR Coron x 1,39)
Provoquée
(RR Mies CVx1,87)
(RR Coron x 2,52)
Sévérité climatère
(RR Coron x 2)
THM...

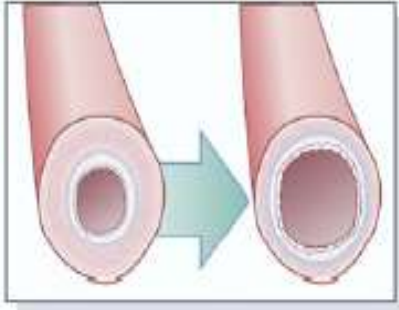
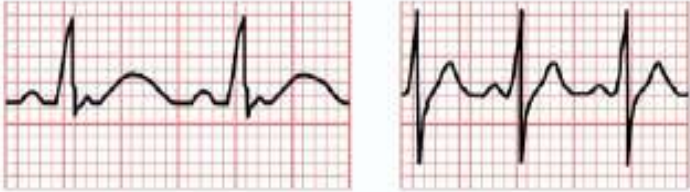
*HTAX, HTAG, Pré-éclampsie et éclampsie (avec ou sans HTA pré-existante)

Impact of Hormonal Contraception on Mechanisms of Cardiovascular Disease

Estrogens		Progestins
<ul style="list-style-type: none"> ↓ LDL oxidation ↓ LDL binding ↑↓ lipoprotein* *** ↑ blood pressure ↓ oxidation damage ↓ VSMC proliferation ↓ glucose tolerance*** 	<h3>Atherosclerosis</h3> 	<ul style="list-style-type: none"> ↑↓ HDL effect* ** ↑↓ blood pressure** ↑ glucose tolerance**
<ul style="list-style-type: none"> ↑ coagulation factors ↓ platelet aggregation 	<h3>Thrombosis</h3> 	<ul style="list-style-type: none"> ↑ coagulation factors ↓ platelet aggregation ↓ nitric oxide**

Shufelt CL, et al. JACC. 2009;53:221-231.

Impact of Hormonal Contraception on Mechanisms of Cardiovascular Disease

Estrogens		Progestins
<ul style="list-style-type: none"> ↑ nitric oxide ↓ endothelin ↑ Cox-2 ↓ neuroendocrine response ↓ VSMC proliferation 	<p>Vasomotion</p> 	<ul style="list-style-type: none"> ↑ vasoconstriction** ↓ nitric oxide**
<ul style="list-style-type: none"> ↑QT prolongation 	<p>Arrhythmogenesis</p> 	<ul style="list-style-type: none"> ↓QT prolongation

Shufelt CL, et al. JACC. 2009;53:221-231.



ESC

European Society
of Cardiology

European Heart Journal (2021) 42, 967–984

doi:10.1093/eurheartj/ehaa1044

ESC REPORT

Cardiovascular health after menopause transition, pregnancy disorders, and other gynaecologic conditions: a consensus document from European cardiologists, gynaecologists, and endocrinologists

Angela H.E.M. Maas ^{1*}, Giuseppe Rosano ², Renata Cifkova ^{3,4},
Alaide Chieffo ⁵, Dorenda van Dijken ⁶, Haitham Hamoda ⁷,
Vijay Kunadian ⁸, Ellen Laan ⁹, Irene Lambrinoudaki ¹⁰,
Kate Maclaran¹¹, Nick Panay ¹², John C. Stevenson ¹³, Mick van Trotsenburg¹⁴,
and Peter Collins¹³

Practice points

- Combined OCP should be avoided in women with a history of VTE, stroke, CVD, or any other PVD
 - Use of OCP is contraindicated in 35 plus women who smoke and in women with severe dyslipidaemia or obesity
 - POCs, administered by oral, sub-cutaneous, or intra-uterine routes can be prescribed in women at elevated cardiovascular risk
-

Prescription contraception

- **Facteurs de risque**
 - Âge
 - Tabagisme
 - Hérité
 - Chiffres tensionnels
 - Bilan glucido-lipidique
LP(a)

- **Prévention secondaire**

- **Et suivi+++**

Cœur et grossesse

- **HTA**
 - ≥ 140 ou ≥ 90 mmHg et $\geq 20^{\text{ème}}$ SA
 - Automesure tensionnelle ≥ 135 \geq ou 85 mmHg
 - Alphaméthylidopa, Labétalol, Nicardipine
- **Accidents artériels**
 - Dissection aortique
 - Dissection artérielle : coronaire+++
- **Décompensation d'une cardiopathie**
- **Myocardiopathie du péripartum**
- **Traitements cardiovasculaires**
- **Accouchement...**

Impact des désordres hypertensifs de la grossesse

	HTA	Maladie CV	Coronaropathie	AVC	Démence vasculaire	IC	FA	MRC
DHG	2,3-2,8	1,6-2,3	1,7-2,2	1,9		1,5-4,2	1,4	4,3
HTAG	2,8	1,4-1,7			2,4			1,5
Pré-éclampsie	2,2-4,5	1,4-1,7	1,7-2,5	1,5-1,9	2,2-3	2-4,2	1,7	2,3

Adapté d'après O'Kelly AC. et al, Circ Research 2022

Mécanismes



O'Kelly AC. et al, Circ Research 2022

Hypertension artérielle

Hypertensive disorders of pregnancy and onset of chronic hypertension in France: the nationwide CONCEPTION study

Pauline Boucheron ^{1†}, Grégory Lailler ^{1*†}, Elodie Moutengou ¹, Nolwenn Regnault ¹, Amélie Gabet ¹, Catherine Deneux-Tharaux ^{2,3}, Sandrine Kretz ⁴, Clémence Grave ¹, Claire Mounier-Vehier ⁵, Vassilis Tsatsaris ^{3,6}, Geneviève Plu-Bureau ^{2,3,7}, Jacques Blacher ^{3,4}, and Valérie Olié ¹

ESC European Heart Journal (2022) 43, 3352–3361
European Society of Cardiology <https://doi.org/10.1093/eurheartj/ehab686>

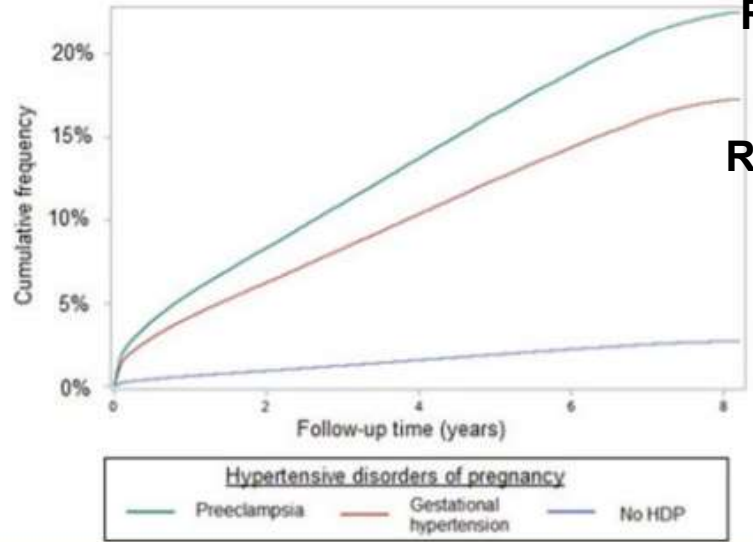
TRANSLATIONAL RESEARCH
Hypertension

Hypertensive disorders of pregnancy and onset of chronic hypertension France 2010 - 2018



2,663,573 primiparous women

- 113,803 Gestational hypertension
- 66,260 Pre-eclampsia



PréE
RR X 8,10
HTAG
RR X 6,03



Adjusted Hazard Ratios of developing chronic hypertension

- Gestational hypertension: aHR = 6.03 (95%CI: 5.89-6.17)
- Pre-eclampsia: aHR = 8.10 (95%CI: 7.88-8.33)

Hypertensive disorders of pregnancy increase the risk of developing chronic hypertension in primiparous women in the first years following delivery

Précocité pré-éclampsie

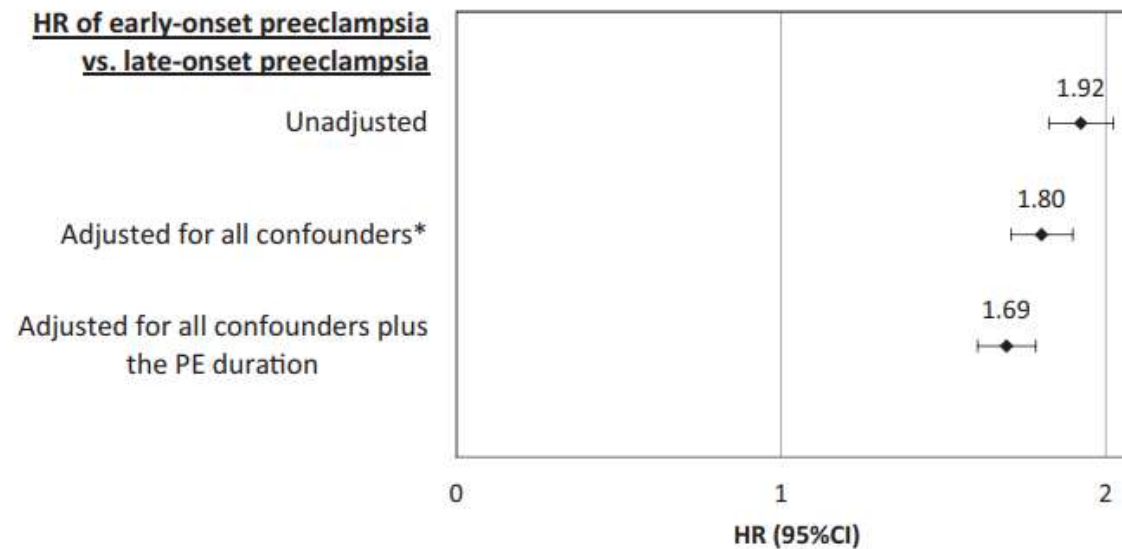


Figure 4 Hazard ratios of chronic hypertension in early-onset pre-eclampsia vs. late-onset pre-eclampsia. CI, confidence interval; HR, hazard ratio.

*Confounders: year of delivery, maternal age, social deprivation, gestational diabetes, obesity, tobacco, and history of diabetes.

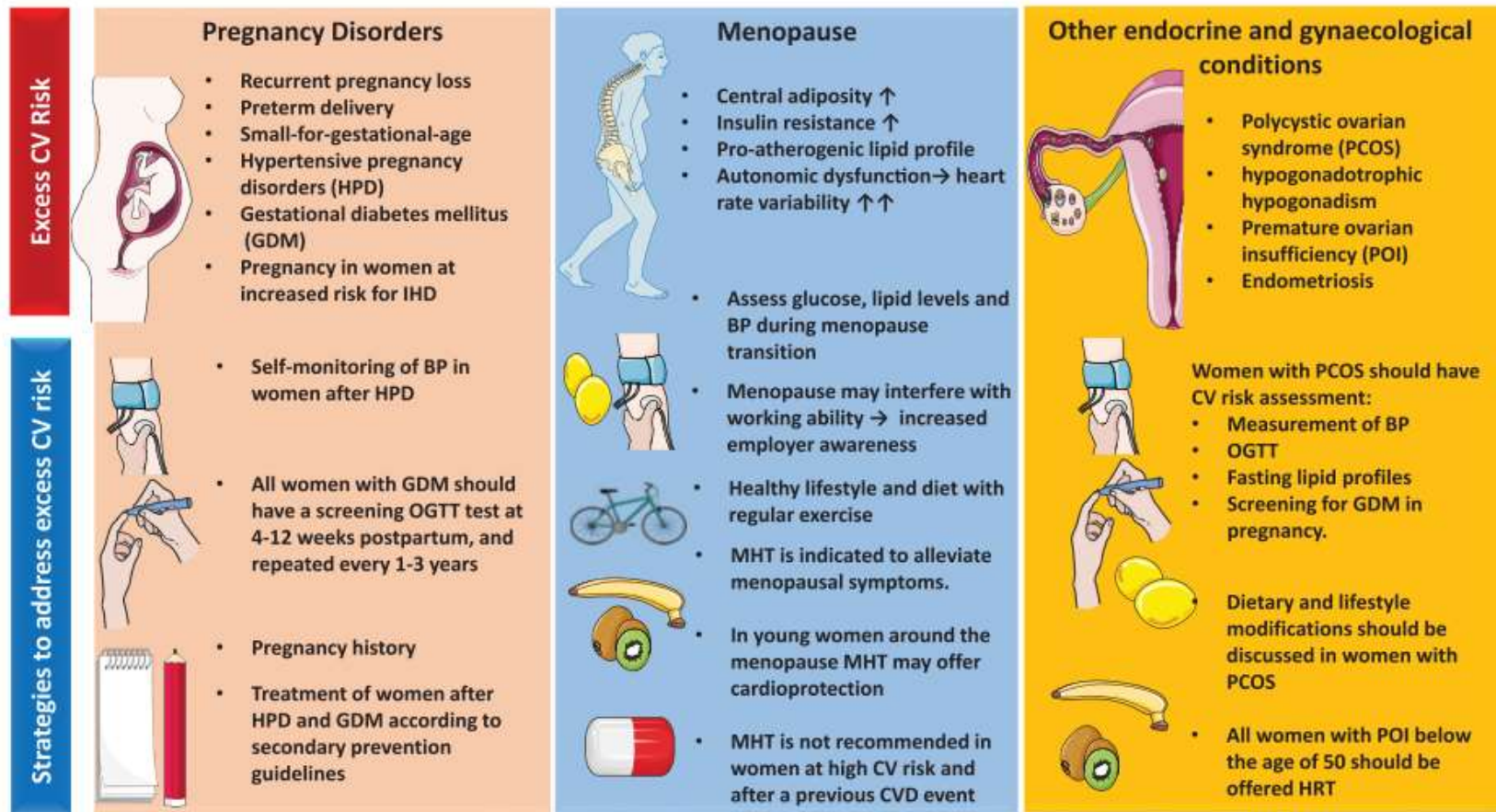
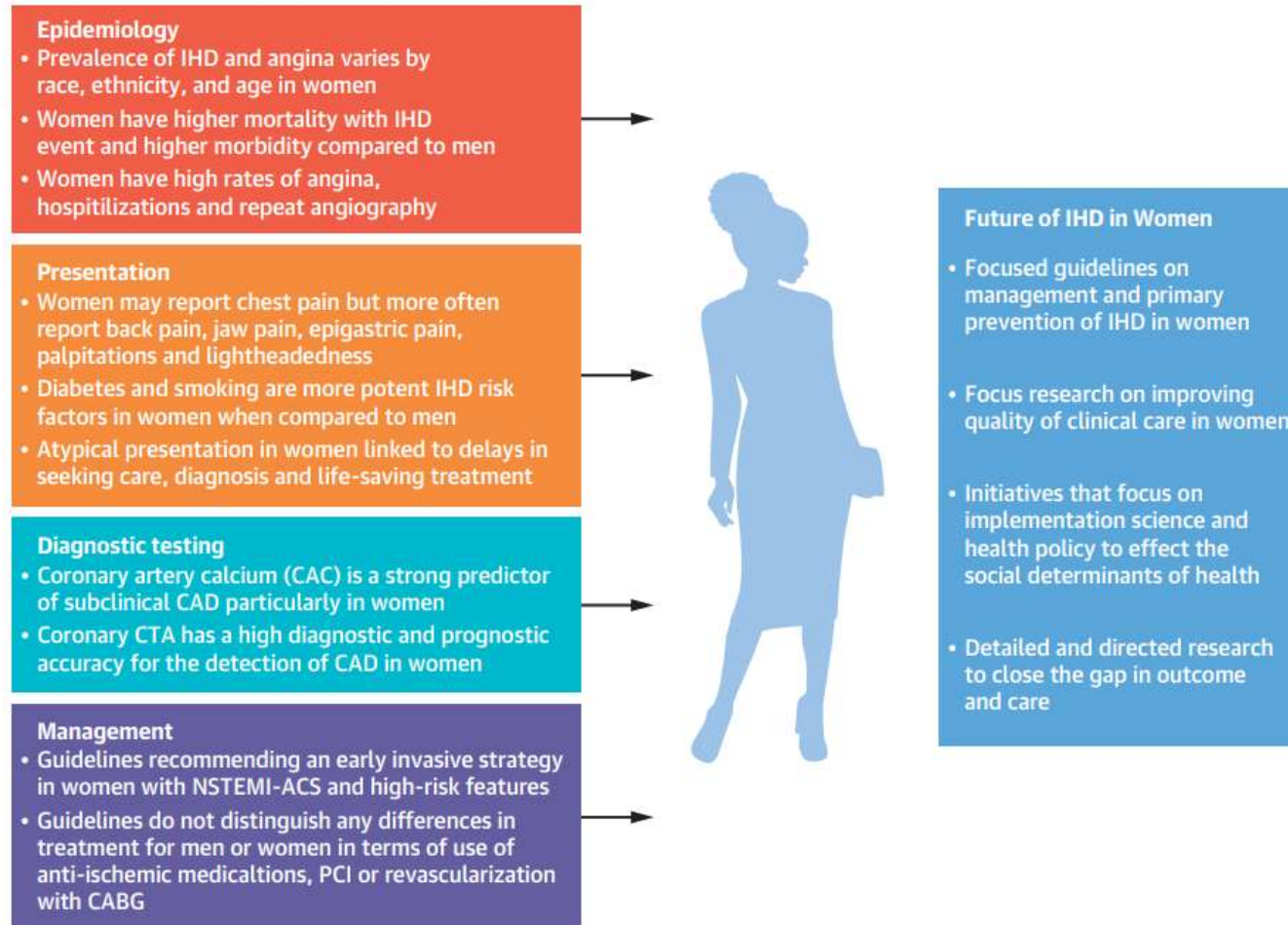


Figure 1 Female-specific risk factors and strategies for prevention. BP, blood pressure; CVD, cardiovascular disease; GDM, gestational diabetes mellitus; HPD, hypertensive pregnancy disorders; IHD, ischaemic heart disease; MHT, menopausal hormone therapy; OGTT, oral glucose tolerance test; PCOS, polycystic ovarian syndrome; POI, premature ovarian insufficiency.

CENTRAL ILLUSTRATION Sex-Related Differences in Ischemic Heart Disease



Solola Nussbaum S, et al. *J Am Coll Cardiol.* 2022;79(14):1398-1406.

Visual diagram illustrating the epidemiology, presentation, diagnostic testing, and management of ischemic heart disease (IHD) in women as well as the means to improve the future care of IHD in women. CABG = coronary artery bypass grafting; CAC = coronary artery calcium; CAD = coronary artery disease; CTA = computed tomography angiography; NSTEMI-ACS = non-ST-segment elevation myocardial infarction acute coronary syndrome; PCI = percutaneous coronary intervention.

Facteurs de risque – Sexe et genre

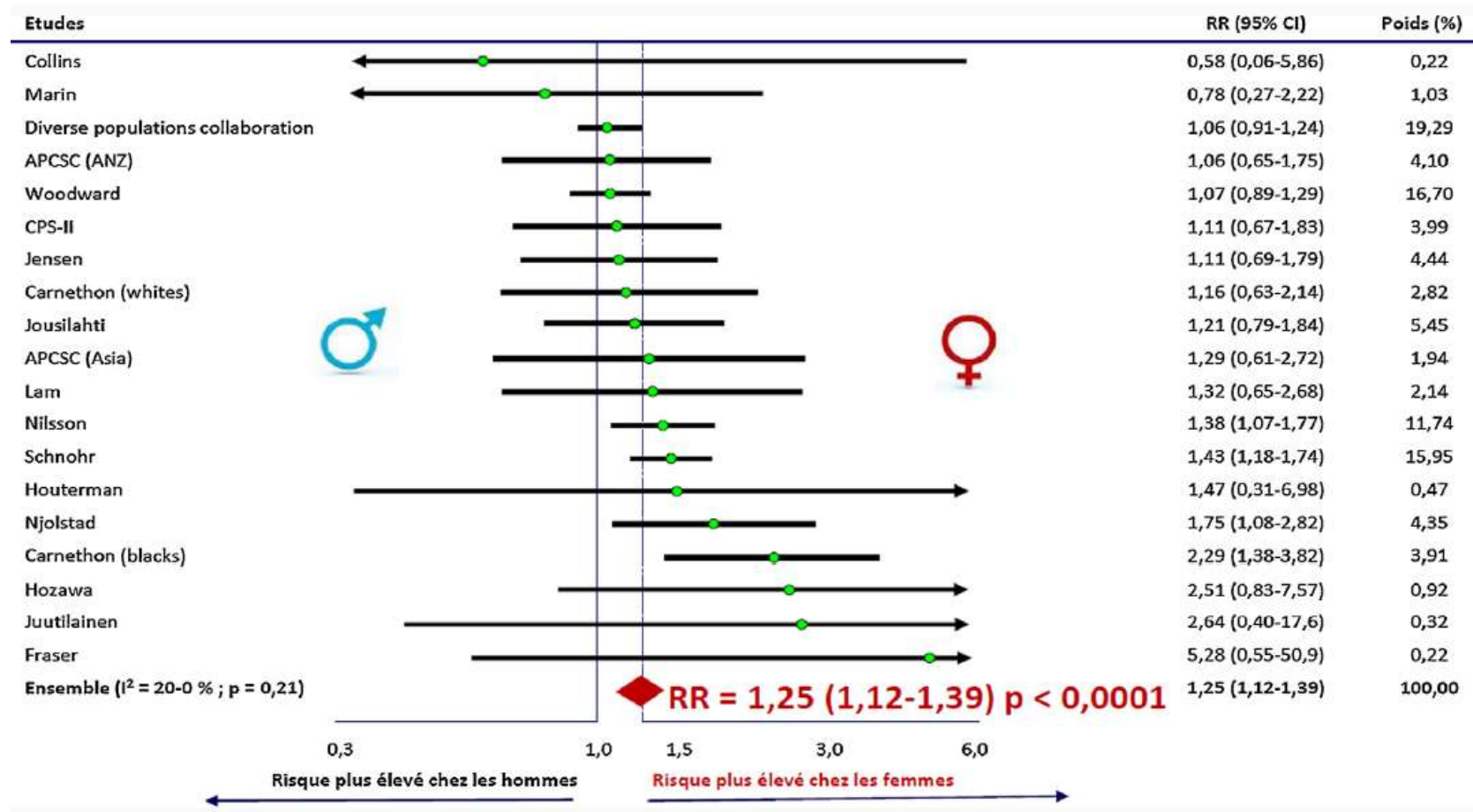
Facteurs de risque communs

- Tabac : RR x 1,25
- Diabète : RR augmenté
- Stress psychosocial/précarité
- Loisirs
- Maladies auto-immunes

Facteurs de risque spécifiques

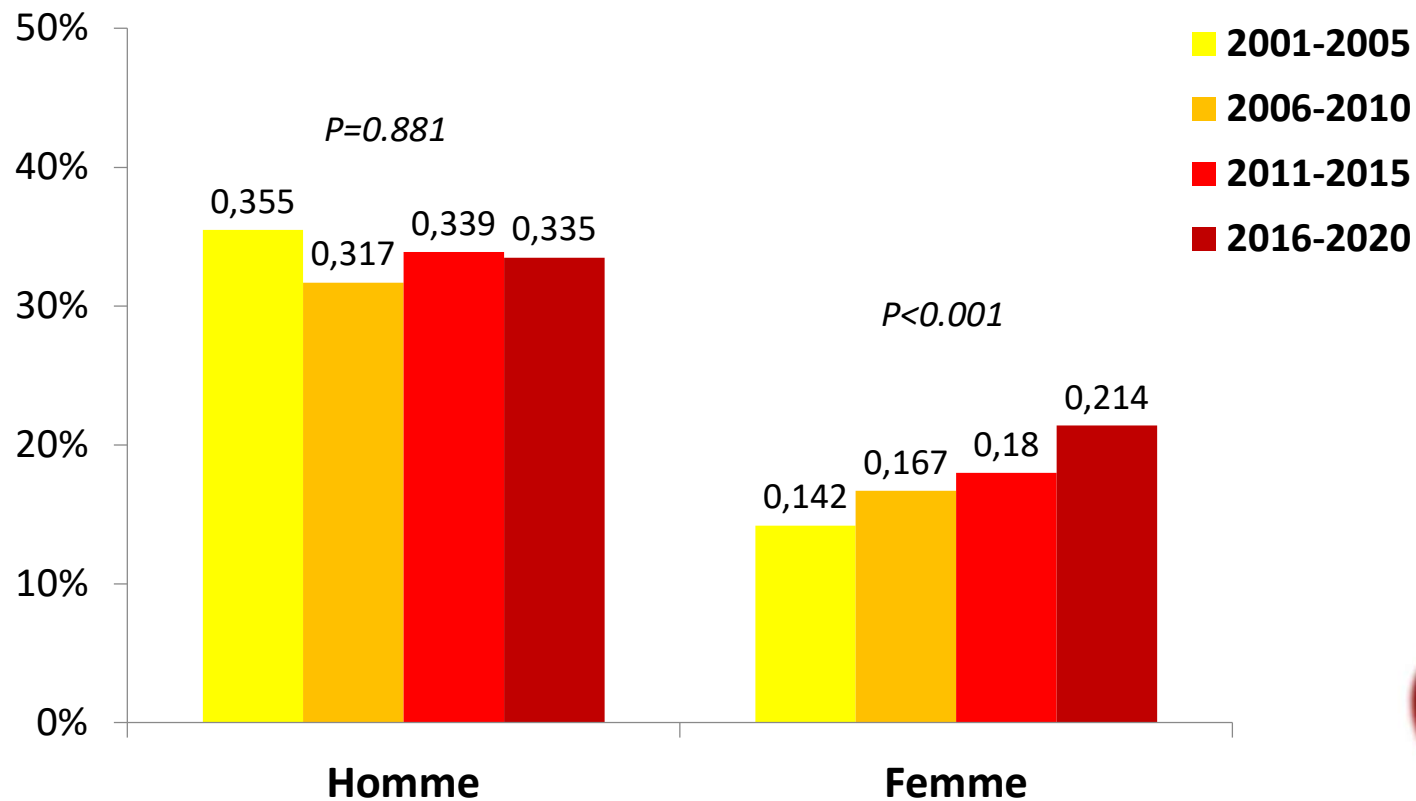
- Puberté précoce
- Grossesse compliquée
- Syndrome des ovaires polykistiques
- Contraception
- Radiothérapie médiastinale
- Ménopause précoce
- Traitement hormonal

Impact du tabac selon le genre : +25%

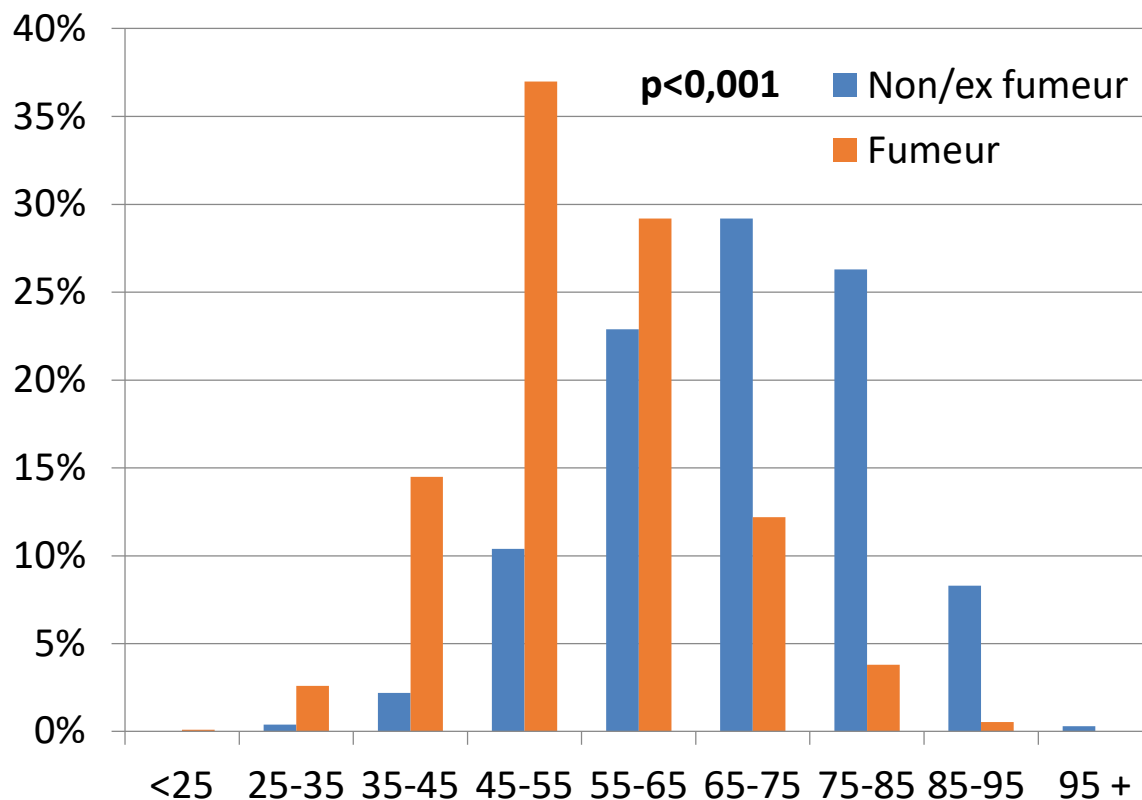


Thomas D. Presse med 2017

Evolution sur 20 ans de la prévalence du tabagisme chez les patients hospitalisés pour un infarctus



Taux de fumeurs parmi les patients hospitalisés pour un infarctus du myocarde

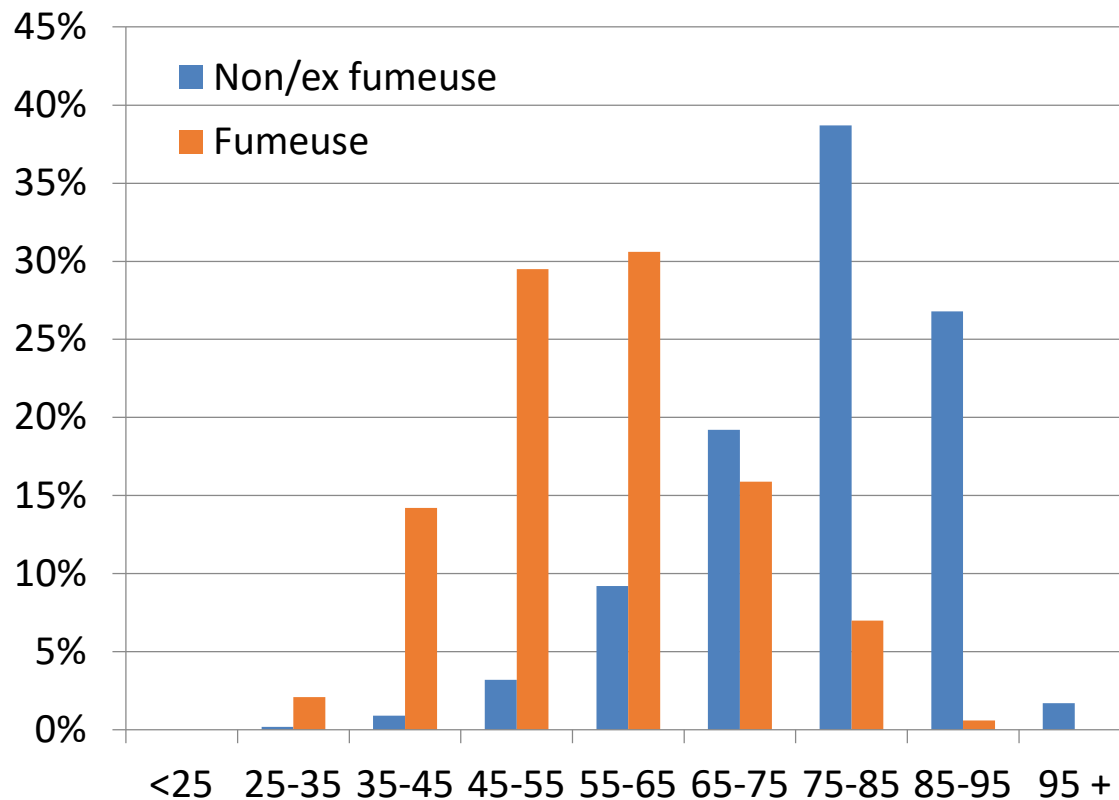


- Age moyen
 - fumeurs = 53 ans
 - non/ex fumeurs = 69 ans
- Les fumeurs font un infarctus 16 ans plus tôt



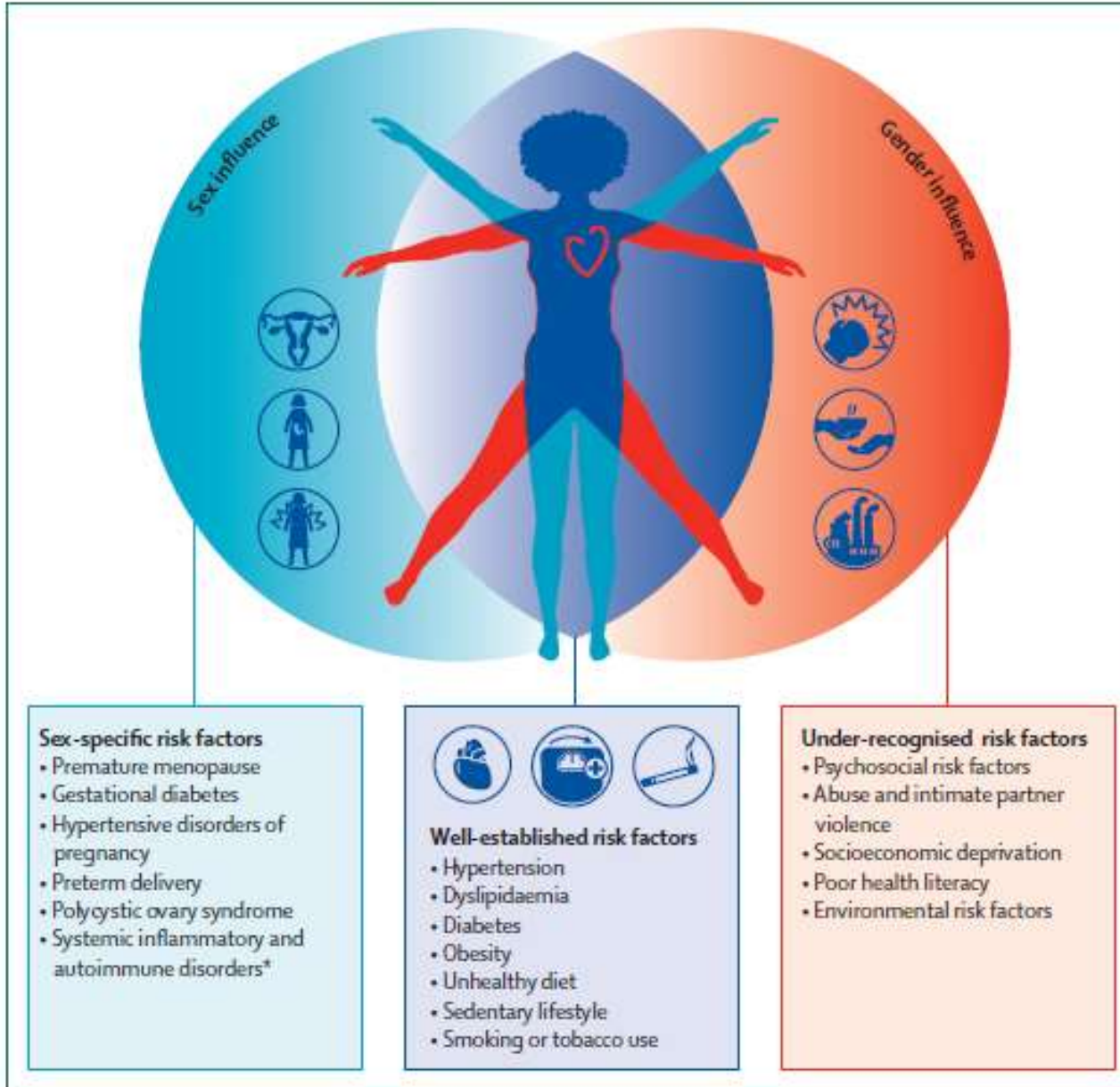
Diapositive Pr Marianne Zeller

Taux de fumeuses parmi les patients hospitalisés pour un infarctus



- Age moyen
 - fumeuses = 56 ans
 - non/ex fumeurs = 79 ans
- Les fumeuses font un infarctus 23 ans plus tôt





Vogel B. et al, Lancet 2021

Particularités de l'infarctus chez la femme

2097 individuals with MI at age ≤ 50

Women = 404 (19%)



Men = 1693 (81%)



Risk Factors

- Women were more likely to have diabetes and underlying rheumatic conditions
- Women had lower median income and more likely to have public insurance

Clinical Presentation

- The most common presenting symptom in both women and men was chest pain
- Women were more likely to also have dyspnea, palpitations, or fatigue

Management

- Women were less likely to undergo angiography and revascularization
- Women were less likely to be on guideline-directed post-MI medications

Outcomes

- Women had increased all-cause mortality over a median follow-up of 11.2 years

❖ Augmentation < 60 ans

❖ Mécanismes particuliers

**Dissection coronaire
Microcirculation
(Tako-tsubo)**

❖ Moindre recours
à la réadaptation

Take home figure Among young individuals with myocardial infarction, there were significant differences in risk factors, clinical presentation, management, and outcomes between men and women. IA, invasive angiography.

Age (25-84):

Sex: Male Female

Ethnicity:

UK postcode: leave blank if unknown
Postcode:

Clinical information

Smoking status:

Diabetes status:

Angina or heart attack in a 1st degree relative < 60?

Chronic kidney disease?

Atrial fibrillation?

On blood pressure treatment?

Rheumatoid arthritis?

Leave blank if unknown

Cholesterol/HDL ratio:

Systolic blood pressure (mmHg):

Body mass index

Height (cm):

Weight (kg):

Calculate risk over years

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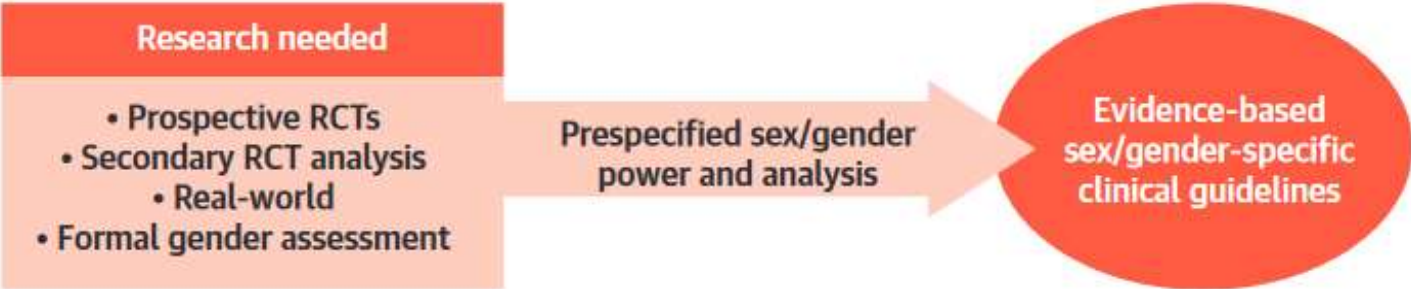
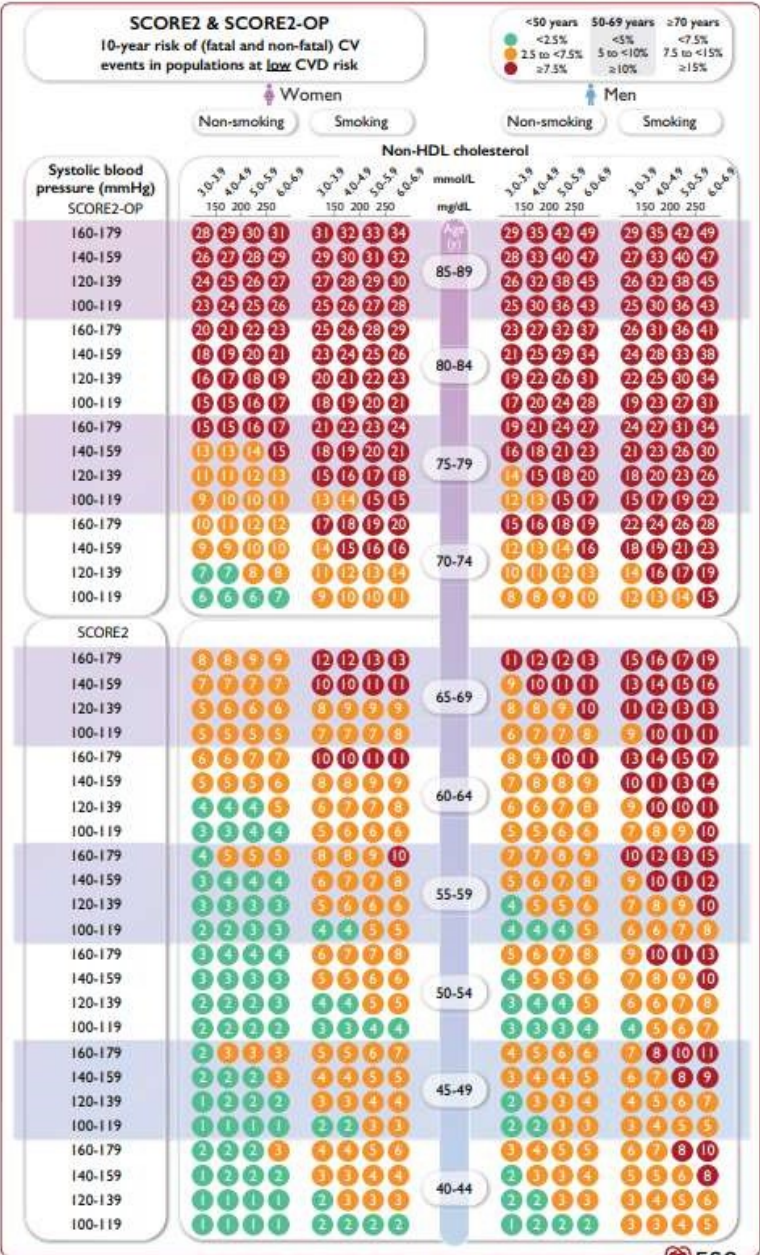


Table I Benefits and risks of menopausal hormone therapy (MHT) for women with age at menopause >45 years and of hormone replacement therapy (HRT) for women with early menopause (<45 years) and women with premature ovarian insufficiency (POI, <40 years)

Benefits	Risks
<ul style="list-style-type: none"> ● MHT is the most effective treatment for menopausal symptoms.^{100,102,103} ● Systemic and topical (vaginal) MHT is effective for the genitourinary syndrome of menopause (GSM).^{102,103,142} ● MHT prevents postmenopausal bone loss.^{101,128} ● MHT may aid in the management of low mood that results from menopause.^{102,106} ● MHT may decrease CVD and all-cause mortality in women <60 years of age and within 10 years of menopause. ● Early initiation of MHT after menopause has the greatest benefit for cardiovascular health.^{100,102,103} ● In women with POI, the use of HRT until the average age of menopause is recommended for menopausal symptoms, CVD, osteoporosis, and cognitive decline.^{143–146} ● Short-term (up to 4 years) HRT in women after risk-reducing salpingo—oophorectomy (RRSO) does not increase the risk of breast cancer and reduces the long-term effects of early menopause.^{147,148} 	<ul style="list-style-type: none"> ● Oestrogen-alone MHT increases the risk of endometrial cancer.^{100,102,103} ● Oral, but not transdermal, MHT increases the risk of VTE.^{100,141} ● The risk of stroke with MHT is slightly elevated, with less risk of transdermal preparations compared to oral therapy.^{100–102,141} ● MHT, especially when containing progestogens, may be associated with an increased risk of breast cancer. This depends on the type of progestogen and seems to dissipate when MHT is discontinued.^{136–140} ● MHT use over the age of 65 may cause deterioration in cognitive function.¹⁰¹ ● MHT is not recommended in women at high cardiovascular risk and after a previous CVD event.^{100–102}

Prescription THM

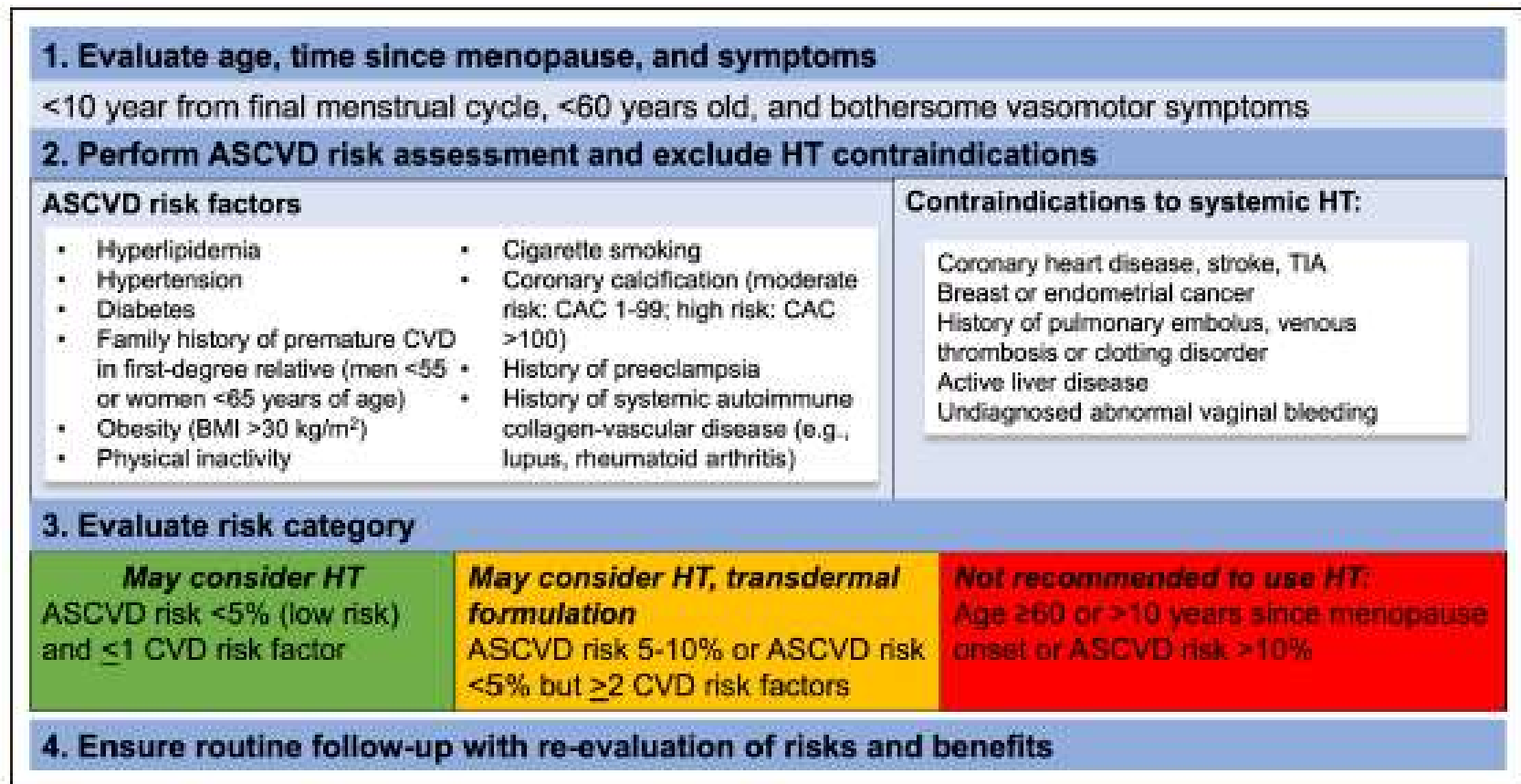


Figure 5. Contemporary approach to prescribing hormone therapy (HT) and HT risk assessment.

HT is appropriate for treatment of vasomotor symptoms in women who are otherwise healthy at the time of menopause, within 10 y of menopause, and under age 60 y. However, the decision to prescribe HT should still consider a woman's individual cardiovascular disease (CVD) risk factors and employ a shared decision-making approach. ASCVD indicates atherosclerotic CVD; CAC, coronary artery calcium; and TIA, transient ischemic attack.



Cochrane
Library

Cochrane Database of Systematic Reviews

Hormone therapy for preventing cardiovascular disease in post-menopausal women (Review)

Boardman HMP, Hartley L, Eisinga A, Main C, Roqué i Figuls M, Bonfill Cosp X, Gabriel Sanchez R, Knight B

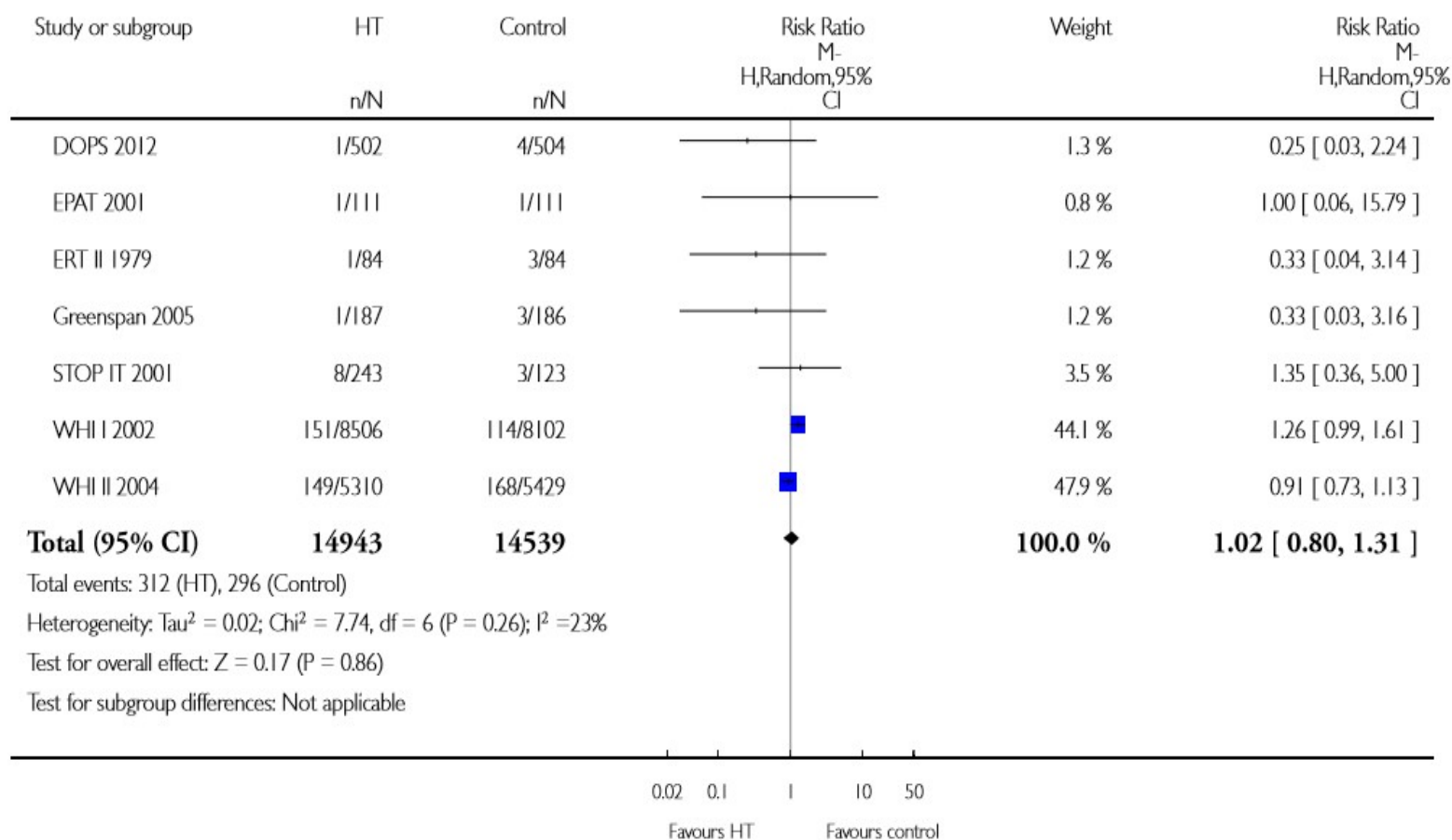
Cochrane Database of Systematic Reviews 2015

Analysis 1.3. Comparison 1 Hormone therapy versus placebo in primary prevention, Outcome 3 Non-fatal myocardial infarction.

Review: Hormone therapy for preventing cardiovascular disease in post-menopausal women

Comparison: 1 Hormone therapy versus placebo in primary prevention

Outcome: 3 Non-fatal myocardial infarction

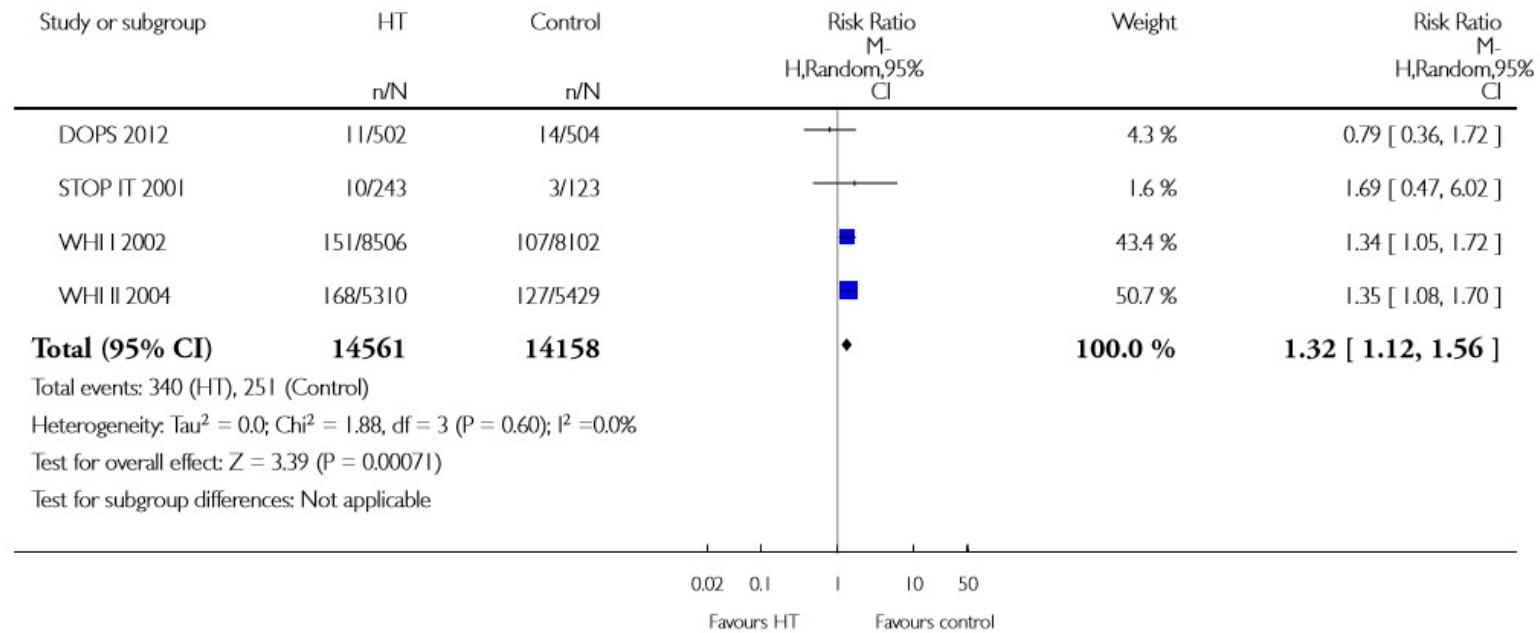


Analysis 1.4. Comparison 1 Hormone therapy versus placebo in primary prevention, Outcome 4 Stroke.

Review: Hormone therapy for preventing cardiovascular disease in post-menopausal women

Comparison: 1 Hormone therapy versus placebo in primary prevention

Outcome: 4 Stroke



Conclusions



- **Facteurs de risques différents**
 - Prévalence
 - Impact
 - Spécifiques
- **Échelles de risque adaptées**
- **Protocoles de recherche ciblés**
- **Opportunités de prévention**