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## Sédentarité: de quoi parle-t-on? Comment expliquer autant d'effets péjoratifs sur la santé?

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# LA SEDENTARITE

## FAITS ET MEFAITS

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Clermont-Ferrand





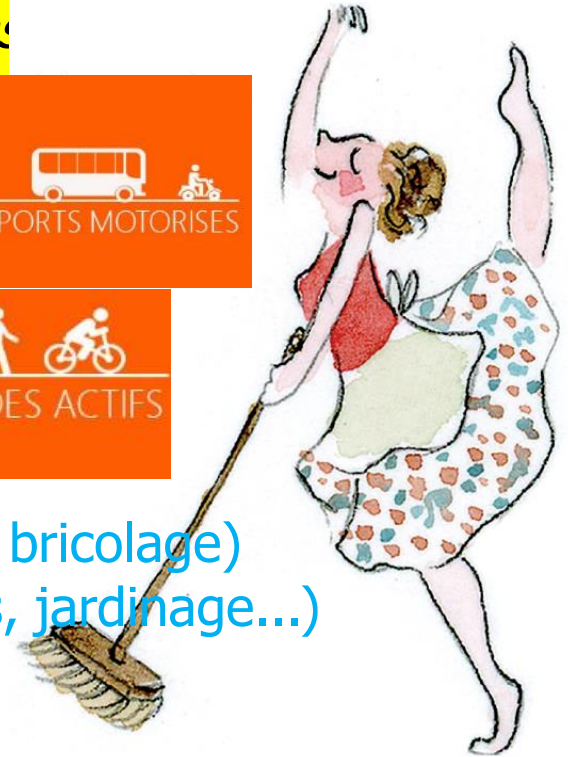
## Quelques définitions

### Activité physique

Tout mouvement produit par la contraction des muscles entraînant une *augmentation de la dépense au dessus de la dépense de repos.*

Activité physique :

- lors des activités professionnelles
- lors des déplacements
- dans le cadre de la vie domestique (ménage, bricolage)
- lors des activités de loisirs (activités sportives, jardinage...)





## Quelques définitions



### **Inactivité physique :**

niveau d'AP inférieur au niveau d'AP recommandé pour la santé

### Recommandations d'Activités Physiques :

*adultes* : 30 minutes d'AP d'intensité modérée au minimum 5x/sem

*enfants et adolescents* : 60 min/j

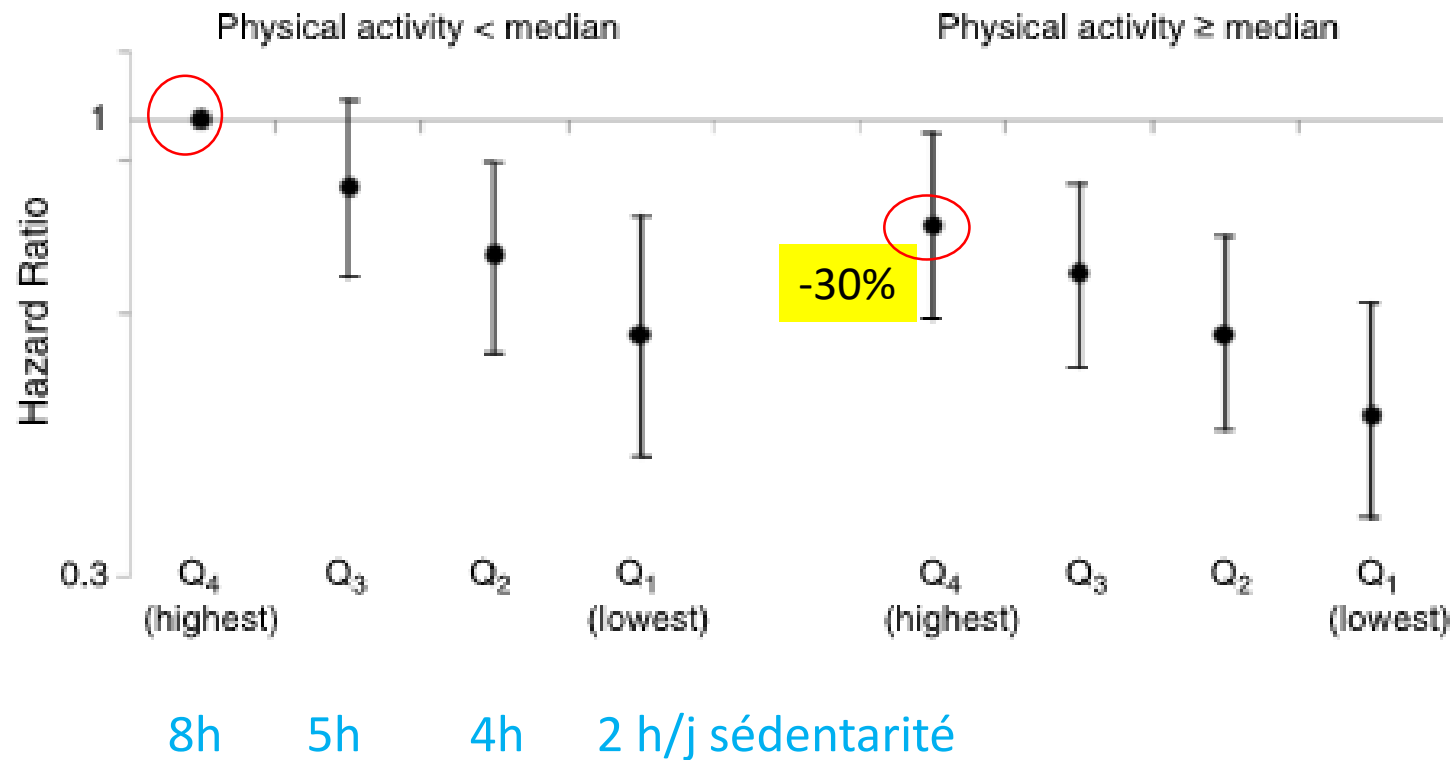
(OMS 2010, ANSES 2016, INSERM 2019)

### **Sédentarité ou comportement sédentaire**

Temps cumulé assis ou allongé, pendant la période d'éveil, au cours duquel la dépense énergétique est égale à la dépense énergétique de repos (<1,6MET)

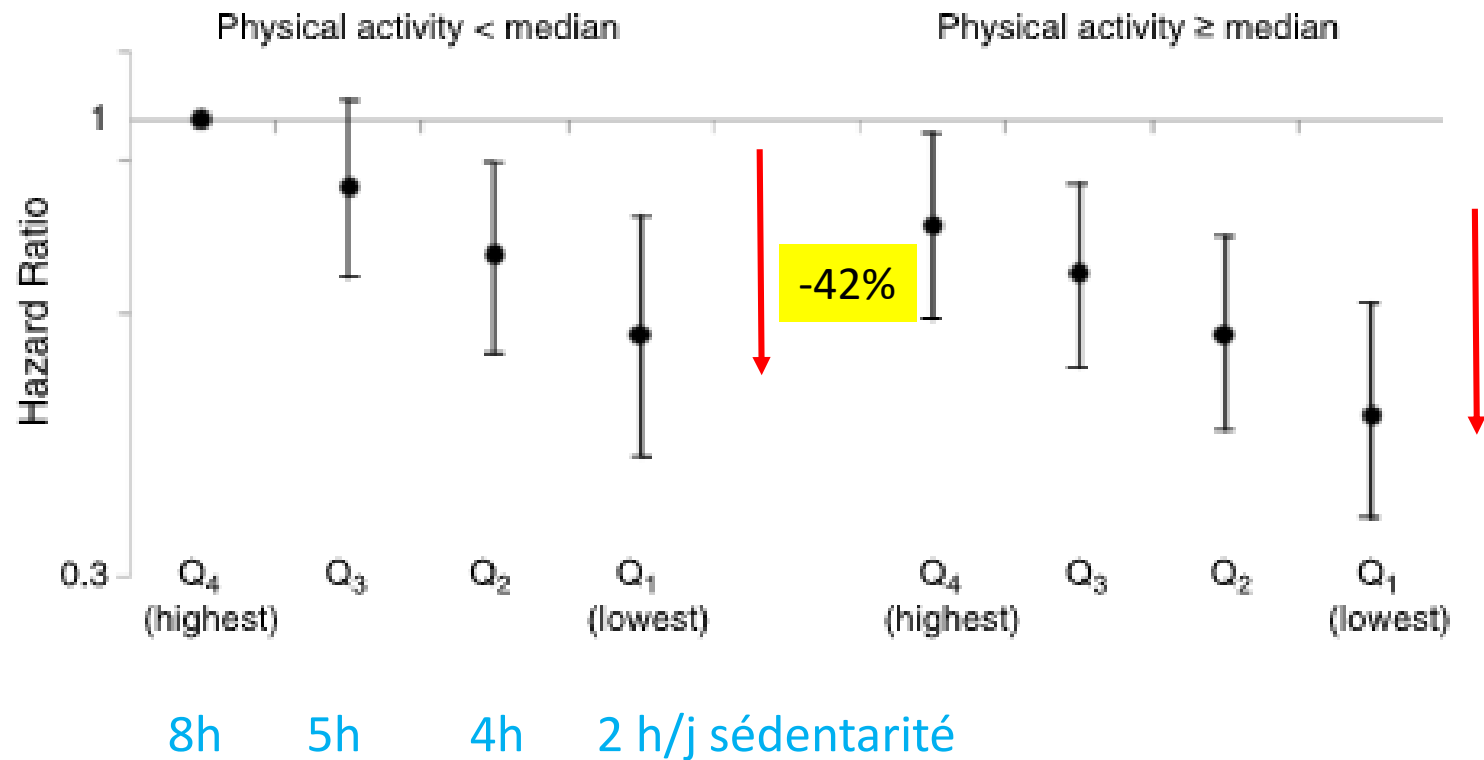
(Sedentary Behaviour Research Network 2012)

# Risques de mortalité en fonction des quartiles de sédentarité (moyennes de 2001 et 2003) en fonction de l'activité physique



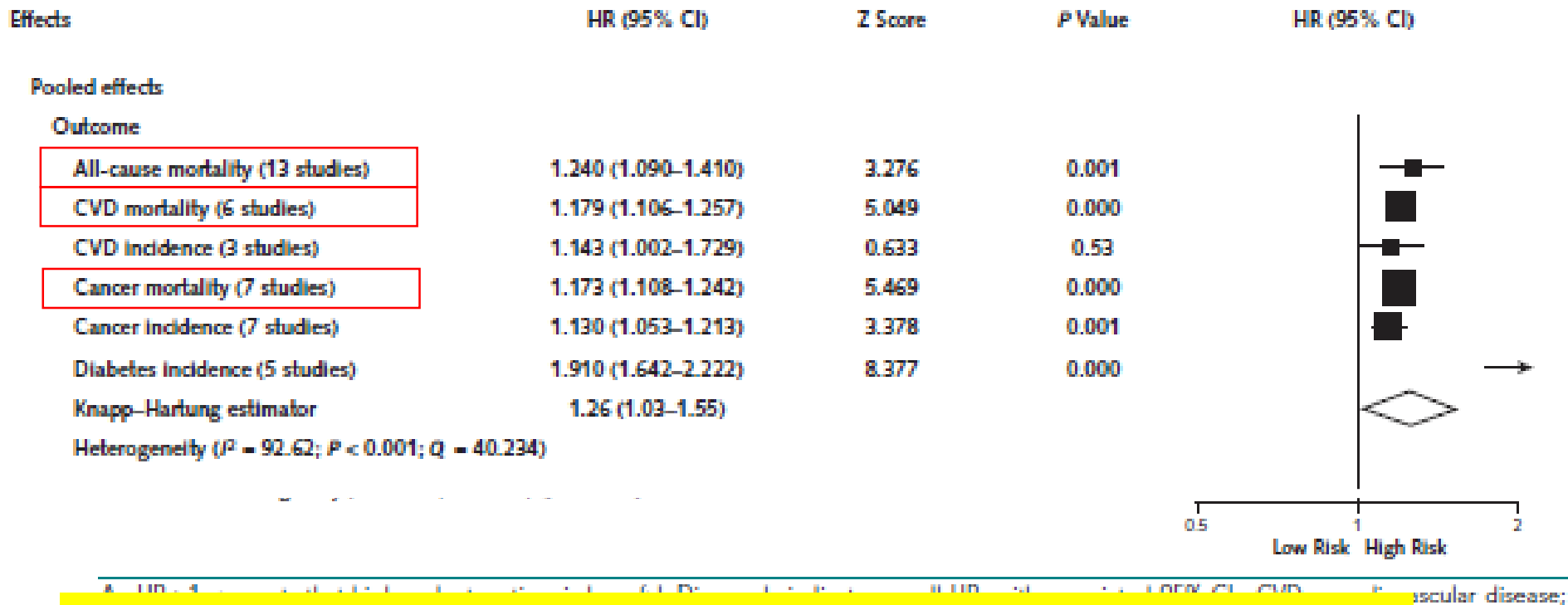
Après ajustements multiples

# La sédentarité augmente la mortalité indépendamment du niveau d'activité physique



Après ajustements multiples

# Association entre sédentarité et morbi-morbidité



**Chaque  $\uparrow 1\text{h/j} \rightarrow \uparrow$  risque DT2 de 22% et de SM de 39%**  
 (Van der Berg 2015, Wijndaele 2017)

41 études (entre 800 000 à 29 000 sujets/item)

# Sédentarité et risques de cancer

## **Television Viewing and Time Spent Sedentary in Relation to Cancer Risk: A Meta-analysis**

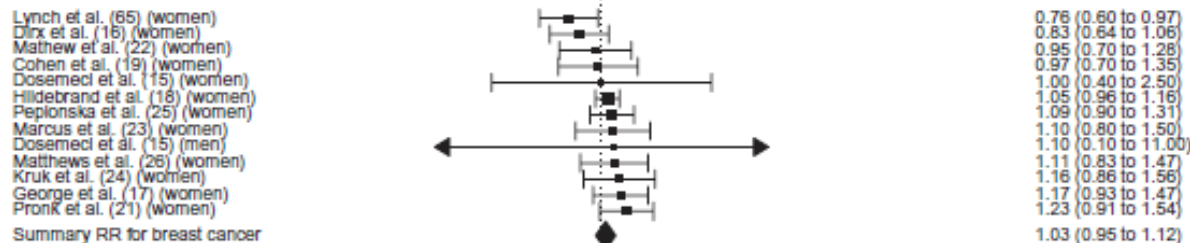
Daniela Schmid, Michael F. Leitzmann

JNCI J Natl Cancer Inst (2014) 106(7): dju098

43 études observationnelles  
68936 cas de cancers



### RRs of breast cancer



### RRs of colon cancer



Colon cancer

### RRs of rectal cancer



### RRs of colorectal cancer



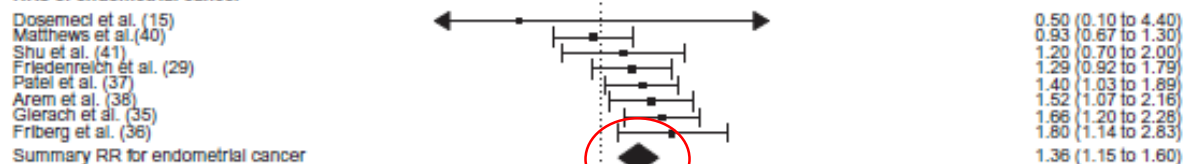
### RRs of total colorectal cancer



Colorectal cancer

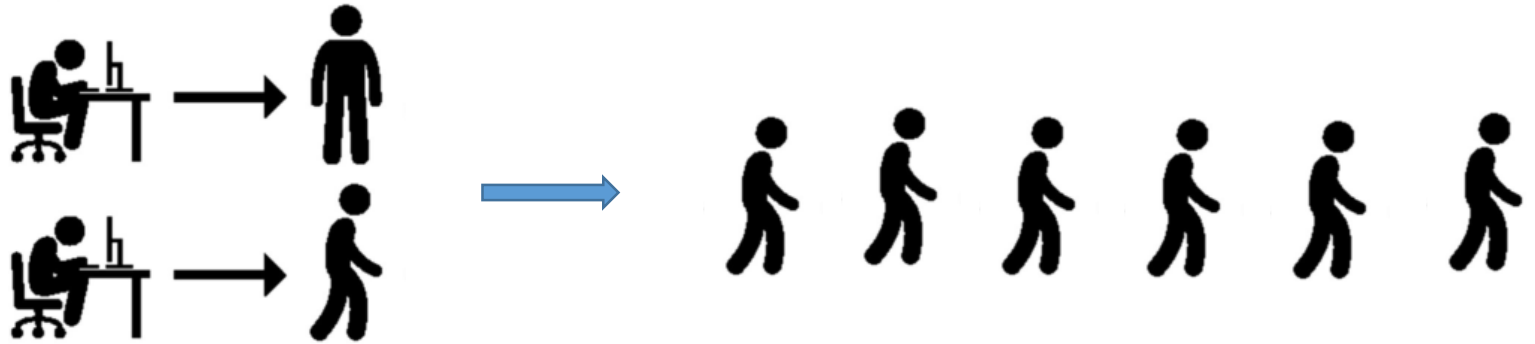
Chaque ↑ 2h/jour temps sédentarité associée à  
+8% risques cancer colon  
+10% risques cancer endomètre

### RRs of endometrial cancer



Endometrial cancer

## Peut-être plus d'AP pour compenser les effets de la sédentarité?



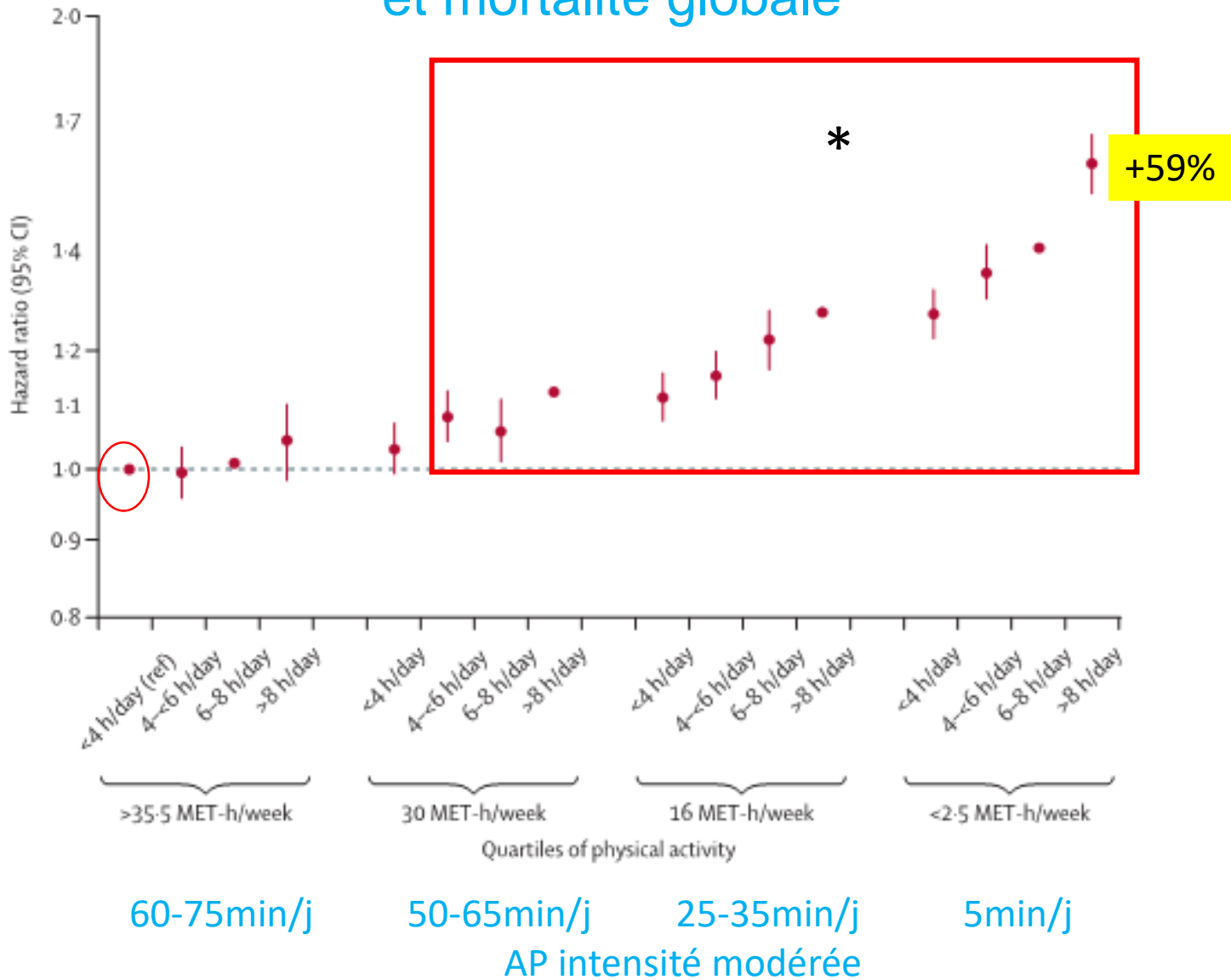
Cohortes prospectives

16 études revues avec les auteurs pour analyse homogène

→ *1 million de sujets*

suivis 2 à 18,1 ans; décès 8,4%

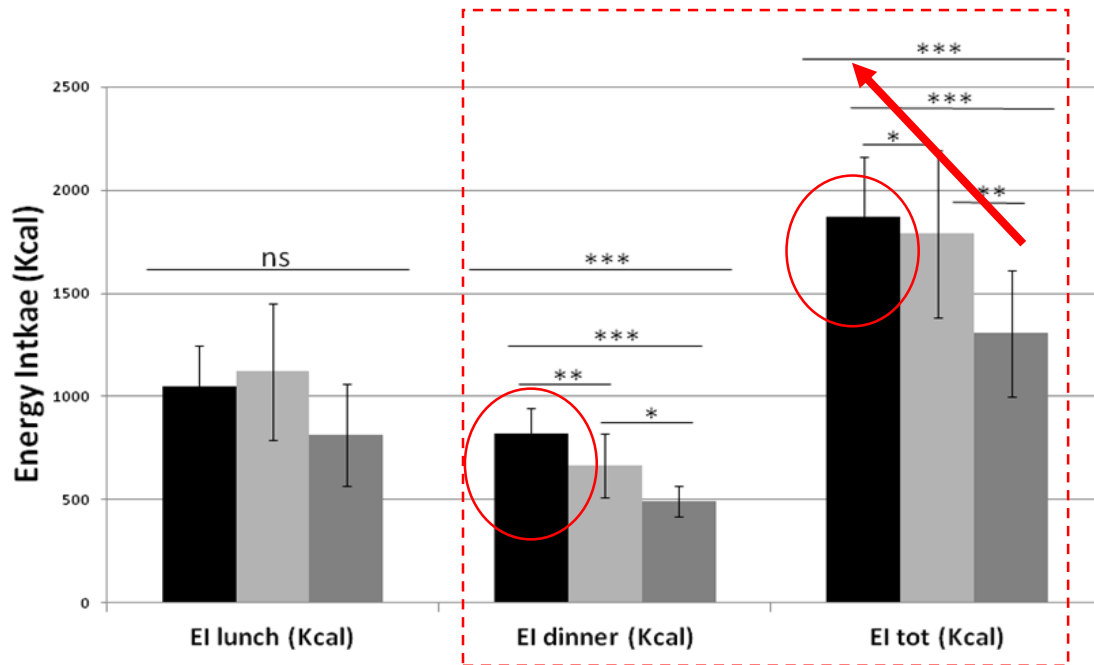
# Méta-analyse sur association AP- temps passé assis et mortalité globale



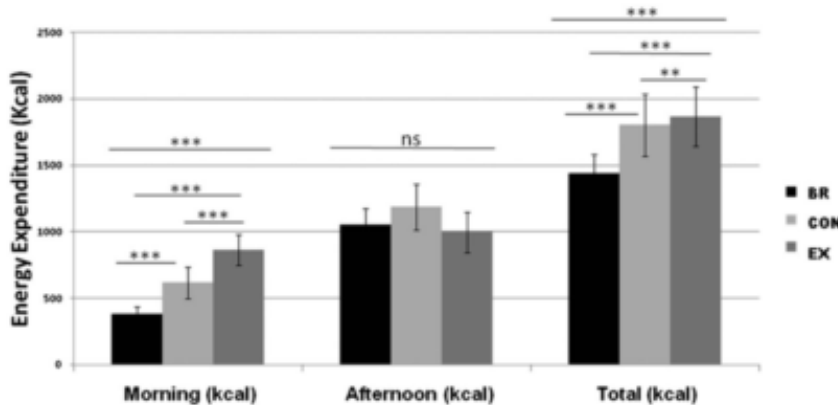
# Comment expliquer les effets de la sédentarité sur la santé?

Qu'est-ce que fait la sédentarité sur la santé?

# Sédentarité et augmentation de la prise alimentaire



4h bed rest  
 4h CTL  
 3x10 min vélo  
 75%VO<sub>2</sub>max (11h)



Comparison of characteristics and dietary intake of QUALITY<sup>a</sup> subjects between 2 screen time groups.

	Screen time <sup>b</sup>				P-value
	Low (n = 226)		High (n = 295)		
	Mean	SD	Mean	SD	
<b>Children</b>					
Age (year)	9.5	0.9	9.7	0.9	0.003
Boys (%)	45		62		<0.001
Children's BMI (kg/m <sup>2</sup> )	18.4	3.4	20.4	4.8	<0.001
Overweight/obese (%)	34		49		<0.001
Screen time (h/d) <sup>c</sup>	1.2	0.7	3.6	2.4	<0.001
Physical activity (counts/min)	594	188	582	184	0.430
<b>Parents</b>					
Mothers' BMI (kg/m <sup>2</sup> )	28.8	6.1	30.0	7.0	0.031
Fathers' BMI (kg/m <sup>2</sup> )	30.3	5.5	31.0	5.4	0.146
Household income	43,763	17,883	40,929	19,390	0.064
Parent holding a university degree (%)	61		50		0.005
<b>Children's dietary intake</b>					
Energy (kcal)	1639	387	1722	395	0.010
Total fat (g/1000 kcal)	36	5.8	36	5.1	0.411
Total added sugar (g/1000 kcal)	29	11	30	12	0.290
Fiber (g/1000 kcal)	8.4	2.1	7.7	2.0	<0.001
Sodium (mg/1000 kcal)	1422	304	1484	349	0.019
Sugar-sweetened beverages (mL/1000 kcal)	79	92	87	90	0.382
Hamburger/hot dog/pizza (g/1000 kcal)	15	24	17	28	0.244
Vegetables & fruit (serving/1000 kcal)	2.8	1.3	2.5	1.3	0.004
Dairy products (serving/1000 kcal)	1.2	0.5	1.1	0.5	0.098
HEI-C <sup>d</sup>	79	9.8	78	9.3	0.119



## Screen time is associated with dietary intake in overweight Canadian children ☆☆☆★☆☆

Lei Shang<sup>a,b</sup>, JiaWei Wang<sup>b,\*</sup>, Jennifer O'Loughlin<sup>c,d</sup>, Angelo Tremblay<sup>e</sup>, Marie-Ève Mathieu<sup>f</sup>, Mélanie Henderson<sup>g</sup>, Katherine Gray-Donald<sup>b,h</sup>



N = 630  
8 - 10 ans

# « Sitting disease »

## Organ damage

### HEART DISEASE

Muscles burn less fat and blood flows more sluggishly during a long sit, allowing fatty acids to more easily clog the heart. Prolonged sitting has been linked to high blood pressure and elevated cholesterol, and people with the most sedentary time are more than twice as likely to have cardiovascular disease than those with the least.

### OVERPRODUCTIVE PANCREAS

The pancreas produces insulin, a hormone that carries glucose to cells for energy. But cells in idle muscles don't respond as readily to insulin, so the pancreas produces more and more, which can lead to diabetes and other diseases. A 2011 study found a decline in insulin response after just one day of prolonged sitting.

### COLON CANCER

Studies have linked sitting to a greater risk of colon cancer.

### Muscle degeneration

#### MUSHY ABS

When you sit up, your abs keep you upright. But when you sit in a chair, your abs and other muscles and the spine's core muscles don't get used to it. Soft abs hurt your stability, your ability to push off and your ability to maintain a powerful stride.

Flexible hips help keep you balanced, but chronic sitters so rarely extend the hip flexor muscles in front that they become short and tight, limiting range of motion and stride length. Studies have found that decreased hip mobility is a main reason elderly people tend to fall.

#### LIMP GLUTES

Sitting requires your glutes to do absolutely nothing, and they get used to it. Soft glutes hurt your stability, your ability to push off and your ability to maintain a powerful stride.

## Trouble at the top

### FOGGY BRAIN

Moving muscles pump fresh blood and oxygen through the brain and trigger the release of all sorts of brain- and mood-enhancing chemicals. When we are sedentary for a long time, everything slows, including brain function.

### STRAINED NECK

If most of your sitting occurs at a desk at work, craning your neck forward toward a keyboard or tilting your head to cradle a phone while typing can strain the cervical vertebrae and lead to permanent imbalances.



Proper cervical vertebrae alignment

### SORE SHOULDERS AND BACK

The neck doesn't slouch alone. Slumping forward overextends the shoulder and back muscles as well, particularly the trapezius, which connects the neck and shoulders.

### Bad back

#### INFLEXIBLE SPINE

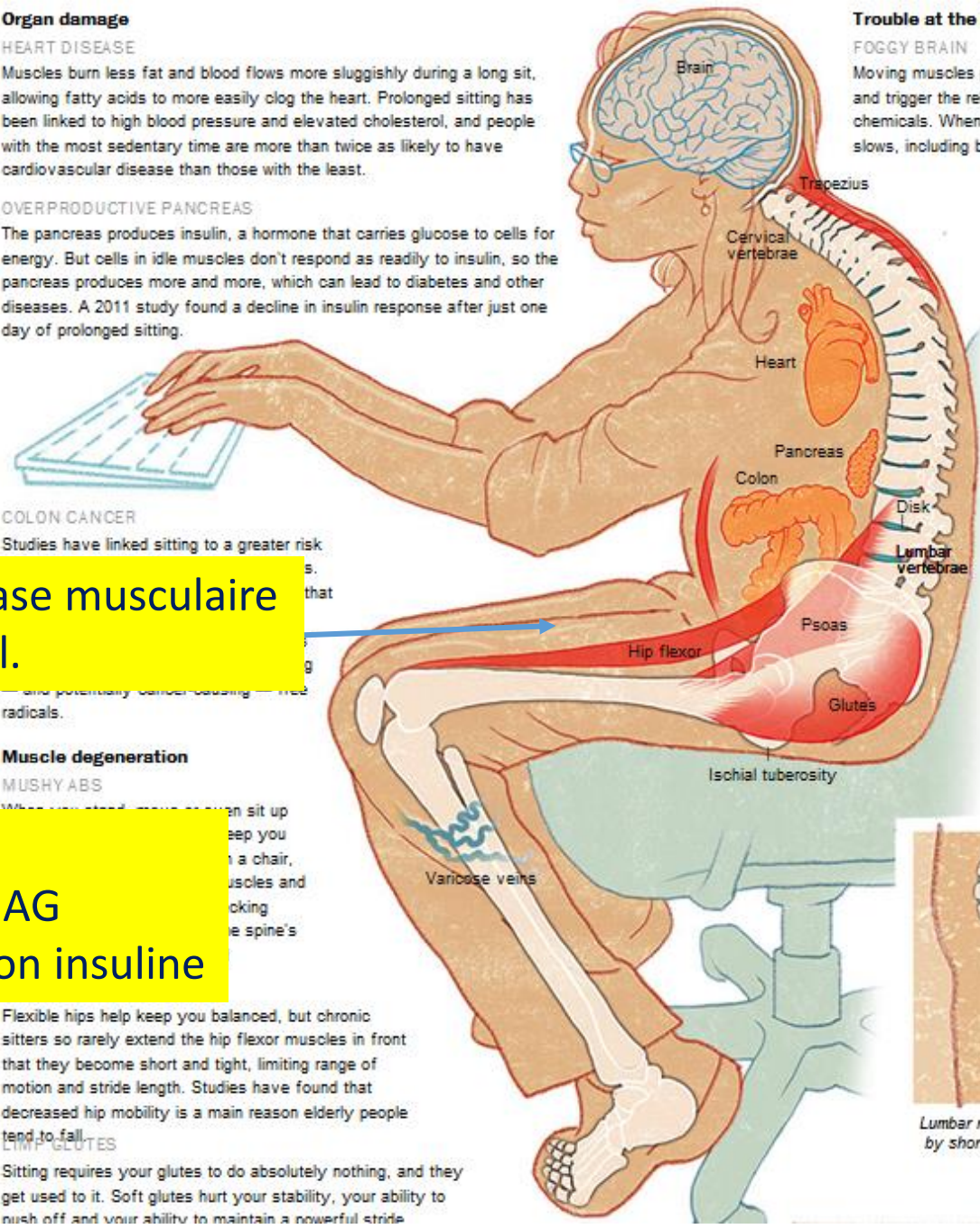
When we move around, soft discs between vertebrae expand and contract like sponges, soaking up fresh blood and nutrients. But when we sit for a long time, discs are squashed unevenly. Collagen hardens around supporting tendons and ligaments.

#### DISK DAMAGE

People who sit more are at greater risk for herniated lumbar disks. A muscle called the psoas travels through the abdominal cavity and, when it tightens, pulls the upper lumbar spine forward. Upper-body weight rests entirely on the ischial tuberosity (sitting bones) instead of being distributed along the arch of the spine.



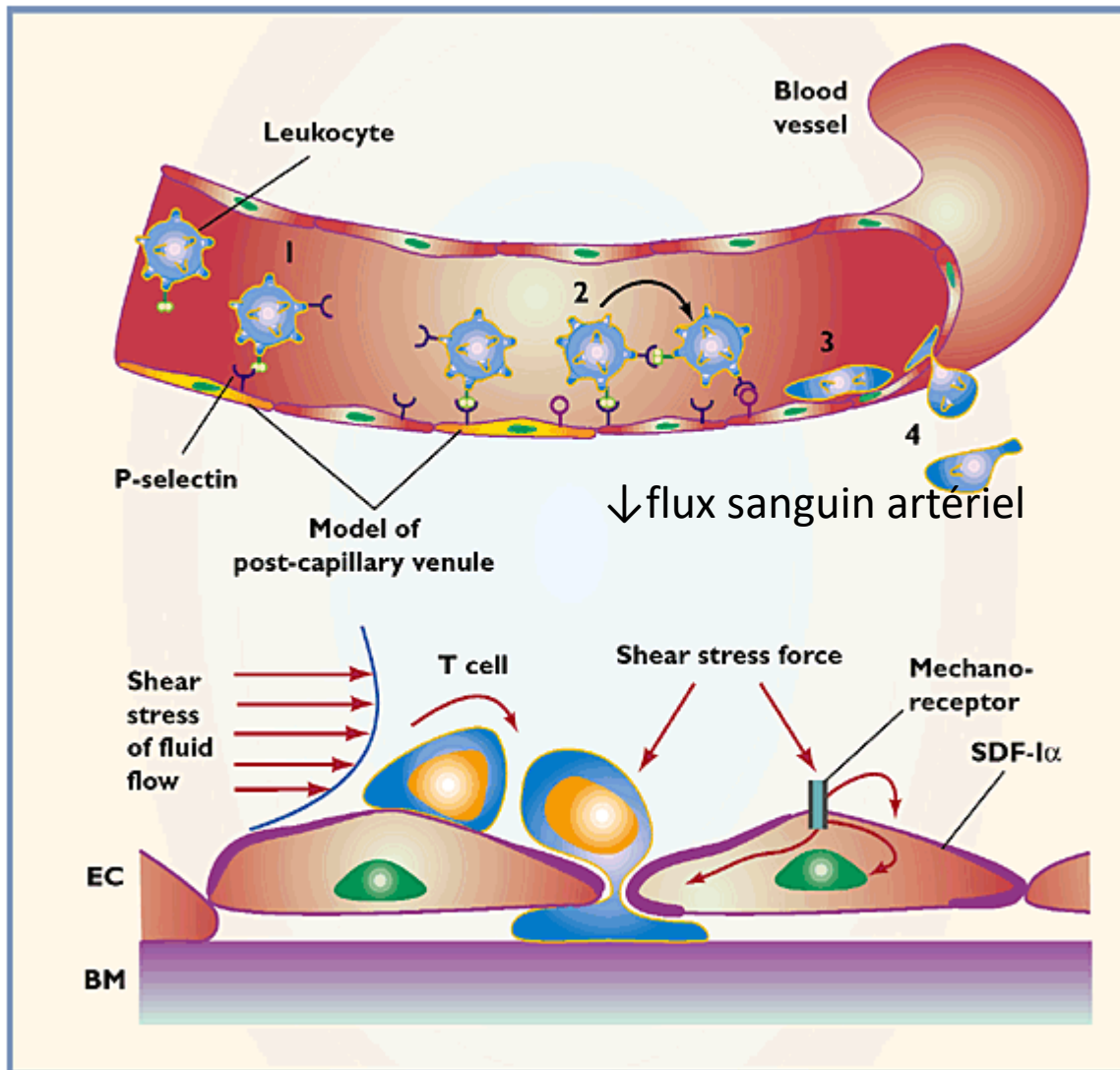
Lumbar region bowed by shortened psoas



↓Lipoprotéine lipase musculaire  
→ ↓ captage TG pl.

↓ AMPK  
→ ↓ oxydation AG  
→ ↓ signalisation insuline

# Shear stress



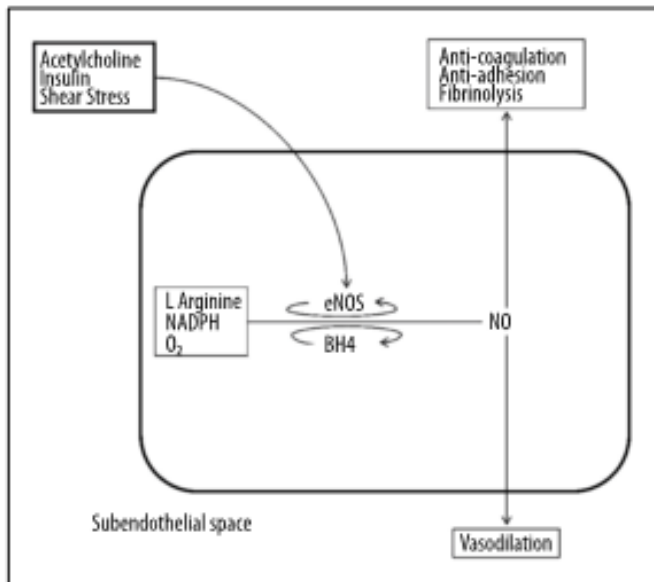
↓flux sanguin artériel



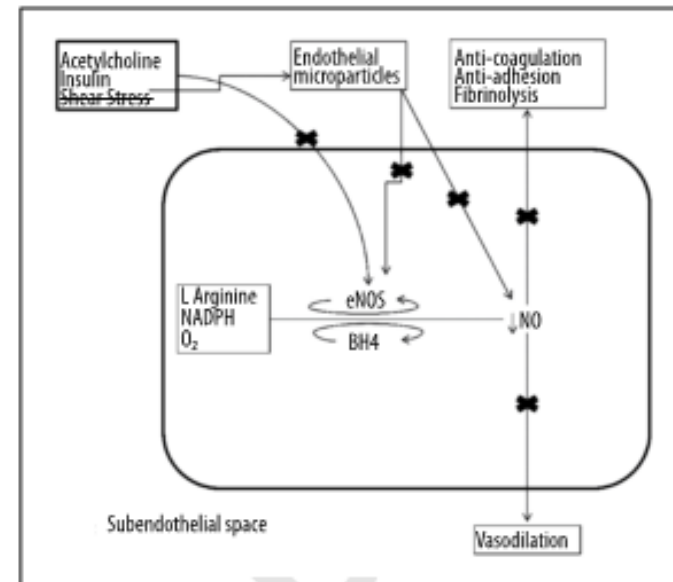
↓stimulation endothélium artériel



# Shear stress et vasodilatation endothélium dépendante



**Figure 2A.** Normal functioning of the shear stress, acetylcholine and insulin mediated NO mechanism in and around the endothelial cell. In the presence of laminar shear stress, insulin and acetylcholine, nitric oxide is produced from L-Arginine. Nitric oxide functions as an anti-oxidant molecule. It also performs the functions of anti-coagulation, anti-adhesion, anti-fibrinolysis and vasodilation in the endothelial environment



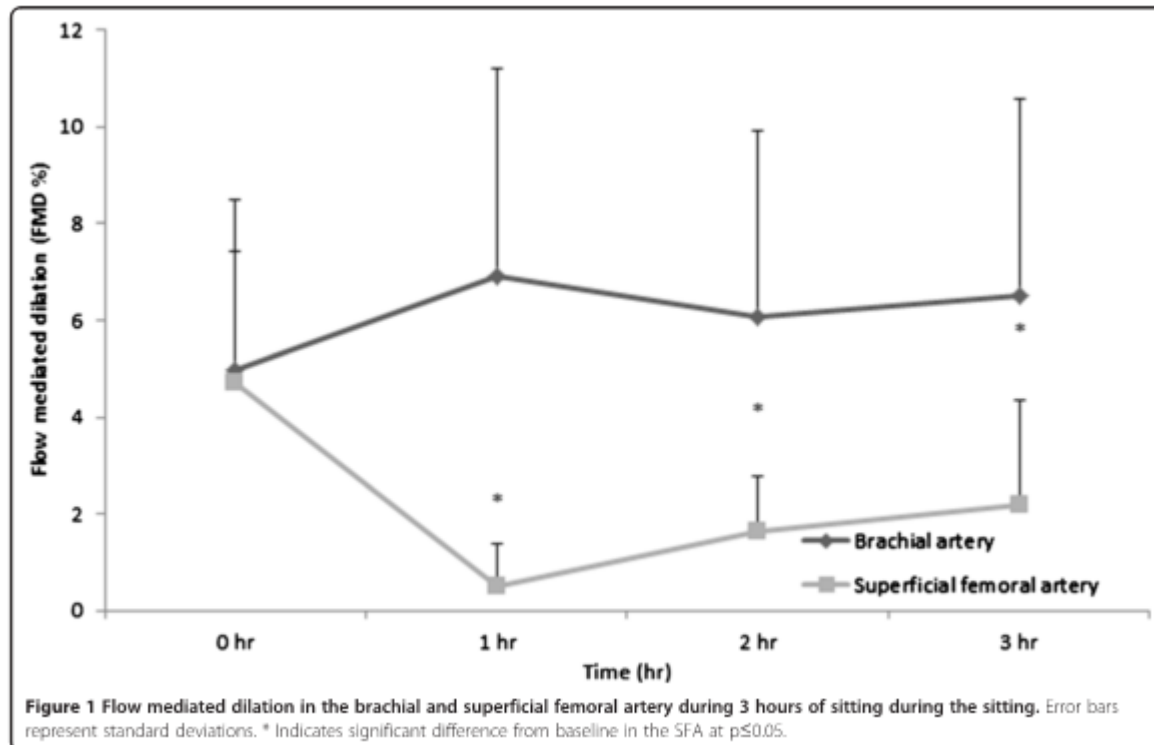
**Figure 2B.** Low, oscillatory or turbulent shear stress results in endothelial injury and release of endothelial microparticles. Altered shear stress directly and indirectly impairs the nitric oxide bioavailability resulting in oxidative stress and decline in anti-atherosclerotic functions thus resulting in endothelial dysfunction and pro-atherosclerotic environment. Crossed out 'shear stress' implies non-laminar shear stress. 'X' marks represent decline in or blocking of a particular function.

→ ↓NO et ↑ processus inflammatoires

# Differences in brachial and femoral artery responses to prolonged sitting

Saurabh S Thosar<sup>1,2\*</sup>, Sylvanna L Bielko<sup>1</sup>, Chad C Wiggins<sup>1</sup> and Janet P Wallace<sup>1</sup>

Thosar *et al. Cardiovascular Ultrasound* 2014, **12**:50  
<http://www.cardiovascularultrasound.com/content/12/1/50>

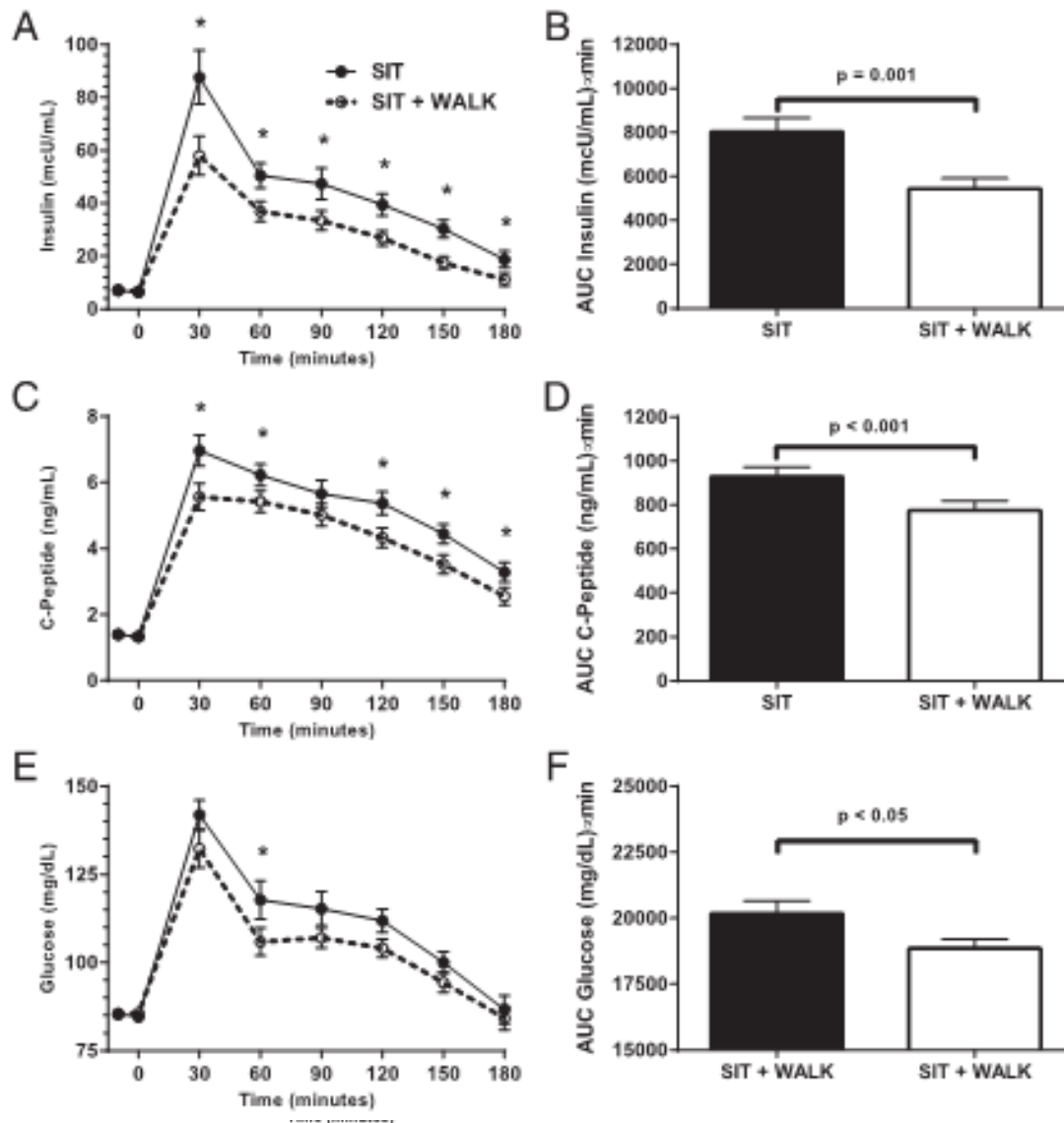


**Figure 1** Flow mediated dilation in the brachial and superficial femoral artery during 3 hours of sitting during the sitting. Error bars represent standard deviations. \* Indicates significant difference from baseline in the SFA at  $p < 0.05$ .

## Effets aigus de la sédentarité vs épisodes de rupture de la sédentarité

Enfants 7-11ans poids normal

- 3h assis
- 3h assis avec /30 min 3min marche (80% VT)= total 18 min



3h de position assise

- ↓captage G muscle
- ↑lipogénèse

**Figure 2.** The effect of sitting interrupted with 3 minutes of moderate-intensity walking every half hour (SIT+WALK) vs SIT on serum insulin concentrations (A); 3-hour insulin AUC (B); serum C-peptide concentrations (C); 3-hour C-peptide AUC (D); plasma glucose concentrations (E); and 3-hour glucose AUC (F). Unadjusted means ± SE are shown in A, C, and E. AUC results (B, D, and F) are mean ± SE adjusted for randomization order. \*, Significantly different, SIT vs SIT+WALK;  $P < .05$ .

♀ surpoids/obèses ménopausées,  $66,6 \pm 4,7$  ans, IHG

7,5h assis en continu, 2 repas

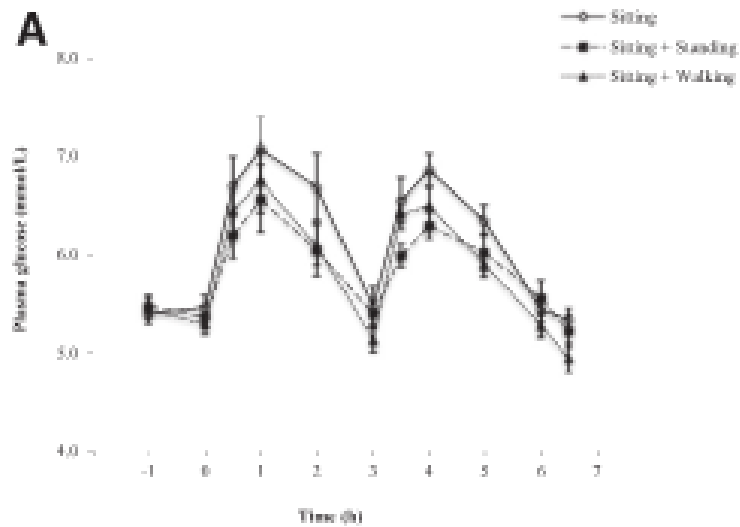
vs avec 5min debout ou marche faible intensité /30 minutes  
(=30 min/7h)

« Activités » (actigraph sur 7j) :

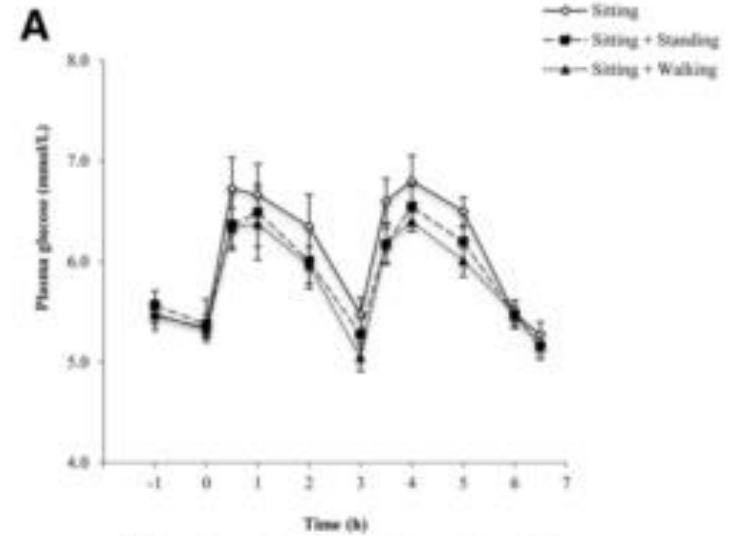
70% sédentaire

25% AP légère

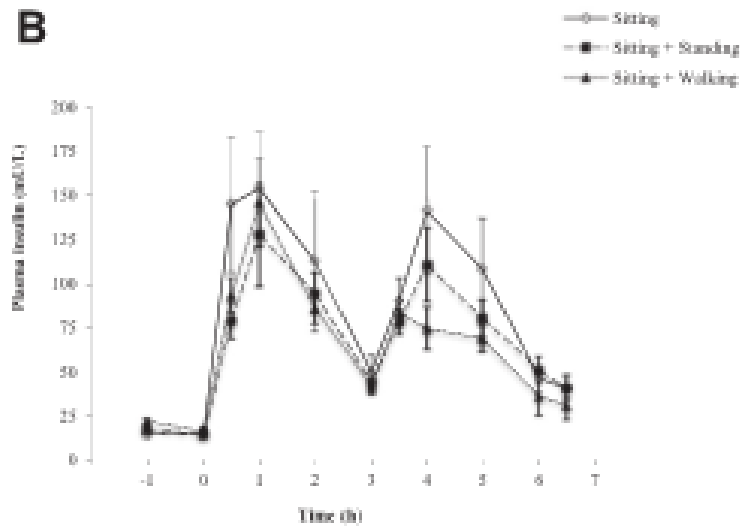
<5% temps: AP d'intensité modérée



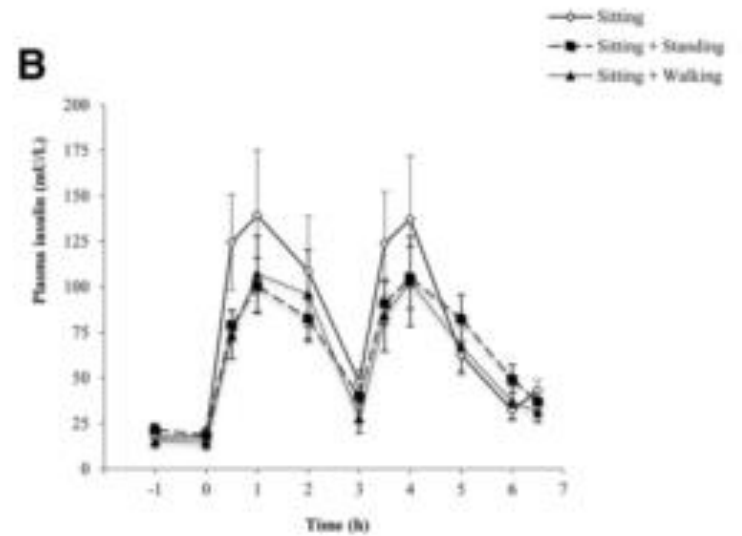
IAUC: Standing vs. sitting  $p=0.022$ ; Walking vs. sitting  $p=0.999$



IAUC: Standing vs. sitting  $p=0.039$ ; Walking vs. sitting  $p=0.027$



IAUC: Standing vs. sitting  $p=0.045$ ; Walking vs. sitting  $p=0.008$



IAUC: Standing vs. sitting  $p=0.325$ ; Walking vs. sitting  $p=0.038$

J1

Effet qui se prolonge à J2

♀ surpoids/obèses ménopausées,  $66,6 \pm 4,7$  ans, IHG

7,5h assis en continu, 2 repas

vs avec 5min debout ou marche faible intensité /30 minutes (=30 min/7h)

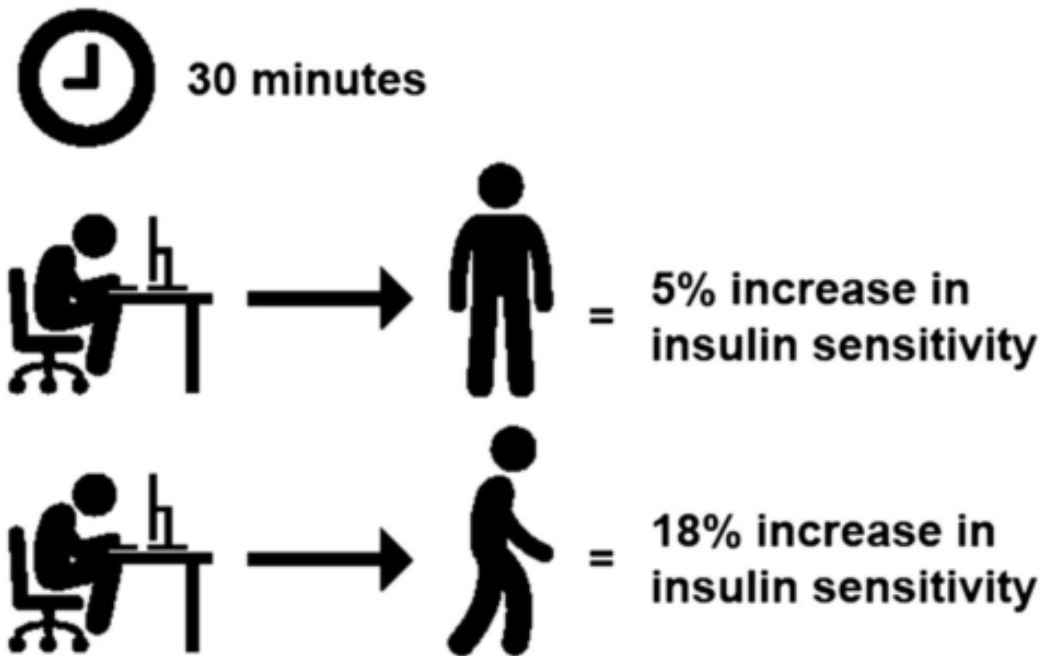


Figure 2. The potential effect on insulin sensitivity of re-allocating 30 min of sedentary time to either light activity or moderate-to-vigorous physical activity (taken from Yates *et al.* [47])

Même résultats chez :

- sujets jeunes IMC normal (Peddie 2013)
- Population générale (Healy 2011)
- sujets avec Intolérance au G (Henson 2016)
- DT2 (Duvivier 2016)
- sujets en surpoids, obèses (Dunstan 2012)
- Séniors
- Autres (Tremblay 2010, Booth 2017)



# Comportements sédentaires

## Etude NutriNet santé

Etude sur une sous population:

→ 35 444 sujets qui travaillent  
44.5±13.0 ans et 80% femmes

→ Temps de sédentarité : travail, déplacement, loisirs

Jours travaillés

Jours non travaillés

Auto-questionnaire

4 dernières semaines

**Table 2 WORKDAYS Distribution of sedentary behaviours (hours per day) by sitting and entertainment types on workdays by socio-demographic characteristics and occupation type**

	WORK SITTING (h/day)	TRANSPORT SITTING (h/day)	LEISURE SITTING (h/day)	TV/DVD TIME (h/day)	OTHER SCREEN TIME (h/day)	NON-SCREEN TIME (h/day)
TOTAL	4.17 (3.07)	1.10 (1.69)	2.19 (1.62)	1.53 (1.24)	2.19 (2.62)	0.97 (1.49)

12h

**Table 3 NON-WORKDAYS Distribution of sedentary behaviours (hours per day) by sitting and entertainment types on non-workdays by socio-demographic characteristics and occupation type**

	TRANSPORT SITTING (h/day)	LEISURE SITTING (h/day)	TV/DVD TIME (h/day)	OTHER SCREEN TIME (h/day)	NON-SCREEN TIME (h/day)
TOTAL	0.85 (1.53)	3.19 (2.05)	2.24 (1.76)	1.85 (1.74)	1.30 (1.35)

8h

Jours travaillés: temps sédentarité dû surtout au temps de travail

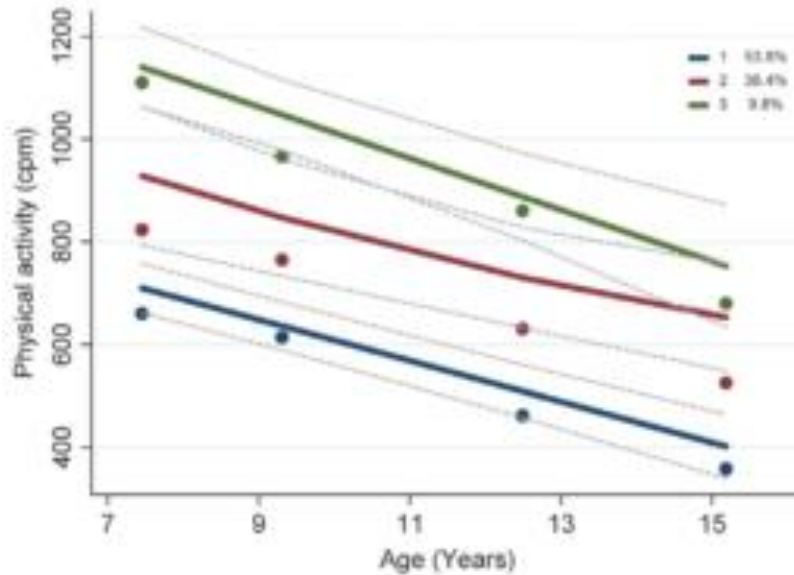
Et lors des loisirs : TV/DVD

Jours non travaillés: loisirs: ordinateurs, tablettes, jeu vidéo (même après 60 ans)

# Timing of the decline in physical activity in childhood and adolescence: Gateshead Millennium Cohort Study

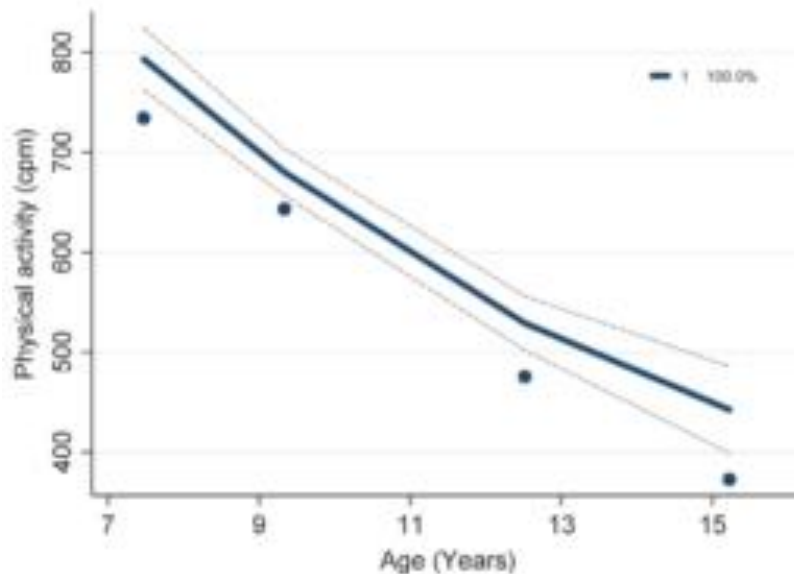
Farooq et al BJSM 2016

Garçons



545 enfants  
nv socio-économiques ≠  
Actigraf  
8 ans suivi

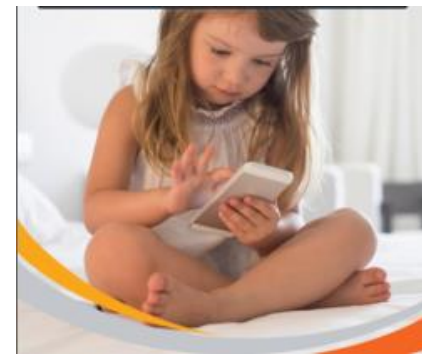
Filles



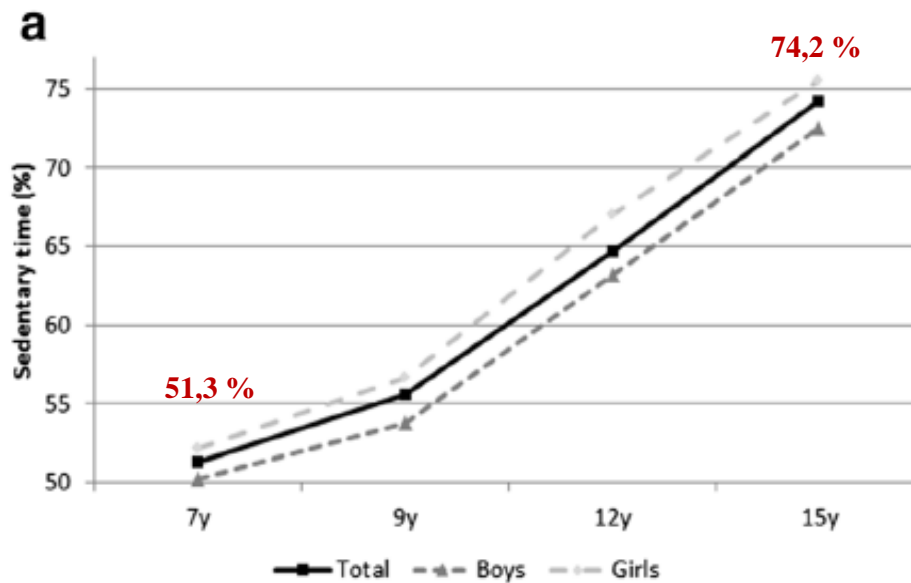


## Development of sedentary behavior across childhood and adolescence: longitudinal analysis of the Gateshead Millennium Study

Xanne Janssen<sup>1\*</sup>, Kay D. Mann<sup>2,3</sup>, Laura Basterfield<sup>2,3</sup>, Kathryn N. Parkinson<sup>3</sup>, Mark S. Pearce<sup>2</sup>, Jessica K. Reilly<sup>3</sup>, Ashley J. Adamson<sup>2,3</sup> and John J. Reilly<sup>1</sup>



N = 1752  
7-15 ans  
7-day Actigraph



## Conclusion

Inactivité physique : un facteur de risque de mortalité et de morbidité

30 min

Sédentarité: un facteur de risque de mortalité et de morbidité

Quel que soit le niveau d'activité physique

12h

Objectifs de santé publique :

- augmenter le temps d'activité physique

ET

- diminuer le temps passé à des activités sédentaires