



Sleep apnoea and driving ability

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Outline

What is obstructive sleep apnoea (OSA)?

OSA and excessive daytime sleepiness: the how and why?

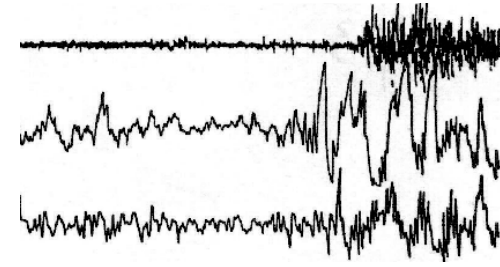
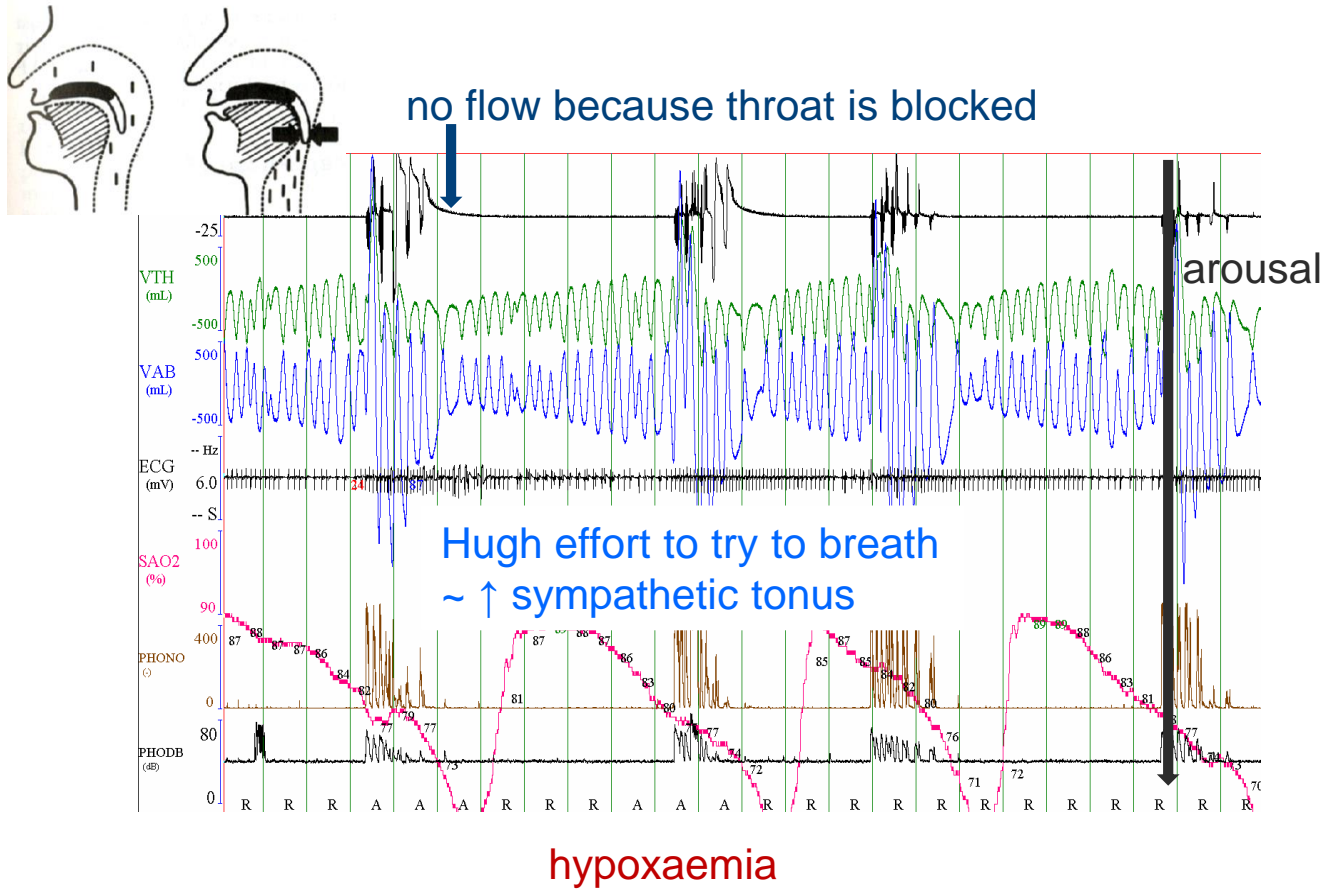
OSA (treatment) and traffic accidents: the facts!

Belgian driving legislation and OSA: the point of view of the “somnologist”.

Belgian driving legislation and OSA: the role of the occupational physician

- discussion -

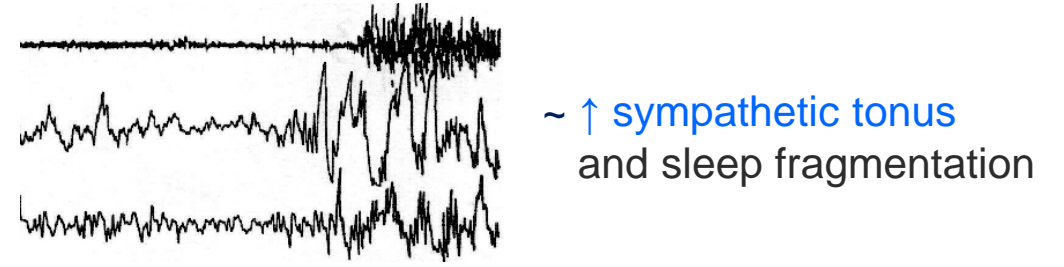
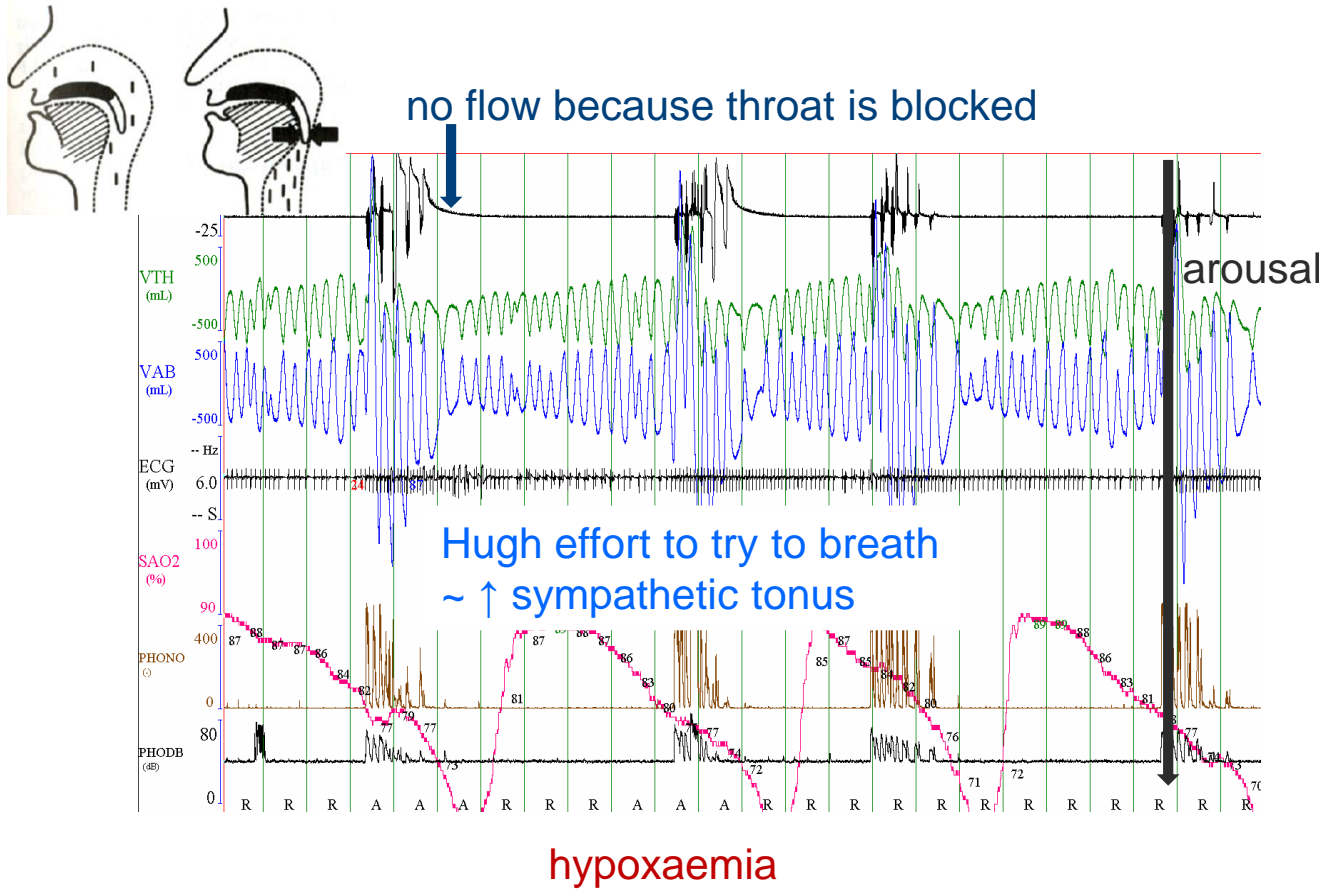
What is obstructive sleep apnoea (OSA)?



~ ↑ sympathetic tonus
and sleep fragmentation



What is obstructive sleep apnoea (OSA)?



Repetitive hypoxaemia
Sympathetic autonomic activation
Sleep fragmentation



excessive daytime sleepiness
neurocognitive dysfunction

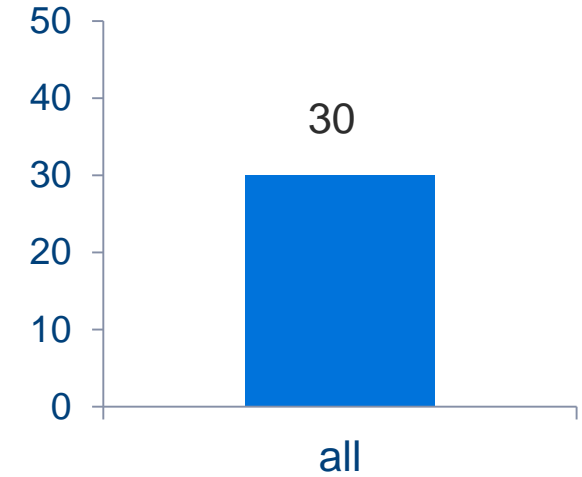
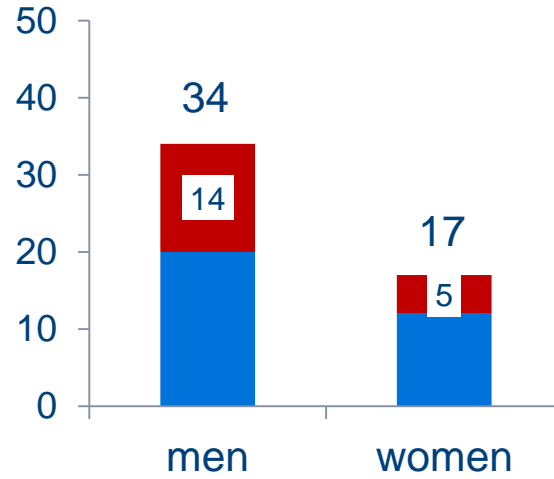
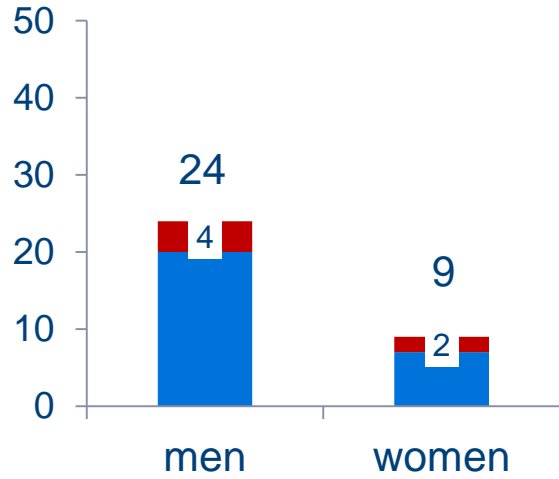
hypertension and
cardiovascular/metabolic disease

What is obstructive sleep apnoea (OSA)?

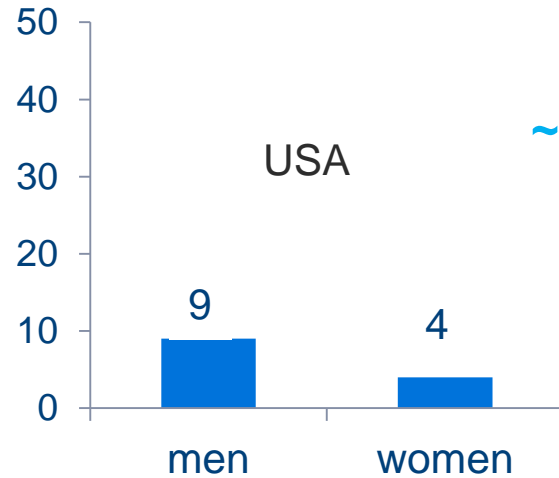
definitions

- **Five** or more obstructive respiratory **events per hour sleep** and **one or more of the following**:
 - Sleepiness, non-restorative sleep, fatigue or insomnia,
 - Waking up with breath holding, gasping or choking sensation
 - Report of habitual snoring, breathing interruptions or both
 - Diagnosis of associated medical or psychiatric disorder (ie, hypertension, coronary artery disease, atrial fibrillation, congestive heart failure, stroke, diabetes type 2, cognitive dysfunction, or mood disorder)
- **15 or more** obstructive respiratory events per hour sleep, **regardless symptoms**

Prevalence % of AHI ≥ 5 Red = % with excessive daytime sleepiness

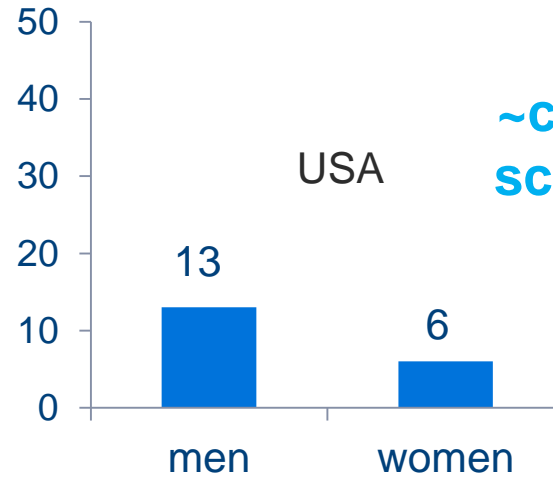


Prevalence % of AHI ≥ 15



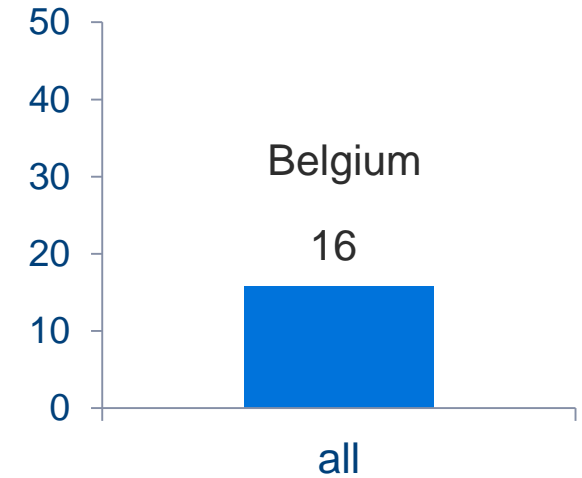
Young. N Engl J Med 1993

↑
~obesity



Peppard. J Am Epid 2013

↑
~changing in scoring tools and rules



Benjafeld. Lancet Resp Med 2019

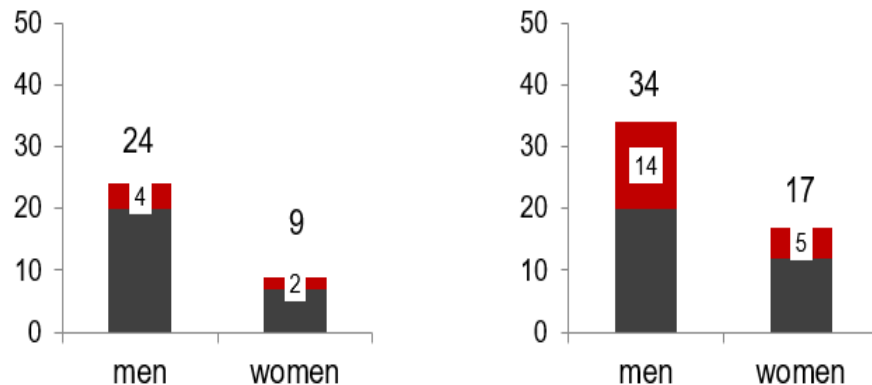
OSA and Excessive Daytime Sleepiness: the how and why?



Excessive daytime sleepiness is not present in all OSA patients

No clinical significant relationship between OSA severity defined as AHI and sleepiness!!!

Prevalence % of AHI ≥ 5



| | AHI<5 | 5≤AHI<15 | 15≤AHI<30 | AHI≥30 |
|-----------------------|-----------|-----------|-----------|-----------|
| Subjects, n | 898 | 524 | 211 | 191 |
| ESS score, mean (SD)* | 7.2 (4.3) | 7.8 (4.4) | 8.3 (4.6) | 9.3 (4.9) |
| ESS score, median* | 6 | 7 | 8 | 9 |
| ESS score ≥ 11, %* | 21 | 28 | 28 | 35 |

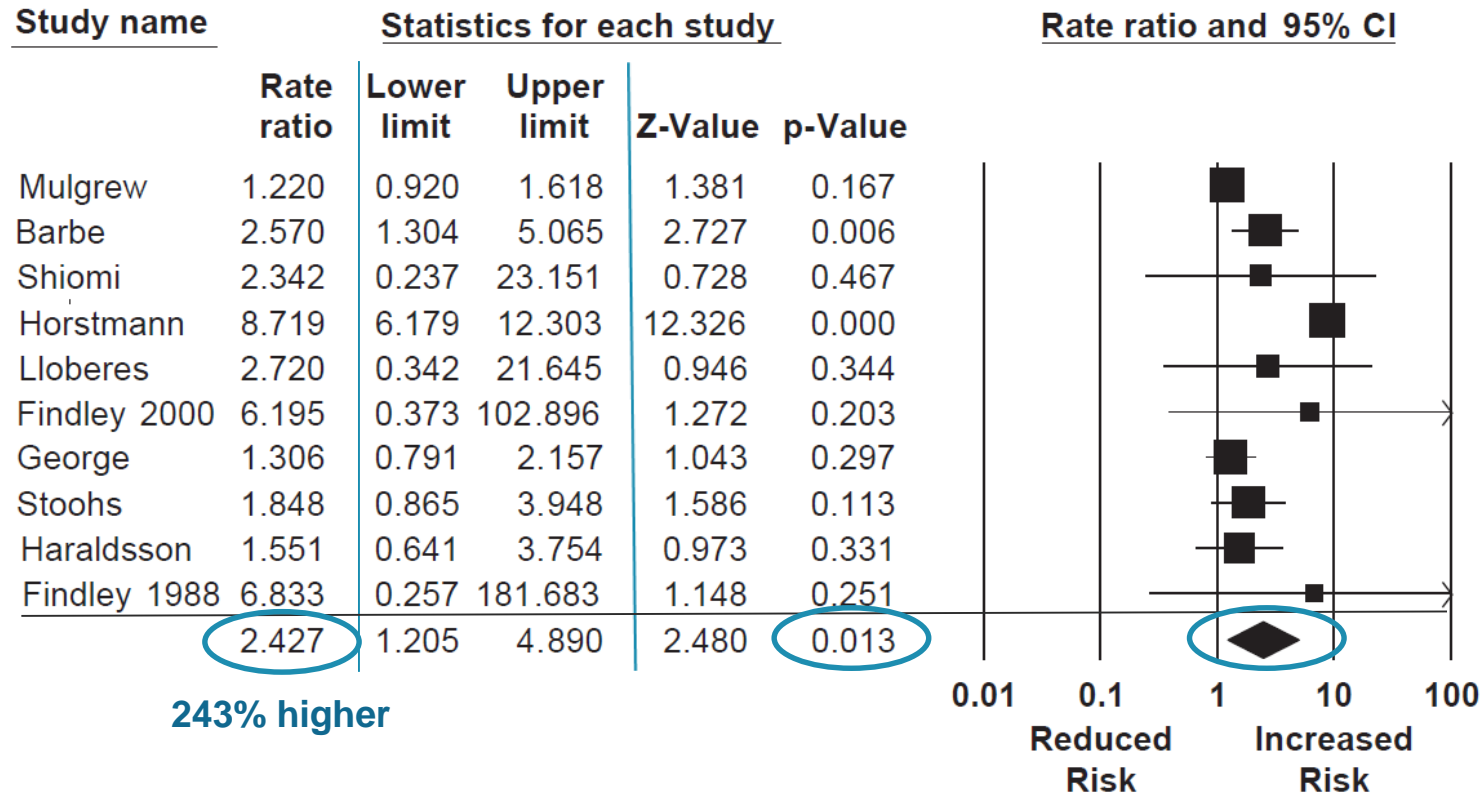
Definition of abbreviations: ESS = Epworth Sleepiness Scale

Weak correlation between subjective sleepiness (ESS) and severity of OSA; a substantial of patients without OSA (21%) report a high ESS, while a substantial proportion of severe OSA (65%) do not report a high ESS

OSA (treatment) and traffic accidents: the facts!

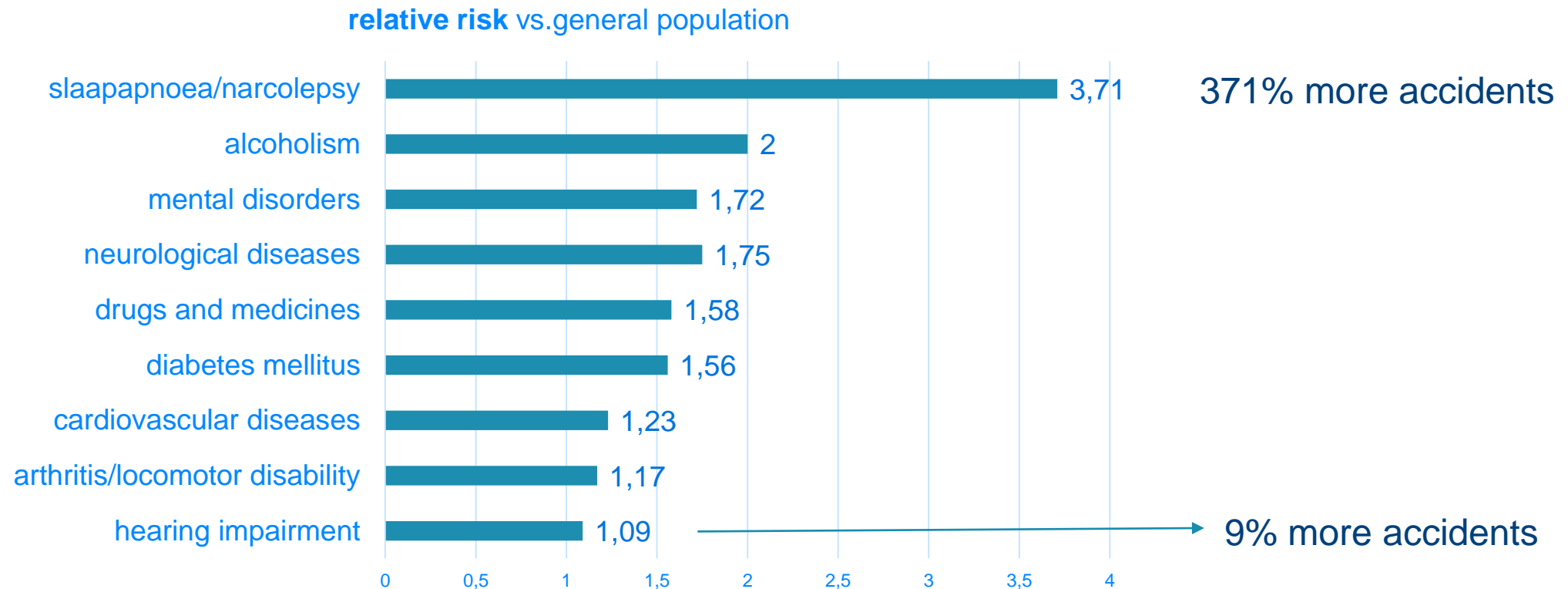
Meta-analysis

Relative crash risk in OSA patients: incidence of crashes occurring among populations of individuals with OSA vs. without the disorder



OSA (treatment) and traffic accidents: the facts!

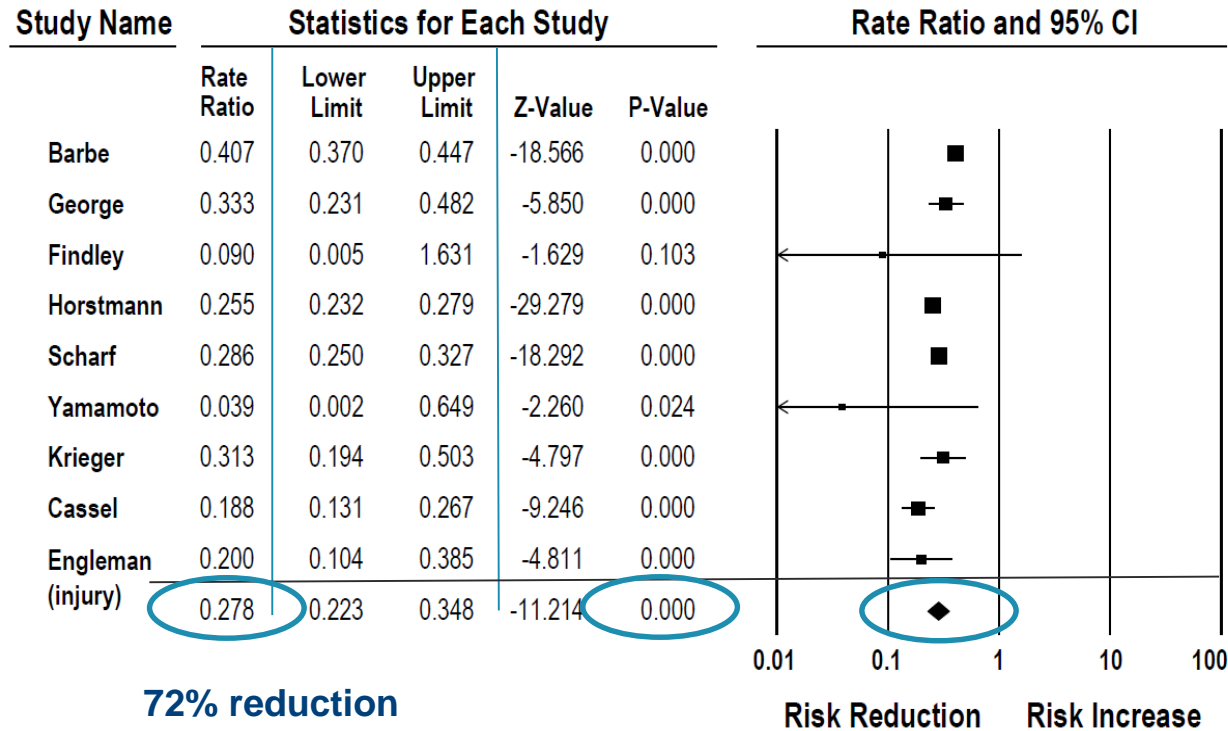
Earlier meta-analysis - within the scope of the “Immortal” project funded by the European Commission in 2003 -
on different diseases and relative risk of accidents while driving



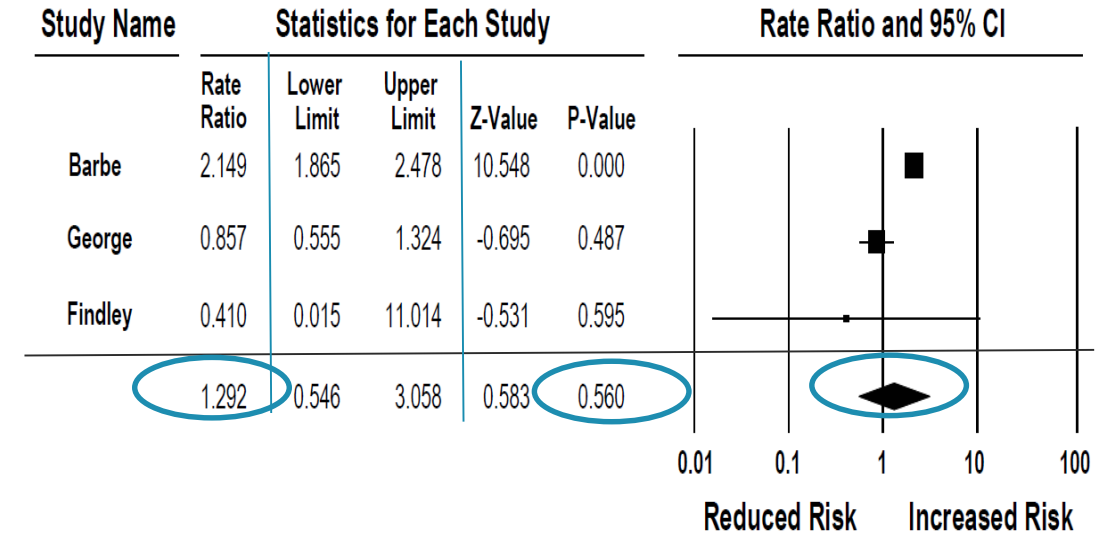
OSA (treatment) and traffic accidents: the facts!

Meta-analysis of effect of CPAP in patients with AHI ≥ 15 / h

Relative crash risk on CPAP treatment versus before



Relative crash risk on CPAP compared to non-OSA subjects

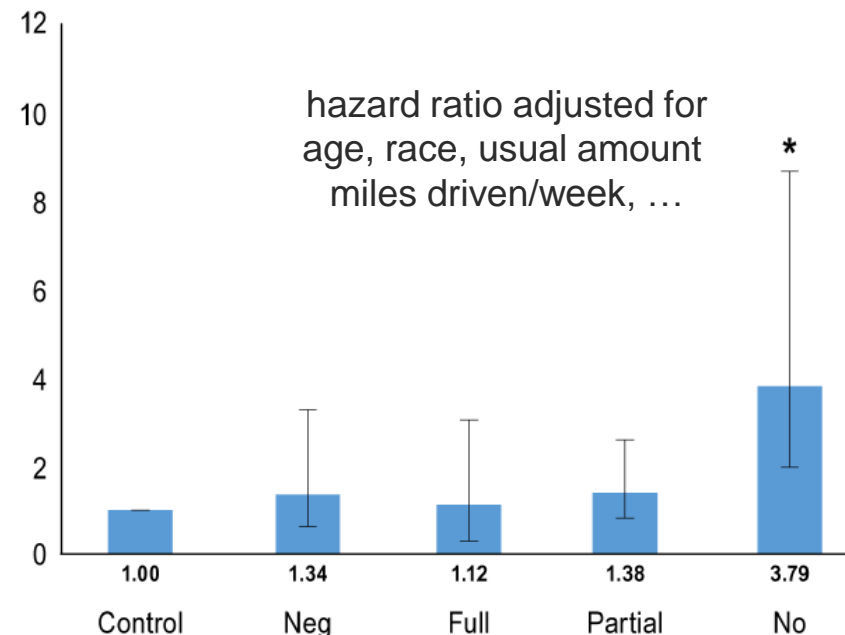
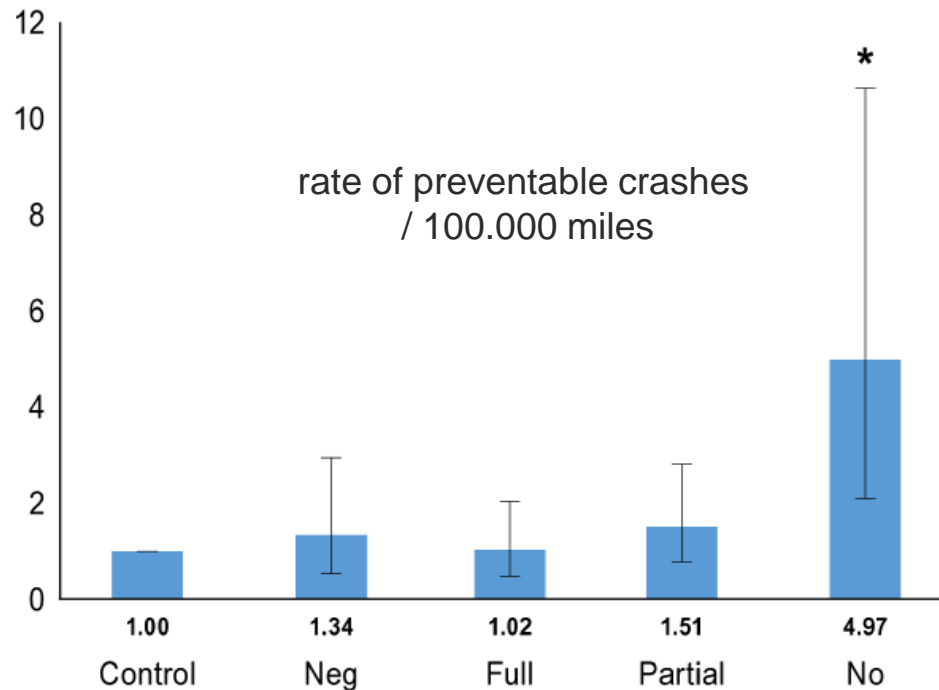
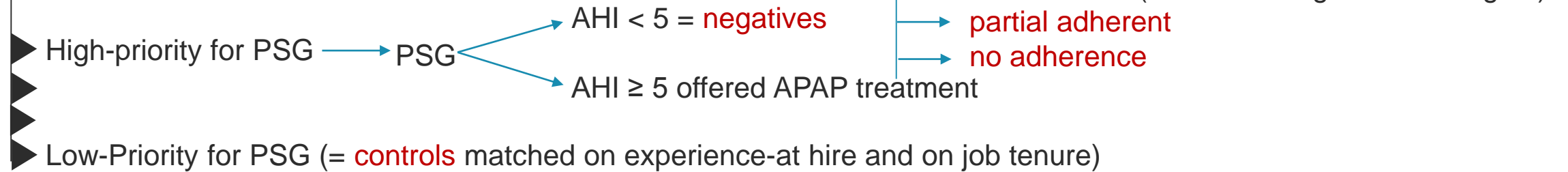


CPAP-treated OSA patients did not show a significantly greater crash risk than their counterparts without OSA

OSA (treatment) and traffic accidents: the facts!

What about commercial drivers?

Screening questionnaire in several thousands of truckers

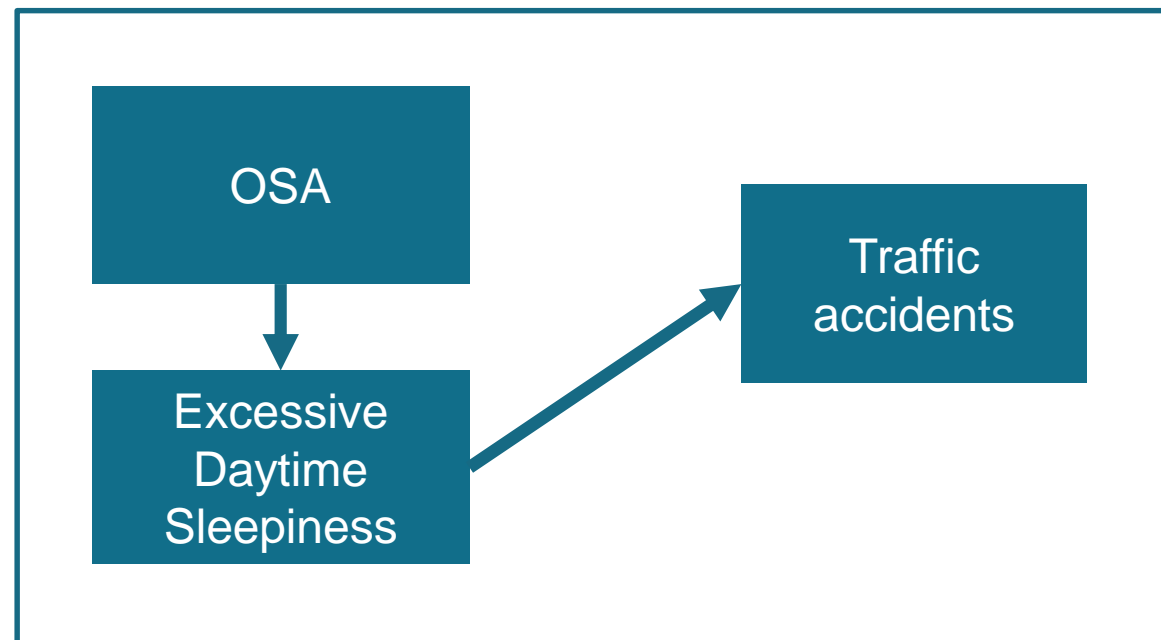


Belgian driving legislation: the point of view of the “somnologist”

KB van 23 maart 1998 ~ rijgeschiktheid
AR du 23 mars 1998 ~ aptitude à la conduite d'un véhicule à moteur
and OSA

Bijlage 6. 4. Pathologische somnolentie

Annexe 6. 4. Somnolence pathologique



KB van 23 maart 1998 ~ rijgeschiktheid
AR du 23 mars 1998 ~ aptitude à la conduite d'un véhicule à moteur
and OSA

Group 2

kandidaten van groep 2 (Art. 42 en 44)

De kandidaat ondertekent een verklaring waarin hij op zijn woord van eer bevestigt, bij zijn weten niet te lijden aan een van de in bijlage 6 genoemde aandoeningen (model bijlage 6, IX) (inclusief vragenlijst ~ snurken en moeheid)

en legt die voor aan de geneesheer van

- een medisch centrum van de Fagad-Medische Rijksdienst, of
- het "Office communautaire régional de la Formation Professionnelle et de l'Arbeitsbemiddeling", of de "Vlaamse Dienst voor Arbeidsbemiddeling en Groepsopleiding", of "l'Institut bruxellois francophone pour la formation professionnelle", of
- de medische dienst van het leger, de rijkswacht of psycho-medisch centrum

les candidats du groupe 2 (Art. 42 et 44)

Le candidat présente une déclaration sur l'honneur aux termes de laquelle il certifie qu'à sa connaissance, il n'est pas atteint d'une affection mentionné dans annexe 6 (modèle, annexe 6, IX) (questionnaire ~ ronflement et fatigue inclus)

devant un médecin

- d'un centre médical de l'Office communautaire régional de la Formation Professionnelle et de l'Arbeitsbemiddeling, ou
- de l'Office communautaire régional de la Formation professionnelle et de l'Arbeitsbemiddeling, du « Vlaamse Dienst voor Arbeidsbemiddeling en Groepsopleiding » ou de l'Institut bruxellois francophone pour la formation professionnelle, ou
- du service médical de l'armée, du service médical de la gendarmerie, ou d'un centre psycho-médico-social

KB van 23 maart 1998 ~ rijgeschiktheid
AR du 23 mars 1998 ~ aptitude à la conduite d'un véhicule à moteur
and OSA

Group 2

Normen voor de kandidaten van groep 2

De kandidaat met pathologische **somnolentie** of bewustzijn stoornissen ten gevolge van het **slaapapneu syndroom** is niet rijgeschikt. De kandidaat met een matig of ernstig slaapapneusyndroom is niet rijgeschikt.

De kandidaat met een matig of ernstig slaapapneusyndroom kan rijgeschikt worden verklaard een maand na het instellen van een **succesvolle behandeling**. Een gunstig verslag, **adequate medische opvolging** en **therapietrouw** zijn vereist.

De geldigheidsduur van de rijgeschiktheid bedraagt maximaal een jaar. Is de kandidaat, na deze periode, nog steeds vrij van symptomen en is er adequate medische opvolging en terapietrouw, dan is de geldigheidsduur voorgeschreven in artikel 44 van het KB 23/3/1998.

Normes pour les candidats du groupe 2

Le candidat souffrant de **somnolence** pathologique ou de troubles de la conscience suite au **syndrome d'apnée du sommeil** est inapte à la conduite. Le candidat atteint d'un syndrome d'apnée du sommeil modéré ou sévère est inapte à la conduite.

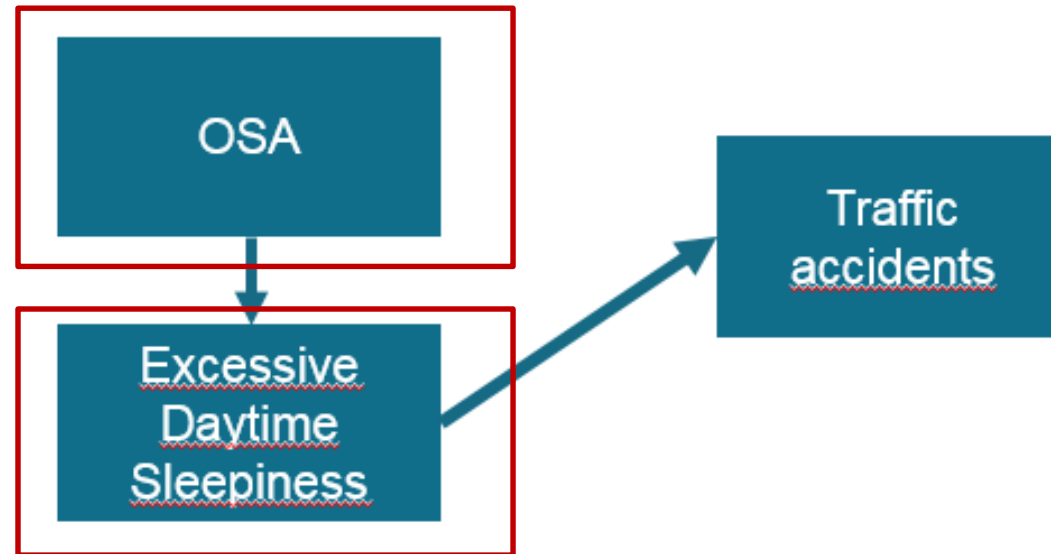
Le candidat atteint du syndrome d'apnée du sommeil modéré ou sévère peut être déclaré apte à la conduite un mois après l'introduction d'un **traitement efficace**. Un rapport favorable, un **suivi médical approprié** et une **thérapie suivie fidèlement** sont requis.

La durée de validité de l'aptitude à la conduite est d'un an maximum. Si le candidat est toujours exempt de troubles ou d'anomalies après cette période, s'il y a un suivi médical approprié et si la thérapie est suivie fidèlement, la durée de validité prévue à l'article 44 de l'AR 23/3/1998 est applicable.

Belgian driving legislation: the point of view of the “somnologist”



and

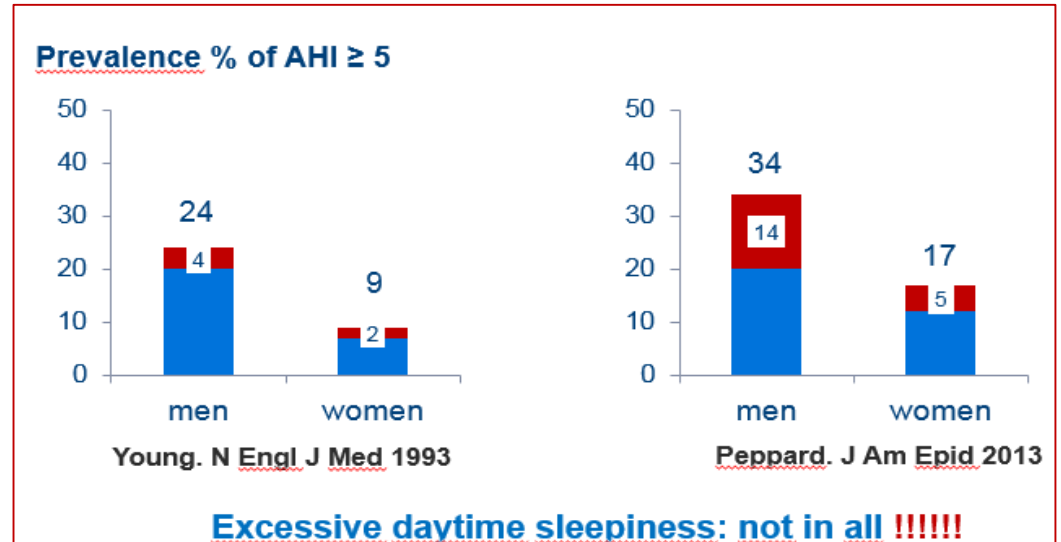
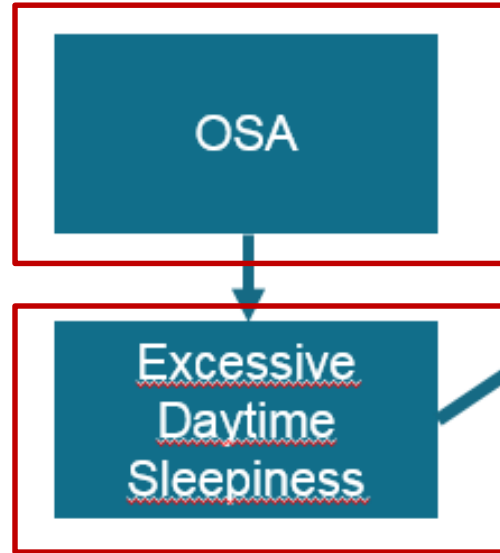


Belgian driving legislation: the point of view of the “somnologist”



1
Not all
OSA-patients
are somnolent

and



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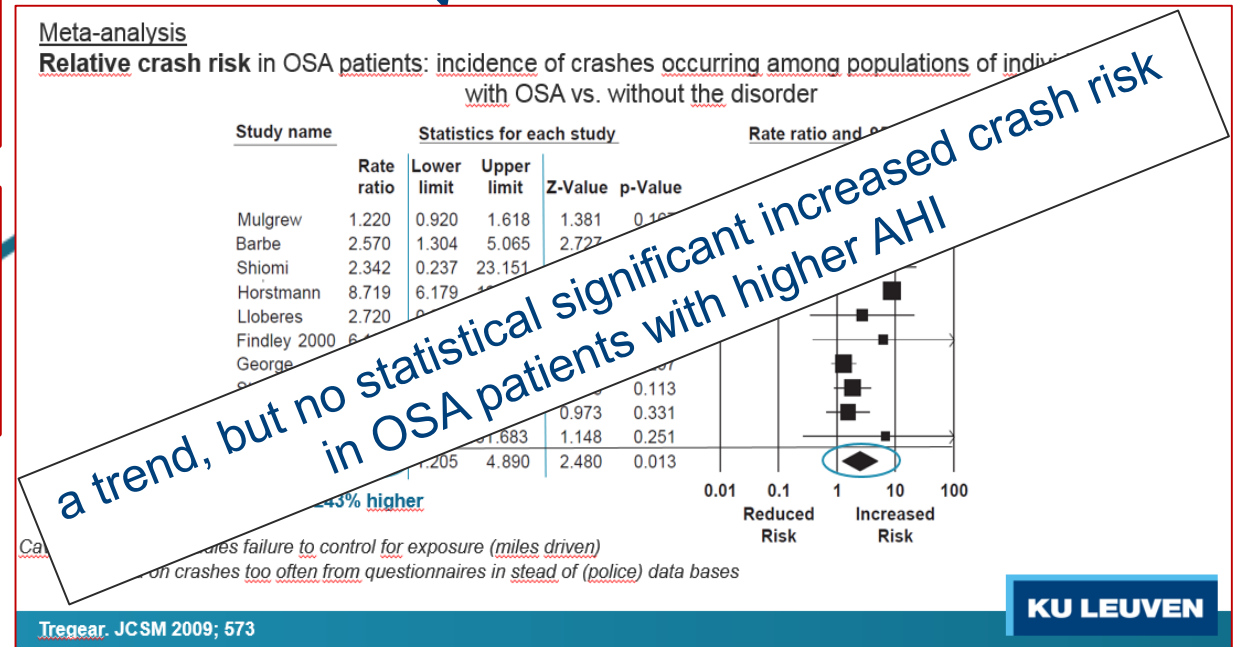
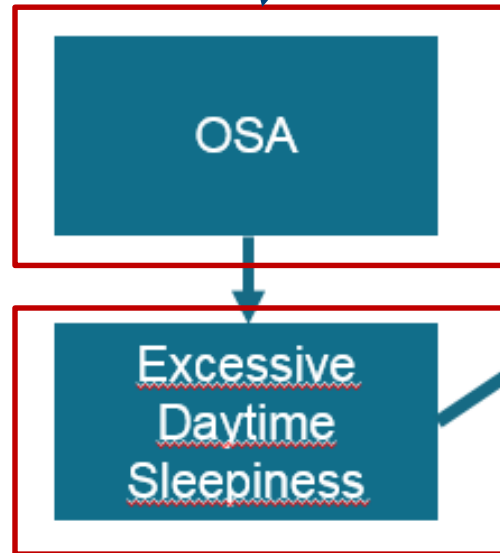
Belgian driving legislation: the point of view of the “somnologist”



1
Not all
OSA-patients
are somnolent

and

2
OSA severity only poorly predicts crash rate



Belgian driving legislation: the point of view of the “somnologist”



How to measure
in OSA

EDS
related to
traffic accidents?

and





The Epworth Sleepiness Scale (ESS)

How Sleepy Are You?

How likely are you to doze off or fall asleep in the following situations? You should rate your chances of dozing off, not just feeling tired. Even if you have not done some of these things recently try to determine how they would have affected you. For each situation, decide whether or not you would have:

- No chance of dozing =0
- Slight chance of dozing =1
- Moderate chance of dozing =2
- High chance of dozing =3

| Situation | Chance of Dozing |
|---|------------------|
| Sitting and reading | • |
| Watching TV | • |
| Sitting inactive in a public place (e.g., a theater or a meeting) | • |
| As a passenger in a car for an hour without a break | • |
| Lying down to rest in the afternoon when circumstances permit | • |
| Sitting and talking to someone | • |
| Sitting quietly after a lunch without alcohol | • |
| In a car, while stopped for a few minutes in traffic | • |

Total Score = _____

>10 = somnolent

>15 = severe somnolent

Belgian driving legislation: the point of view of the “somnologist”



How to measure
in OSA

EDS
related to
traffic accidents?

(Epworth Sleepiness Scale)

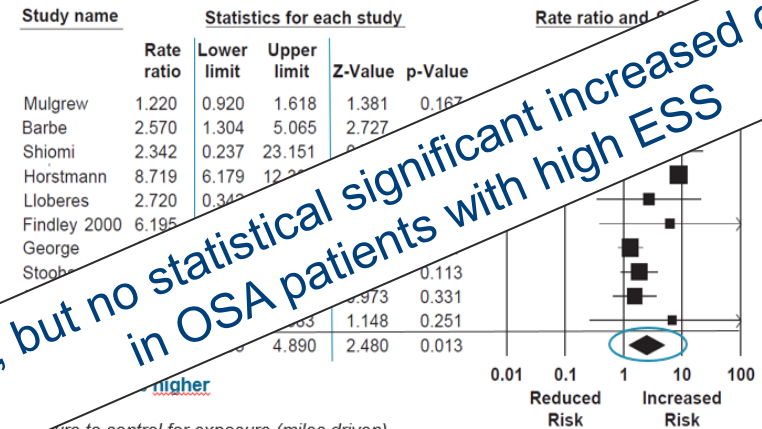
and

OSA

Excessive
Daytime
Sleepiness

Meta-analysis

Relative crash risk in OSA patients: incidence of crashes occurring among populations of individuals with OSA vs. without the disorder



Caution: failure to control for exposure (miles driven)
Crashes too often from questionnaires in stead of (police) data bases

Tregear. JCSM 2009; 573

KU LEUVEN

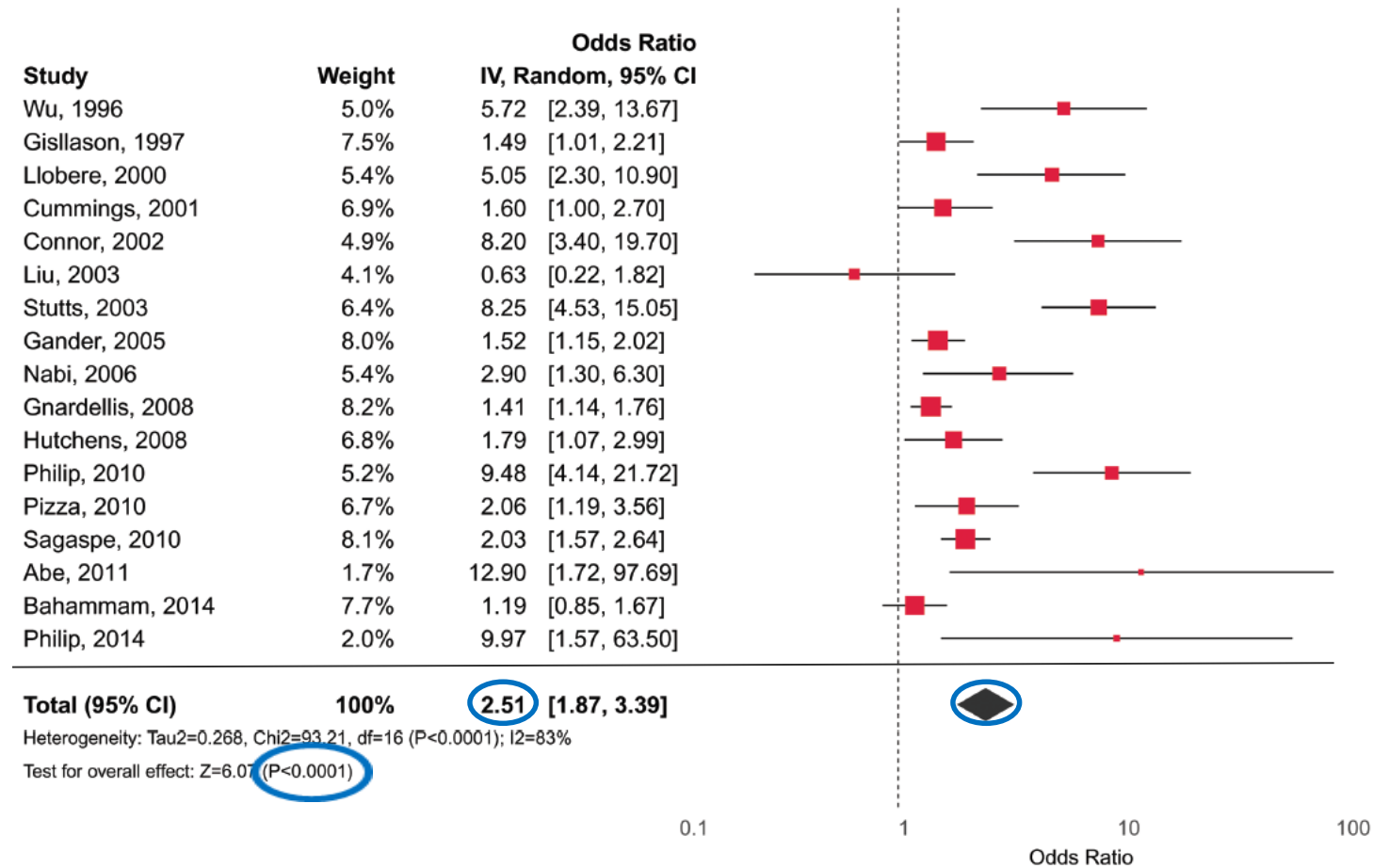
a trend, but no statistical significant increased crash risk in OSA patients with high ESS

Except: ESS > 15

The ESS quantifies behavioral sleepiness in relatively passive situations with low level of alertness (“Sitting and reading or watching TV), whereas sleepiness at the wheel refers to drivers in a condition requiring a high level of alertness (in a car while driving).



Have you experienced in the previous year at least one episode of severe sleepiness at the wheel that made driving difficult or forced you to stop the car?



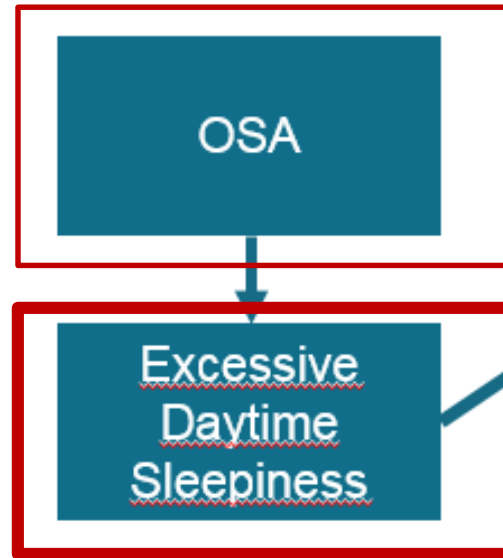
Belgian driving legislation: the point of view of the “somnologist”



How to measure
in OSA

EDS
related to
traffic accidents?

and



(Epworth Sleepiness Scale)
Ask the question~sleepy at the wheel!

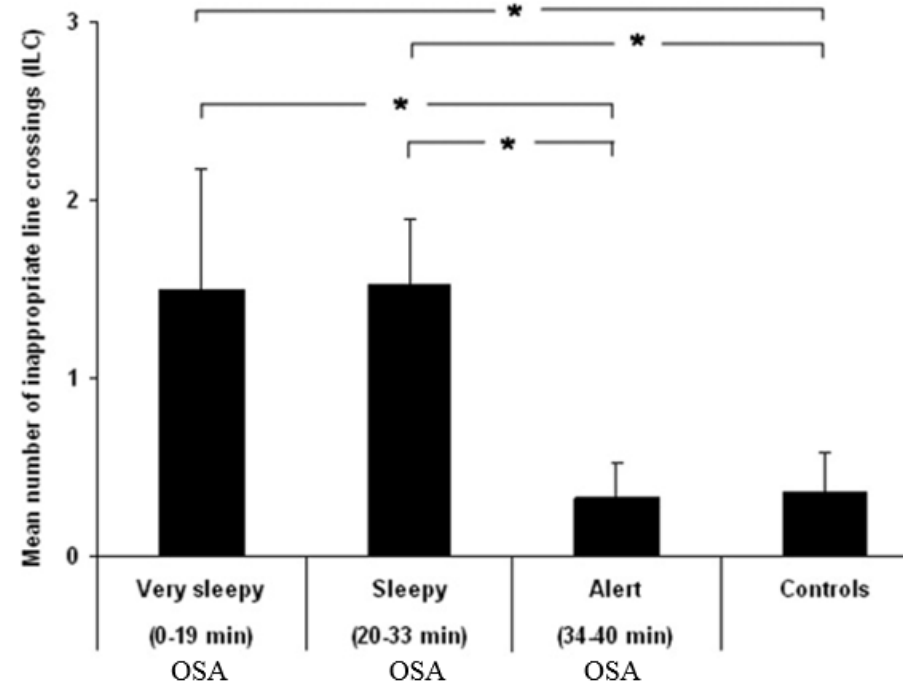
Are these subjective ESS questionnaire and the “sleepy at the wheel” question reliable in an evaluation of driving ability in commercial drivers – a rather punitive situation - ?



The Maintenance of Wakefulness test (MWT 40 minute protocol)

the subject is asked to remain awake while he is exposed repeatedly (4 times 40 minutes every 2 hours) to a sleep-favoring environment during daytime

Number of inappropriate line crossings (ILCs) during 90 minutes real driving (mean \pm standard error) in patients with untreated OSA divided in 3 mean sleep latency groups on MWT with OSA and in healthy control subjects.



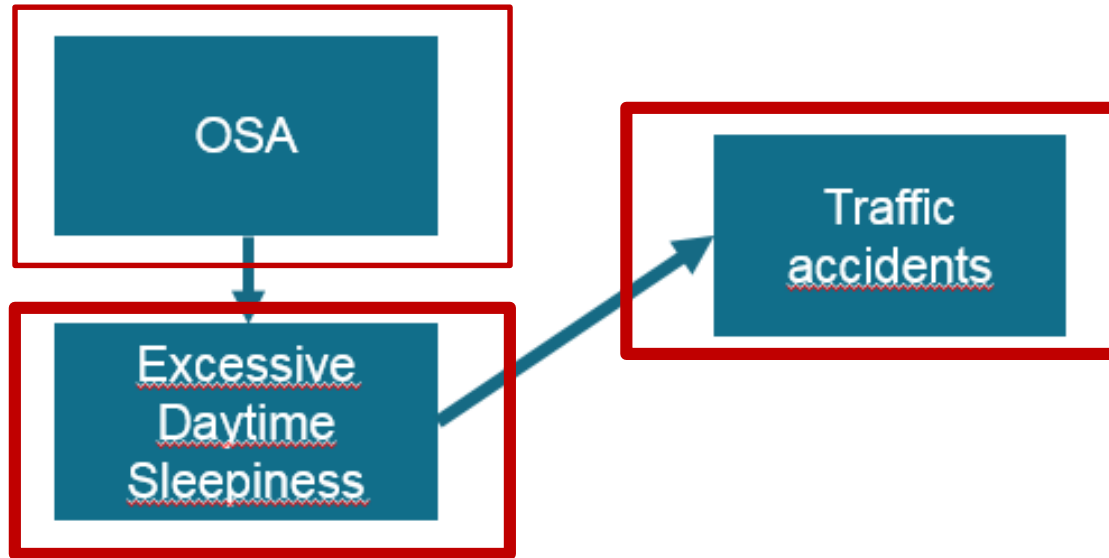
Belgian driving legislation: the point of view of the “somnologist”



How to measure
in OSA

EDS
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(Epworth Sleepiness Scale)

Ask the question~sleepy at the wheel!

Objective testing (i.e. MWT) to measure restored alertness after treatment, in some cases, at the discretion of the specialist*.

Belgian driving legislation: the role of the occupational physician

Screening for OSA in commercial drivers and other-safety-sensitive employees

Recommendations~indications for evaluation by a sleep medicine physician

| Primary Criteria | Secondary Criteria |
|---|---|
| <ol style="list-style-type: none">1. BMI ≥ 40 kg/m² or2. BMI ≥ 33 kg/m² and either<ol style="list-style-type: none">a. Hypertension requiring ≥ 2 medications for control orb. Type 2 diabetes3. Sleepiness-related crash or accident, off-road deviation, or rear-ending another vehicle by report or observation4. Fatigue or sleepiness during the duty period | <ol style="list-style-type: none">1. Symptoms of OSA, which include but are not limited to:<ul style="list-style-type: none">• Loud, habitual snoring• Witnessed apneas• Sleepiness during the major wake period*2. BMI 28–33 kg/m² with any of the following risk factors of OSA**<ul style="list-style-type: none">• Small or recessed jaw• Small airway (modified Mallampati classification of 3 or 4)• Neck size ≥ 17 inches (men), ≥ 15.5 inches (women)• Hypertension (especially if resistant)• Type 2 diabetes, particularly if accompanied by obesity• Cardiovascular disease• Hypothyroidism (untreated)• Age 42 years or older• Family history of OSA• Male, or postmenopausal female |

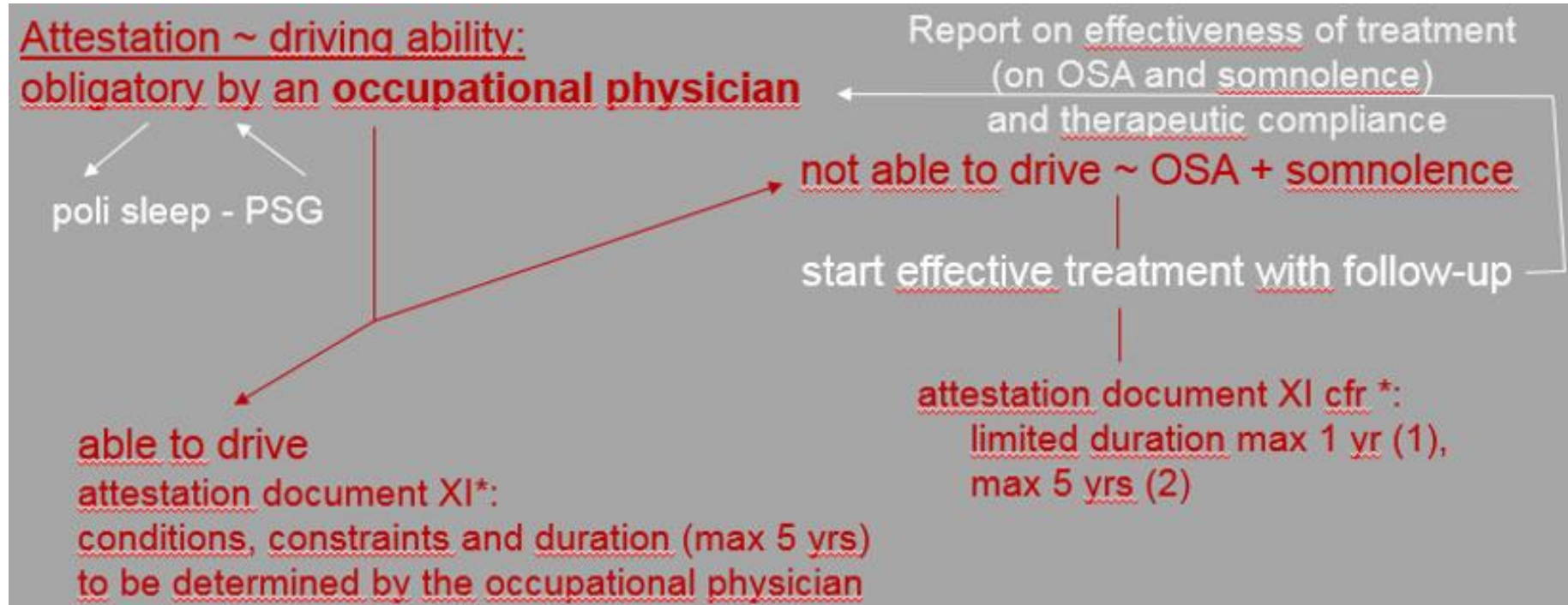
+
 ≥ 2 of risk factors
mentioned below

* = see Section 7.0, absence of reported symptoms is less useful than the presence of symptoms. ** = combination of factors has greater risk than a single

They do not recommend reliance on subjective symptom reporting

Belgian driving legislation: the role of the occupational physician

Key-players in the attestation of driving ability for commercial drivers



Correct communication is mandatory

Driving legislation: a JOINED role for somnologist and occupational physician

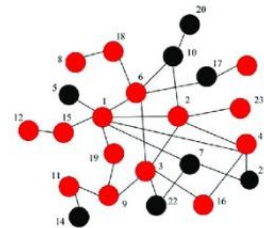
Swedish Traffic Accident Registry data in OSA versus general population

- An increased MVA risk ratio of 2.45 in OSA
Significant reduction in MVA's if CPAP-use \geq 4h/night

- Independent predictors associated with MVA among OSA:

not OSA severity but:

| | Estimate (SE) | OR | 95% CI for OR | P |
|-------------------------------|----------------|------|----------------|-------|
| Age, y | -0.019 (0.010) | 0.98 | 0.962 to 1.000 | 0.05 |
| Hab. sleep time \leq 5 h | 0.96 (0.43) | 2.66 | 1.14 to 6.01 | 0.02 |
| ESS score \geq 16 | 0.76 (0.27) | 2.13 | 1.26 to 3.61 | 0.005 |
| Hypnotic use | 0.73 (0.33) | 2.07 | 1.07 to 3.98 | 0.03 |
| Driving distance, 10,000 km/y | 0.085 (0.04) | 1.09 | 1.01 to 1.18 | 0.03 |
| Sex (male) | 0.33 (0.30) | 1.42 | 0.78 to 2.45 | 0.2 |
| DL type, (C/D/E) | -0.04 (0.35) | 0.92 | 0.536 to 2.02 | 0.9 |
| Diagnosis y | -0.13 (0.09) | 0.88 | 0.74 to 1.05 | 0.9 |
| Constant | 251.0 (179.0) | | | 0.2 |



ESADA data base ~ OSA (n=6984)

OSA severity was associated with MVA risk, but only weakly

