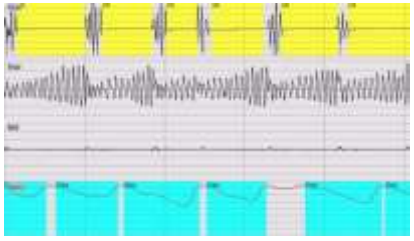
Sreening for Osas in Philips Employees



Michiel Eijsvogel Medisch Spectrum Twente

Why think about screening for OSAS?

- prevalent disease
- disease interfering with:

  well-being, social activity and work
- cardiovascular & accident risk
- effective therapy is available

Screening considerations

- Hospital / Sleep Clinic
  - Patients → (GP) → sleepclinic
  - High prevalence
  - Skilled professionals & equipment

- Screening
  - Clients
  - Low prevalence
  - Simple diagnostics

- Problems!
  - OSAS definition?
  - Gold standard PSG?
  - Scientific evidence to screen?

Statistics

	Gold +	Gold -	
Test +	TP	FP	
Test -	FN		
	TP+FN		

Sensitvity TP / TP+FN

TN / TN +FP

TP / TP+FP

TN / FN+TN

TP+FN / Total

TEST IN H… PRIMARY CARE
PREVALEN… 10%

	AHI ≥		<5	
Pos Q	**80**		800	2600
Neg Q	20		**200**	7400
	100		9000	10000

So in primary care and screening reducing false positive rate by means of a high specificty test is always needed

Sensitivity can be balanced against the importance of missing a true case

In both tests Sens=Spec=80%

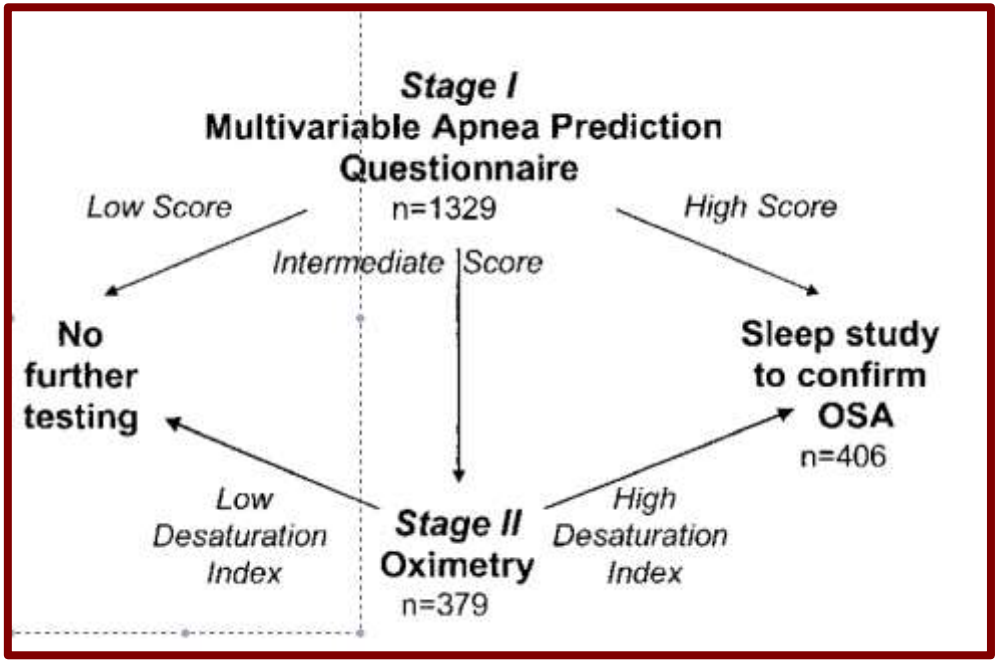
FP 20 → 1800 (90x) → 2600 PSG for finding 800 OSAS patiënts

Screening Questionnaires OSAS
Systematic review 2010 Abrishami

- 1484 studies → 10 studies; 6 real screening!
- Possible verification bias 8 /10
- Pooled Sensitivity 77% Specificity 53%
- High quality: questions with: snoring, tiredness, observed apnea, high RR, age, NC, gender
- Ideal screening Q : 1. Feasibility (simple Q)
  2. Accuracy (clear validation)
  3. Generalizability (different popul.)
- 2 step strategy is promising

2 step strategy

Gurubhagavatula 2004 Commercial drivers



Results ⇧ with 3 groups and 2 step strategy
Results ⇧ with AHI ≥ 30 as " OSA"

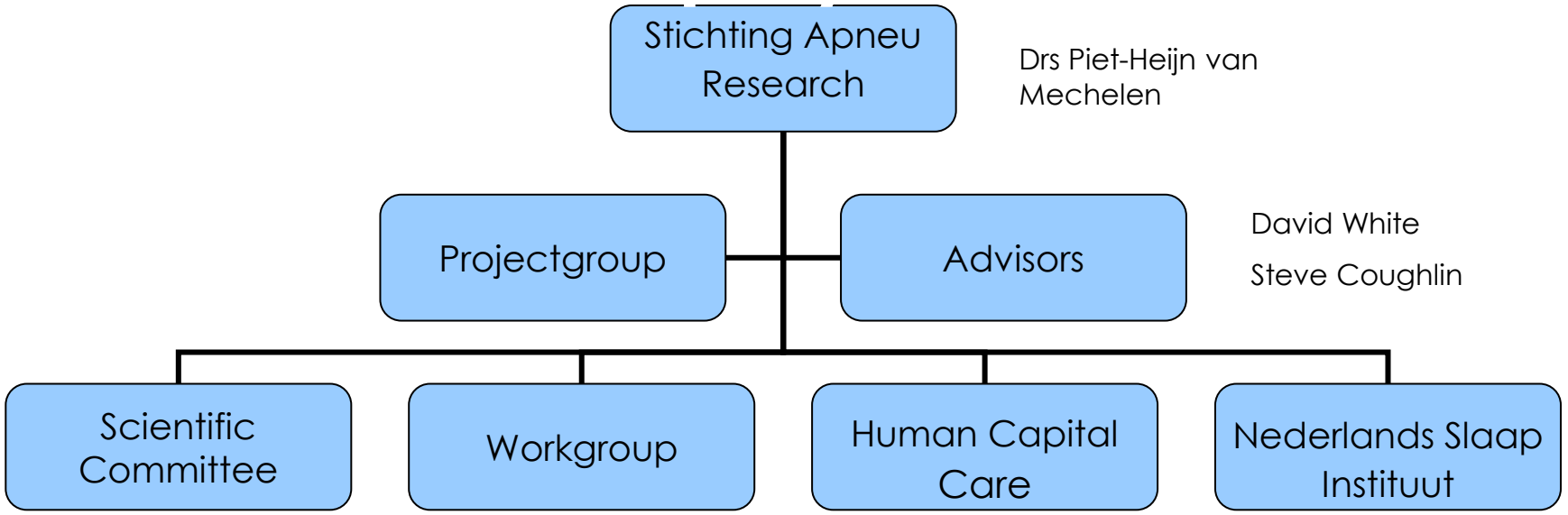
Am J Respir Crit Care Med 2004 Aug 15;170(4):371-6.

Philips employees OSAS studies

- Develop and validate a screening test
  → Sample study

- Offer this test to all Dutch Philips employees
  → Screening study

Organization



Sample Study . Tests in all

STOP-BANG	STOP	S: SNORING	Y/N
		T: TIREDNESS	Y/N
		O: OBSERVED APNEAS	Y/N
		P: BLOOD PRE	Y/N
		B:	Y/N
			Y/N
			Y/N
			/N

Athens Insomnia Scale (AIS)

Epworth Sleepiness Scale (ESS)

Pitsburg Sleep Quality Index (PSQI)

Additional Question list

(4):339-45

OSAS definition

OSAS = AHI ≥ 15 together with

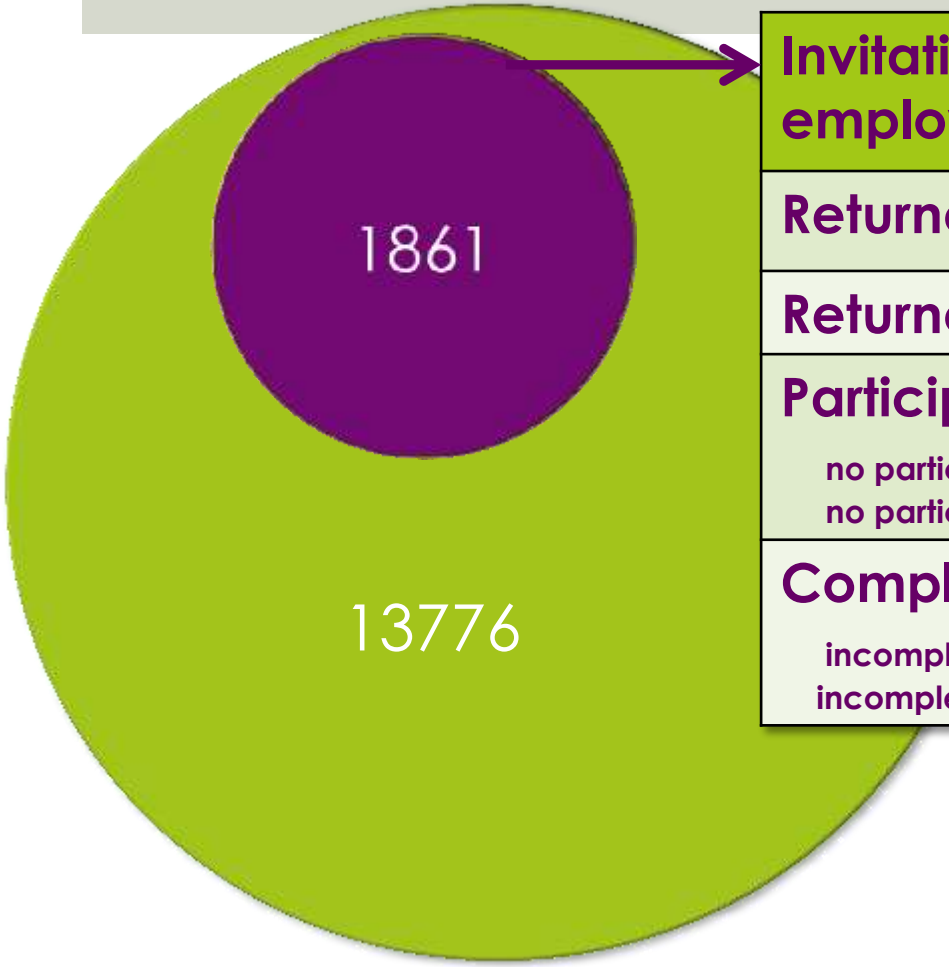
AHI 5-15 + questionnaire derived symptoms

but without overt insomnia

Symptoms table

AHI 5-15	Evaluation of symptoms (Chicago criteria)		Source	Module code
	EXCESSIVE DAYTIME SLEEPINESS			
		or	ESS≥10	3.1 → 3.8
		or	Berlin Q8 (Nodding off or falling asleep while driving: nearly every day/3-4 times a week)	1.8
		or	AIS Q8 (Daytime sleepiness: mild/considerable/intense)	4.8
OR	≥2 OF THE FOLLOWING:			
	Choking or gasping during sleep	or	NA	NA
	Recurrent awakenings from sleep	or	AIS Q2 (Awakenings during the night: minor problem/ considerable problem/ serious problem/ or did not sleep at all)	4.2
	Unrefreshed sleep	or	Berlin Q6 (How often do you feel tired or fatigued after your sleep: nearly every day/ 3-4 times a week)	1.6
	Daytime fatigue	or	STOP Q2 (yes)	2.2
		or	Berlin Q7 (During your waketime, do you feel tired, fatigued or not up to par: nearly every day/ 3-4 times a week)	1.7
	Impaired concentration	or	NA	NA
AND	ABSENCE OF INSOMNIA		Athens insomnia Scale Total score ≤10	4

NA= not available



Invitation letter to employees		**1861**
Returned consent forms		**249**
Returned questionnaires		**235**
Participation sleep studies		**190**
no participation due to OSAS diagnosis	8	
no participation due to other reasons	37	
Complete PSG+PG		**176 (9,5%)**
incomplete data PSG	4	
incomplete data RU-sleeping	10	

Statistical process

1. Looking to individual Questionnaires
2. Is different scoring of the Questionnares better?
   (Low-High <> Low-Intermediate-High)
3. Do individual variables predict OSAS?
4. Do logistic regression in multivariate model with predictive variables and with different cut-off points of questionnaire
5. Best questions with optimal cut-off points (low-intermediate-high risk) is new screening strategy

Gender M/ F	73% / 27%
Age mean (range)	47 ± 9,2
BMI mean BMI ≥ 30	26,9 ± 4,3 14%
Neck cir. > 40 cm male female	27% 39,6 ± 2,1 35,0 ± 2,4
Hypertension ‘”yes”	19%

already treated for OSAS?	3 %
have a sleep study before?	5 %
not have a regular bed partner?	12 %
answered the questions together?	40 %
drink (almost) daily alcohol?	20 %
(almost) daily a stuffed nose?	23 %
treated for cardiac arrhythmia?	4 %
have ever a CVA or TIA?	1 %

Questionnaires	Pos	Score
Berlin Q	36%	≥ 2 C
STOP	45%	≥ 2
STOP-BANG	57%	≥ 3
ESS	9%	≥10
PSQI	34%	> 5
AIS	7%	>10
RU-Flow	35%	>15
PSG AHI	49%	≥ 5
	18%	≥15
	6%	≥30
OSAS	37%	≥ 5+S

STOP-BANG QUESTIONNAIRE

STOP-BANG	STOP	S: SNORING	Y/N
		T: TIREDNESS	Y/N
		O: OBSERVED APNEAS	Y/N
		P: BLOOD PRESSURE	Y/N
	BANG	B: BMI ≥ 35 ?	Y/N
		A: Age ≥ 50 y ?	Y/N
		N: NC ≥ 40 cm ?	Y/N
		G: Gender male ?	Y/N

Scoring:

STOP: High risk of OSA: answering yes to ≥ 2 questions

STOP-BANG: High risk of OSA: answering yes to ≥ 3 questions

Chung F et al Anesthesiology 2008

STOP-BANG. The best Q (classic scoring)

	OSAS +	OSAS -		P value		AHI ≥15	AHI <15	P value
High Risk	**55**	51	106	<0.001		**28**	78	0.001
Low Risk	14	**66**	80			6	**74**	
	69	117	186			41	145	

Cut-off	Sens	Spec	PPV	NPV	Prev
OSAS	**80%**	**56%**	52%	83%	**37%**
AHI 15	68%	51%	26%	93%	22%

RU-sleeping: Nasal flow measurement

2 x2 tabel	OSAS +	OSAS -	Total		AHI ≥15	AHI <15	Total
RU-sleeping 15+	**38**	**23**	***61***		**24**	**37**	***61***
RU-sleeping 15-	**27**	**88**	***115***		**7**	**108**	***115***
Total	***65***	***111***	***176***		***31***	***145***	***176***

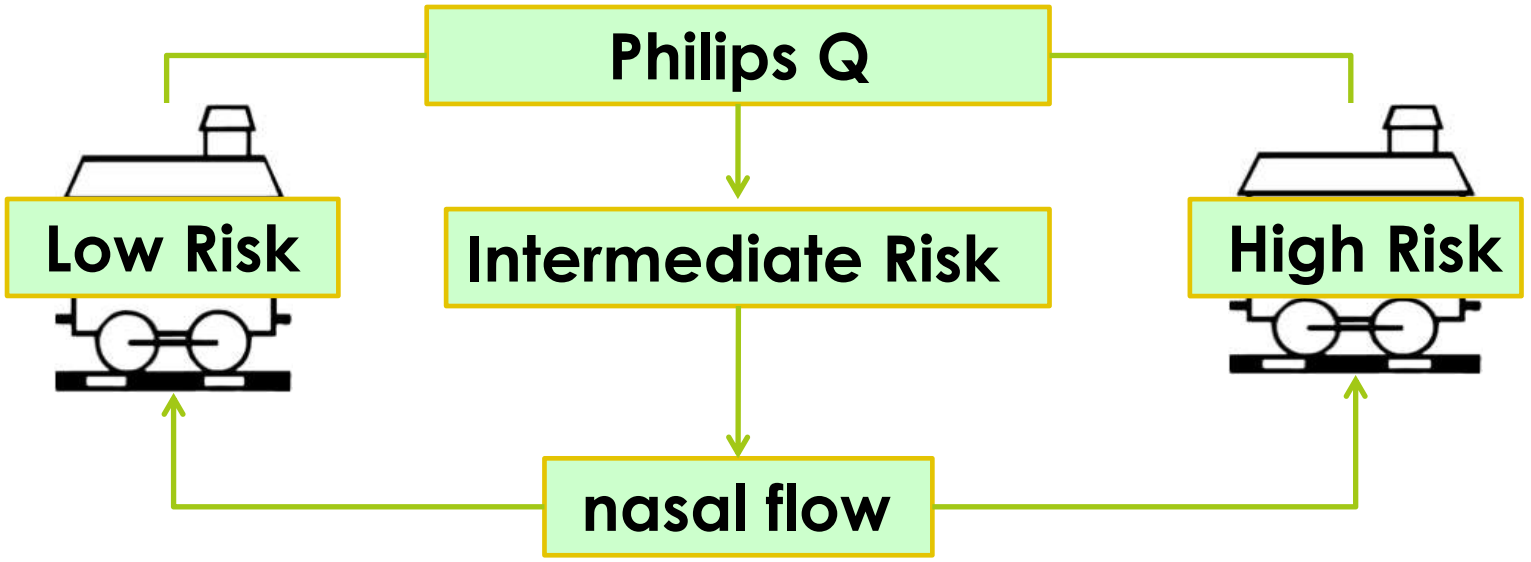
Cut-off	Sens	Spec	PPV	NPV	Prev
OSAS	**58%**	**79%**	62%	77%	**37%**
AHI 15	77%	74%	52%	94%	18%

Variables predicting OSAS

3-way instead of 2-way scoring
STOP-BANG L= 0-1 Int= 2-4 H= >4
Berlin Q L= 0-1 Int= 2 H= 3

	Odds Ratio	Sig.
AIS scoring <10 vs. >=10	27,039	0,013
STOPBANG High vs. Low	8,125	0,012
STOPBANG Intermediate vs. Low	2,810	0,132
Berlin Q High vs. Low	28,910	0,023
Berlin Q Intermediate vs. Low	4,402	0,065
Age >45 vs. <=45	2,904	0,011
Berlin Q-5 (Breathing stops) Yes vs. No	3,381	0,054
Heart failure /arrhythmia Yes vs. No	41,333	0,039

PHILIPSQ 3 WAY SCORING & 2-STEP MODEL



Philips Q = set of 28 items + formula → computing individual change (0-100 %)
Changing cut-off settings low and high → different group having OSAS J/N
→ different sens/specif of 2 step strategy
→ choose optimum settings (sens /spec.)

Model in 10000p. Consequences of choices!

Prev. 10%	Lower cut-off	Upper cut-off	Sens.	Specif.	TP	FP	TN	FN	RU RU	To CLINIC Nr pat	for PSG OSAS Prev
Ideal test			100%	100%	1000	0	9000	0	0	1000	100%
High sensitivity	25	45	82%	69%	815	2835	6165	185	162	3650	22%
High specificity	35	55	66%	89%	661	971	8029	339	2764	1632	41%

PHILIPS SAMPLE STUDY CONCLUSIONS

Complete data (176/1861)		9,5%
OSA	(AHI ≥ 5)	49%
OSAS	(PSG+ sym.)	37%
Poor sleep quality	(PSQI)	34%
Insomnia	(AIS)	7%
EDS	(ESS)	9%
PM- type IV (RU-nasal flow)	Sens. 59 %	Spec. 79 %

3-way Q-scoring + RU-flow: best results

New Philips Q + RU-flow with high specificity model best choice

PHILIPS Sample Study Model results

Questionnaire:

Negative → **"no OSAS"**

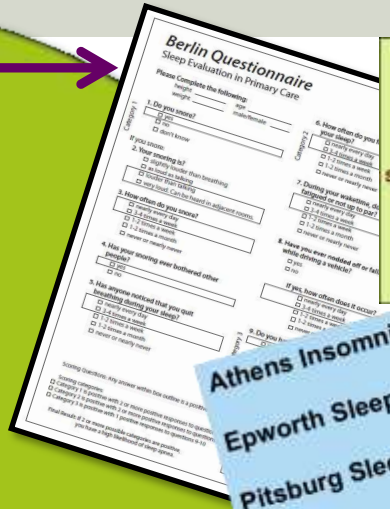
Intermediate → **nasal flow**

Positive → **to Clinic**

Sensitivity	**66 %**
Specificity	**89 %**
When Prevalence	**9 %**
Pos Pred Value	**41 %**
Neg Pred Value	**96 %**

1861

13776



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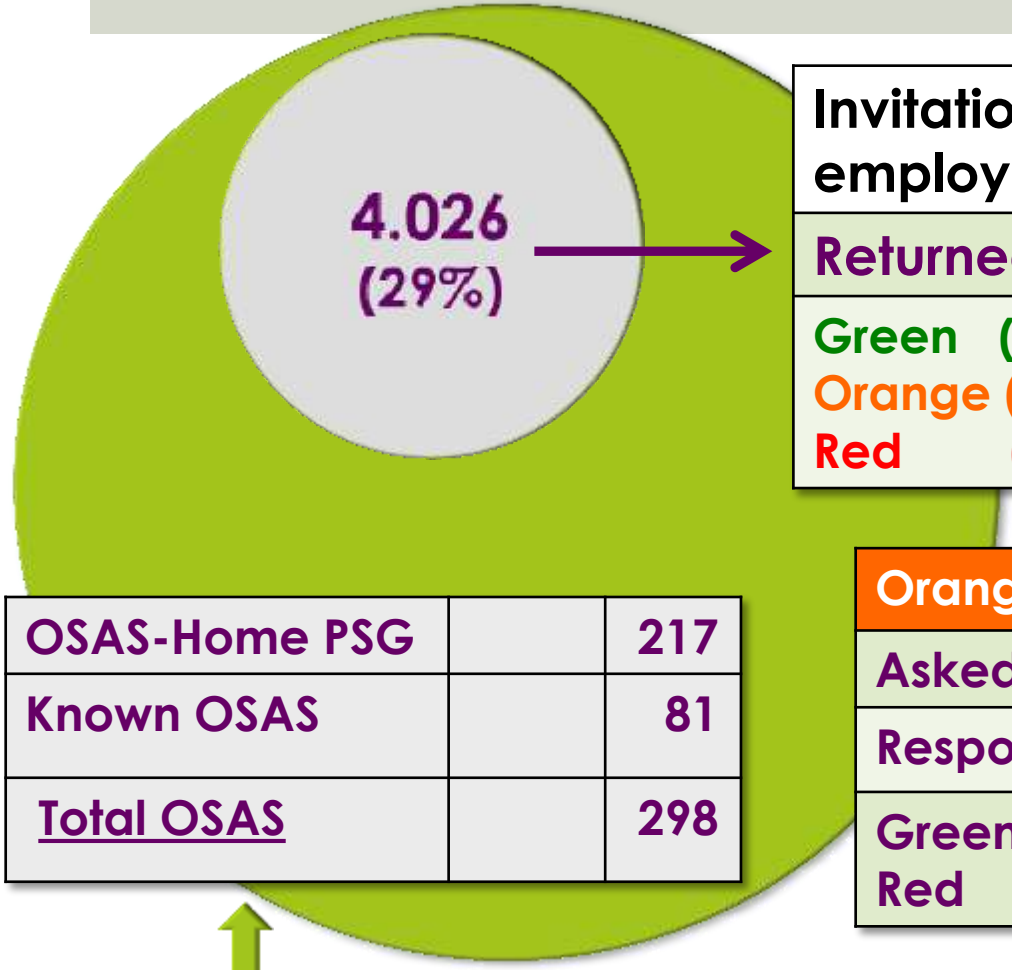


Invitation letter to employees		13.776
Returned PhilipsQ	29%	4.026
Green (Low Risk OSAS)	67 %	2.707
Orange (Intermediate Risk)	22 %	877
Red (High Risk OSAS)	11 %	442

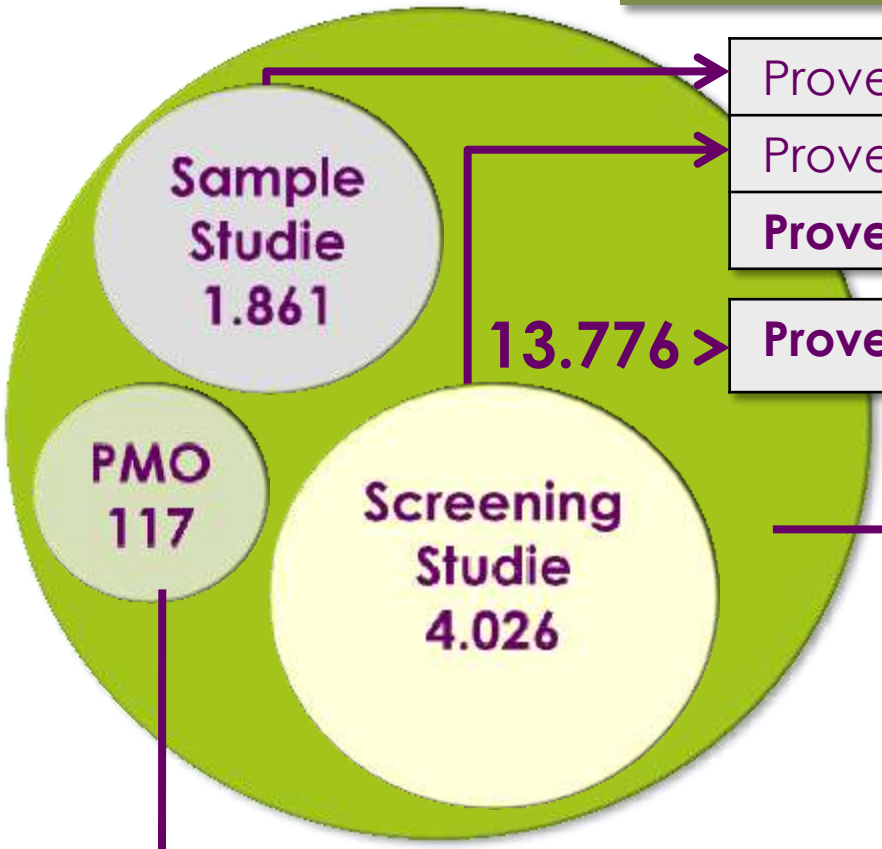
Orange		877
Asked for Nasal Flow		855
Respons Nasal Flow	60 %	523
Green (Low Risk OSAS)	58 %	301
Red (High Risk OSAS)	42 %	222

Final code PhilipsQ		4.026
Green	75 %	3008
Missing Orange data	9 %	354
Red	16 %	664

Red		664
Invited for H-PSG		664
Performed H-PSG	46 %	306
No OSAS	29 %	89
OSAS	71 %	217

OSAS-Home PSG		217
Known OSAS		81
Total OSAS		298

Estimation prevalence OSAS Dutch Philips work force



13.776 >

Proven OSAS (at least)	37 %	65/ 176
Proven OSAS	7,4%	298 / 4026
Proven tot. OSAS (at least)	8,6%	**363 / 4202**
Proven OSAS (absolut min.)	**2,6%**	**363 /13776**

responders

Screening	
Groen	67%
Oranje	22 %
Rood	11 %

Preventive Medical Investigation + additional Philips Questionnaire

non-responders

PMO	
Groen	83 %
Oranje	13 %
Rood	4 %

Estimation prevalence OSAS Dutch Philips working force

1= missing data= 0 OSAS! 2 = computed with no missing data

	Participated Nr: 4.026		Not Participated Nr: 9.750		Total Philips Nr: 13.776	
	1	2	1	2	1	2
Nasal flow respons	60%	*100%*	60%	*100%*	60%	100%
Red %	16,5 %	20,2 %	7,7 %	9,4 %		
Red Nr	664	814	751	916		
% perf. PSG	46%	*100%*	46%	100%	46%	100%
% PSG pos	71%	71%	71%	71%		
OSAS (+ 81 known OSAS*)	298*	578	245	651	543	1229
% OSAS	7,4 %	14,3%			**3,9%**	**8,9%**

Final Conclusions

- Sample study in 1.861 employees
  - 9,5 % participation (5 Q + PG +PSG)
  - strong self-selection, therefore solid 4x4 table
  - outcome: 1 Philips Q + partial population PG
    - Sensitivity 66%, Specificity 89%
    - Prevalence 9% → Neg Pred Value 96%

- Screening study in 13.766 employees
  - 29% participation
    - No second control study with PSG in this group
  - self-selection
  - small sample in non-participation group
  - Estimation of prevalence OSAS in Dutch Philips employees
    - 2,2 % ←→ 14,3 % (absolute borders)
    - 3.9 % ←→ 8,9 % (mean 6,4%)