Indoor Environmental Quality Productivity and Health

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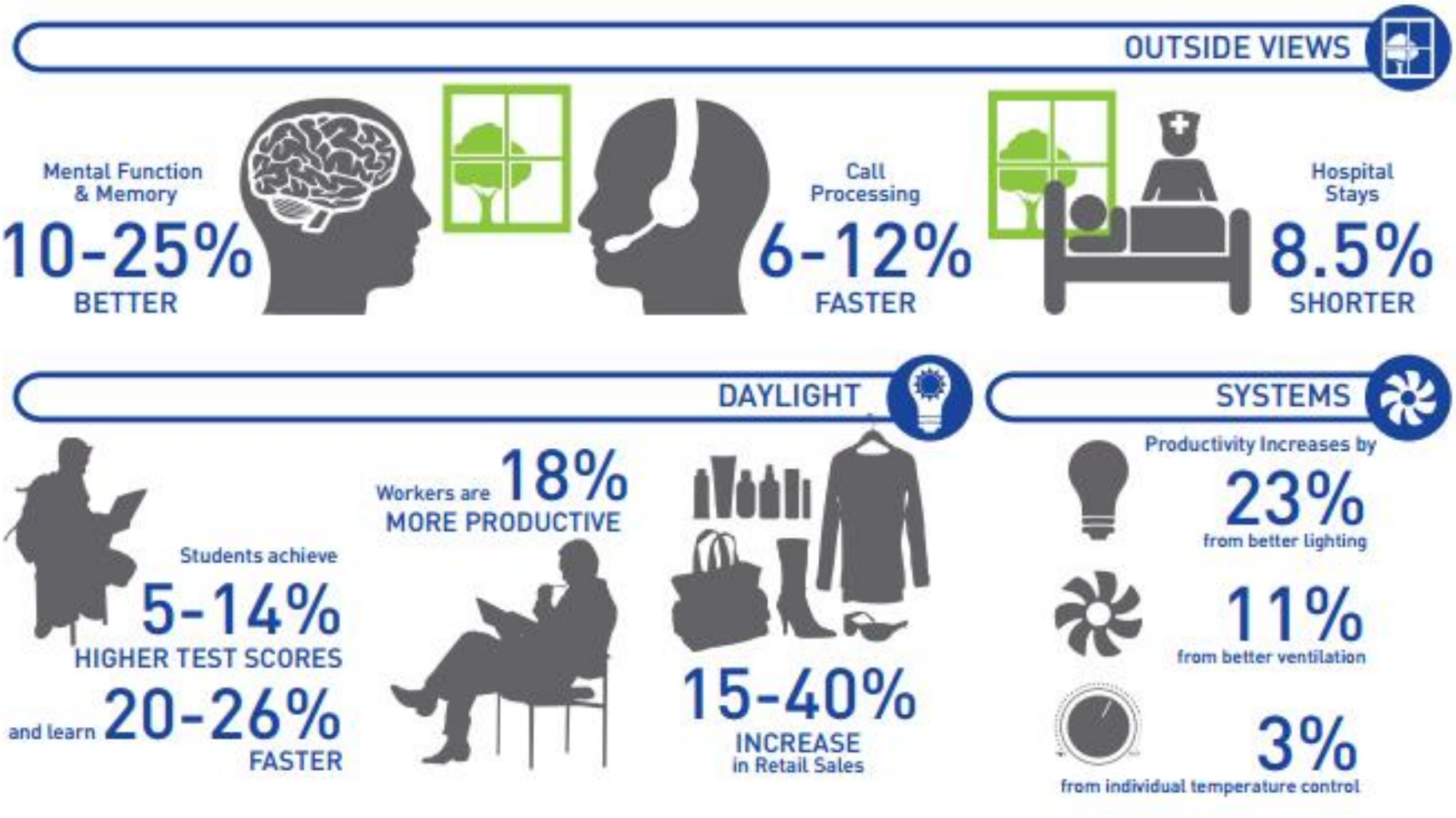
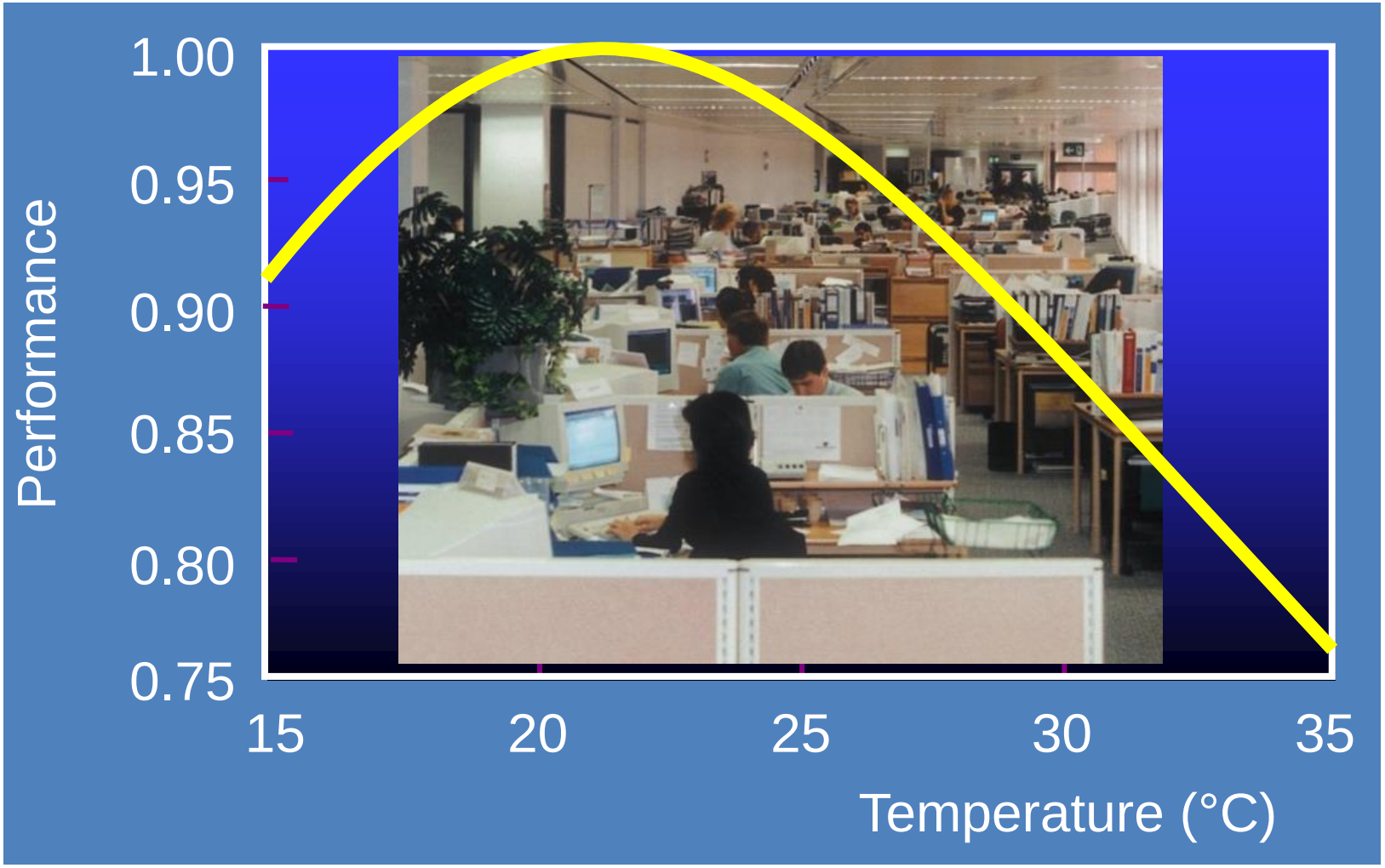
Productivity

POOR IEQ AFFECTS PERFORMANCE OF WORK



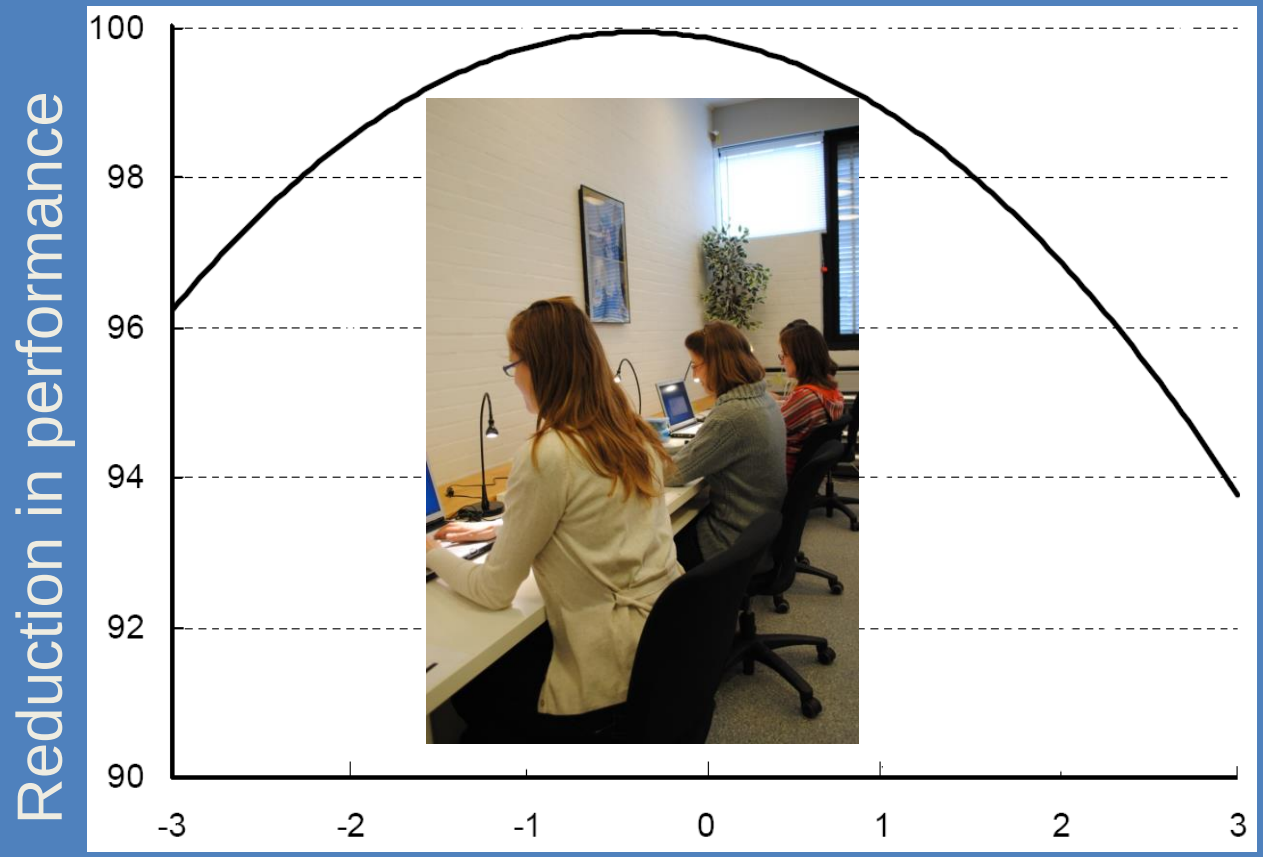
Source: World Green Building Council (2014)

TEMPERATURE AND PERFORMANCE OF OFFICE WORK



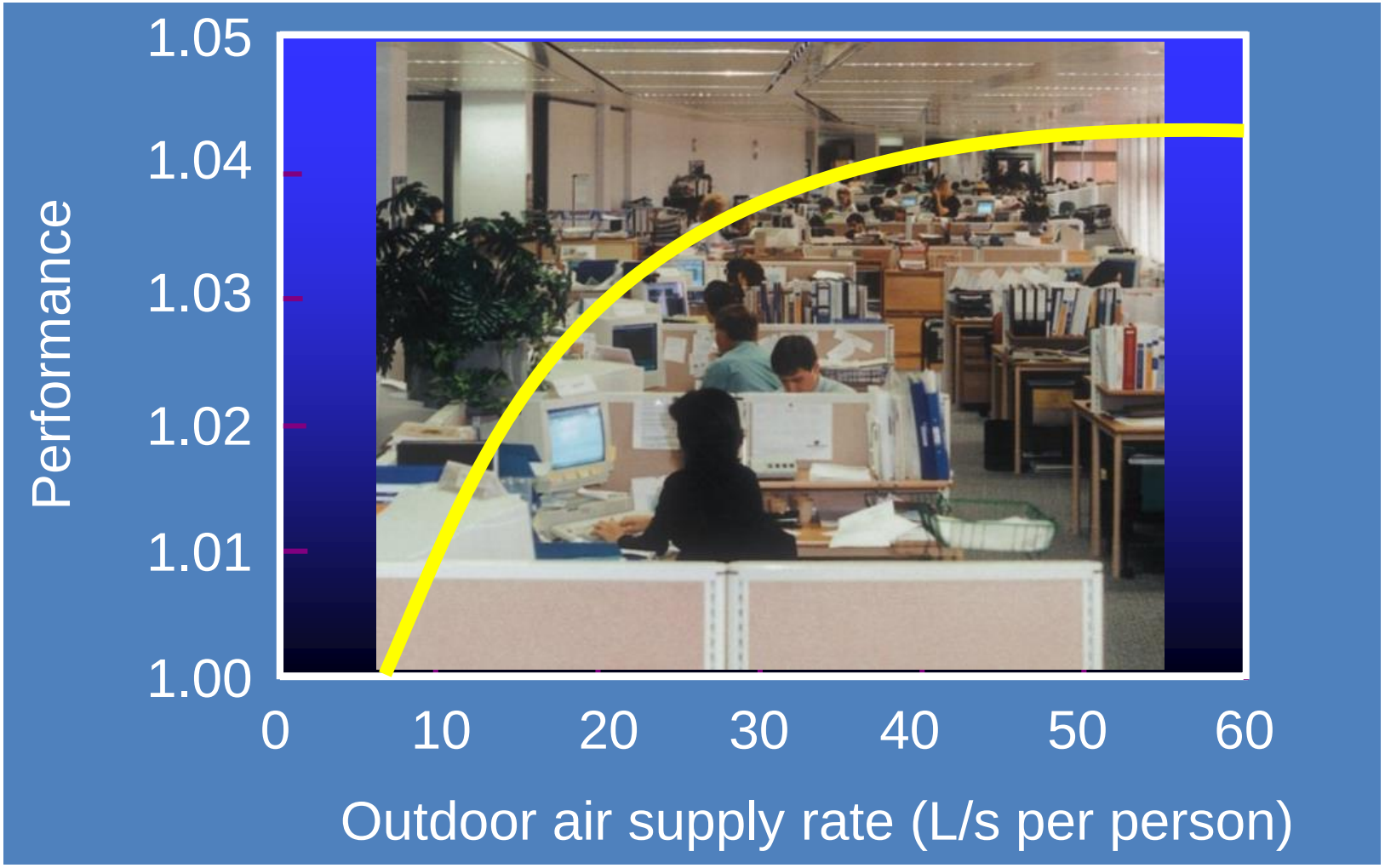
Source: Seppanen et al. (2005)

THERMAL DISCOMFORT AND PERFORMANCE OF OFFICE WORK



Source: Lan et al. (2011)

VENTILATION AND PERFORMANCE OF OFFICE WORK

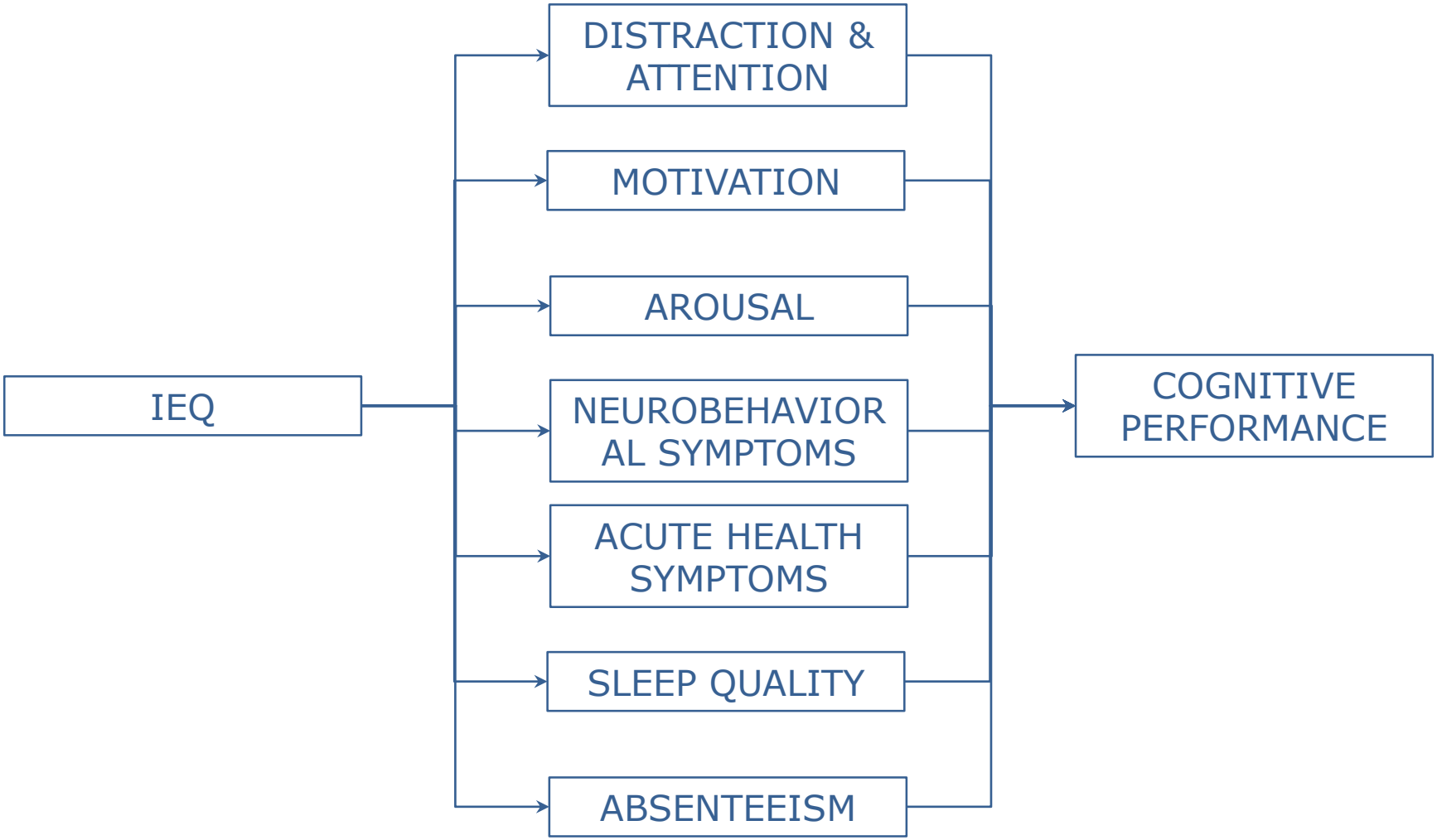


Source: Wargocki and Seppanen (2006)

EVIDENCE: OFFICE WORK

Elevated temperatures and poor air quality can affect performance of office work by 5% (laboratory) to 10% (field)

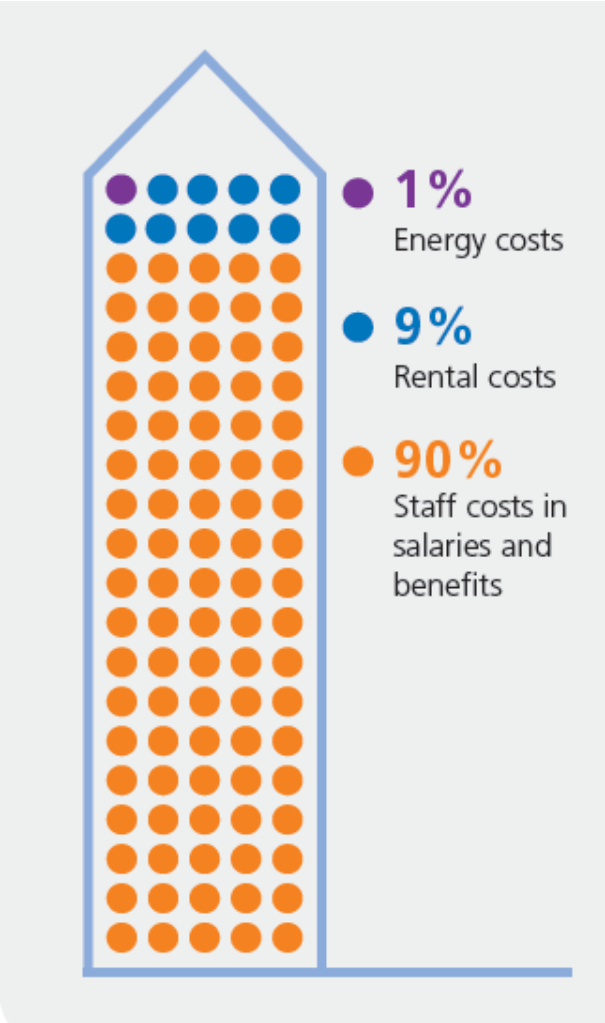
POTENTIAL MECHANISMS



Source: Wargocki and Wyon (in the Press)

CONSEQUENCES

modest gains in work performance can deliver significant financial benefits



it can be assumed that even improvements in productivity of ~1% are cost-effective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CREATING THE
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WORKPLACE
PLACES TO WORK CREATIVELY
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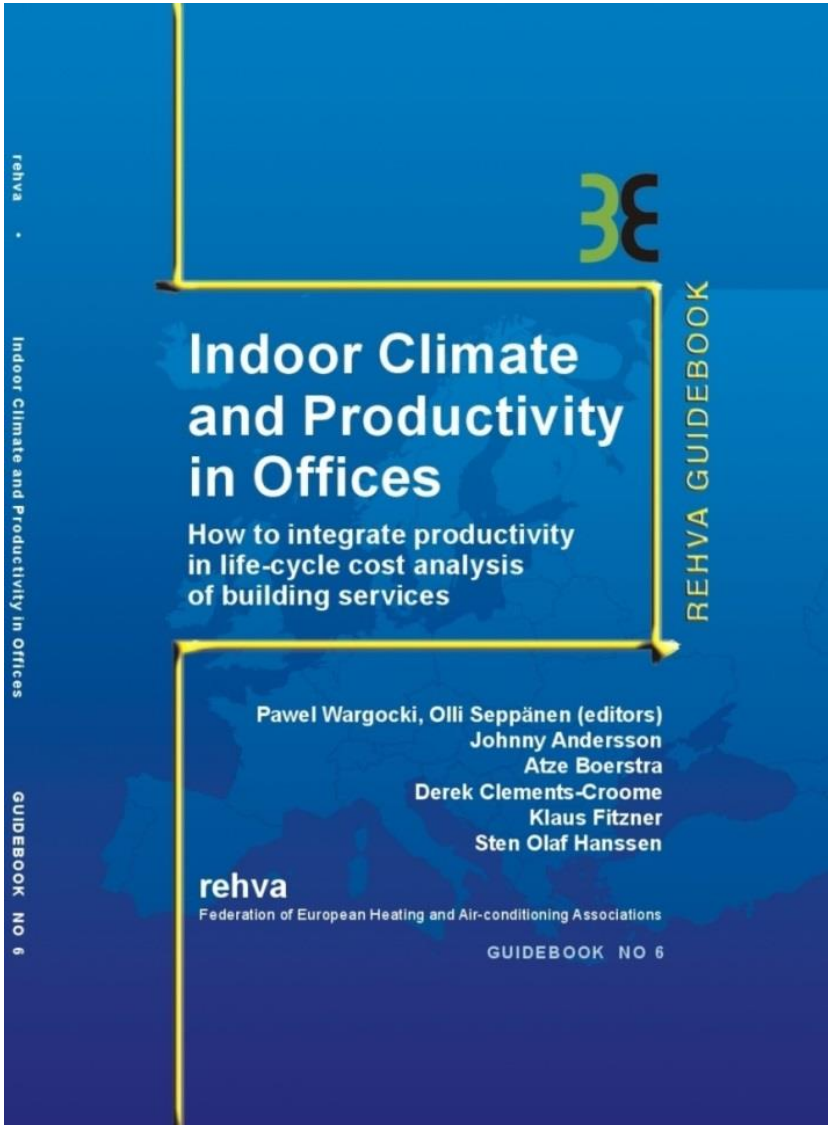
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REHVA GUIDEBOOK
Indoor Climate and Productivity in Offices
How to integrate productivity in life-cycle cost analysis of building services
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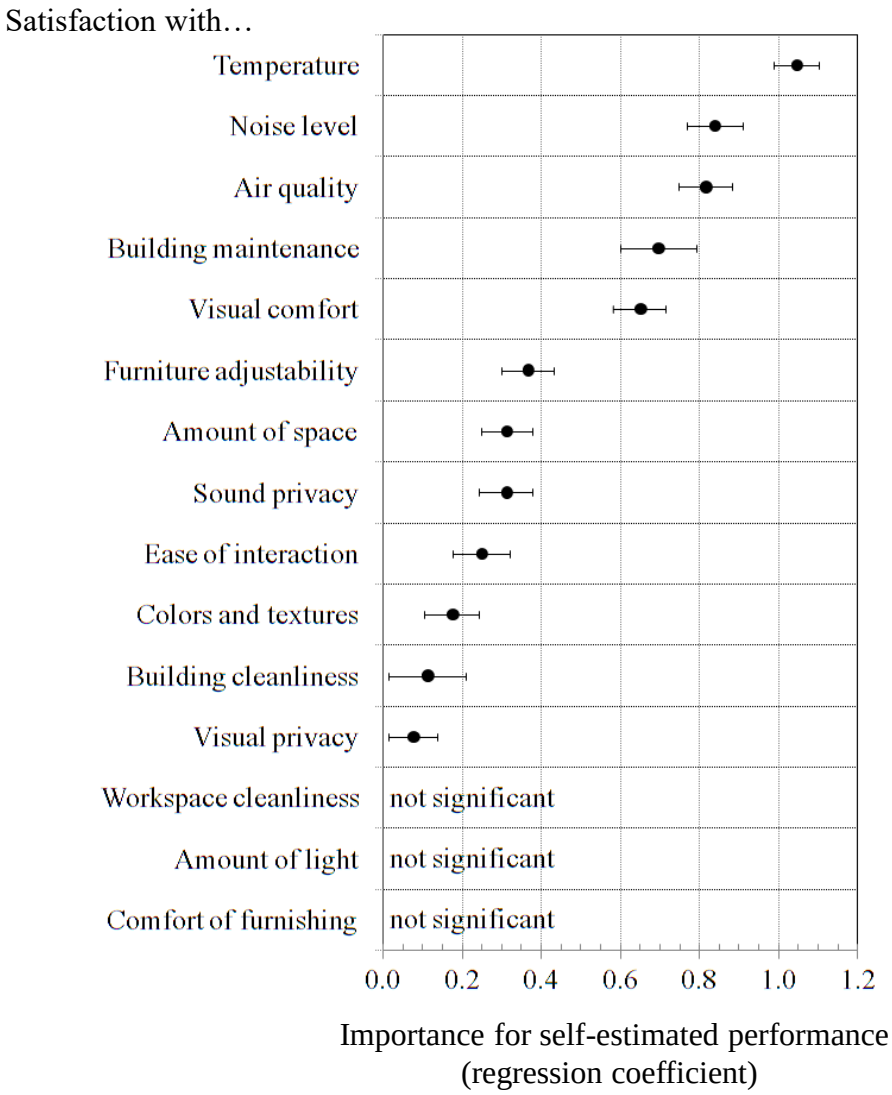
CHALLENGES

- How can performance be reliably measured?
- Which pollutants can be associated with the effects on performance?
- Can the evidence on the effects of IEQ on performance be used in economic calculations?

- What is the combined effect of several IEQ parameters on performance?
- Are there any risks for performance associated with the use of adaptive thermal comfort model?
- Do green buildings promote performance?

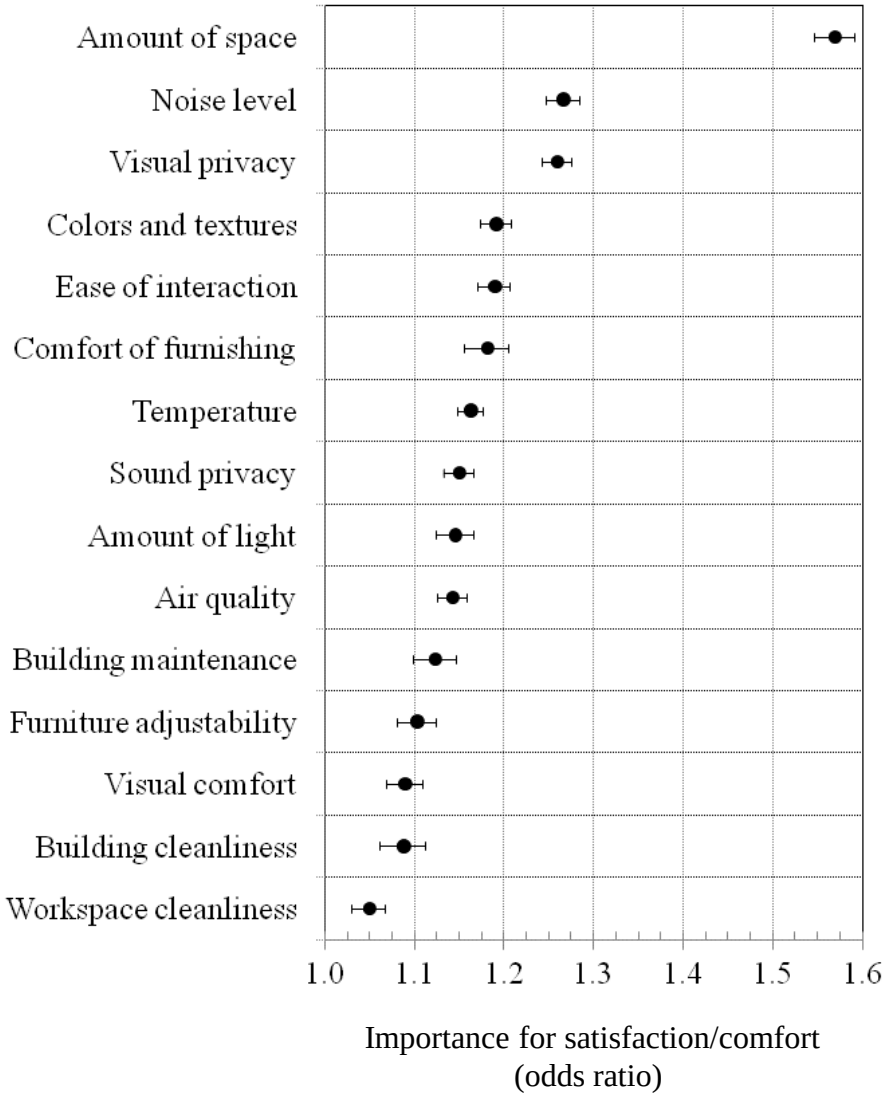
SATISFACTION w/IEQ IMPORTANT FOR self-estimated PERFORMANCE



- Satisfaction with temperature, noise level and air quality = satisfaction with IEQ
- For example, ~15% increase in satisfaction with temperature would increase self-estimated job performance by ~1%

Source: Wargocki et al. (2012)

BUILDING FEATURES ARE IMPORTANT FOR SATISFACTION



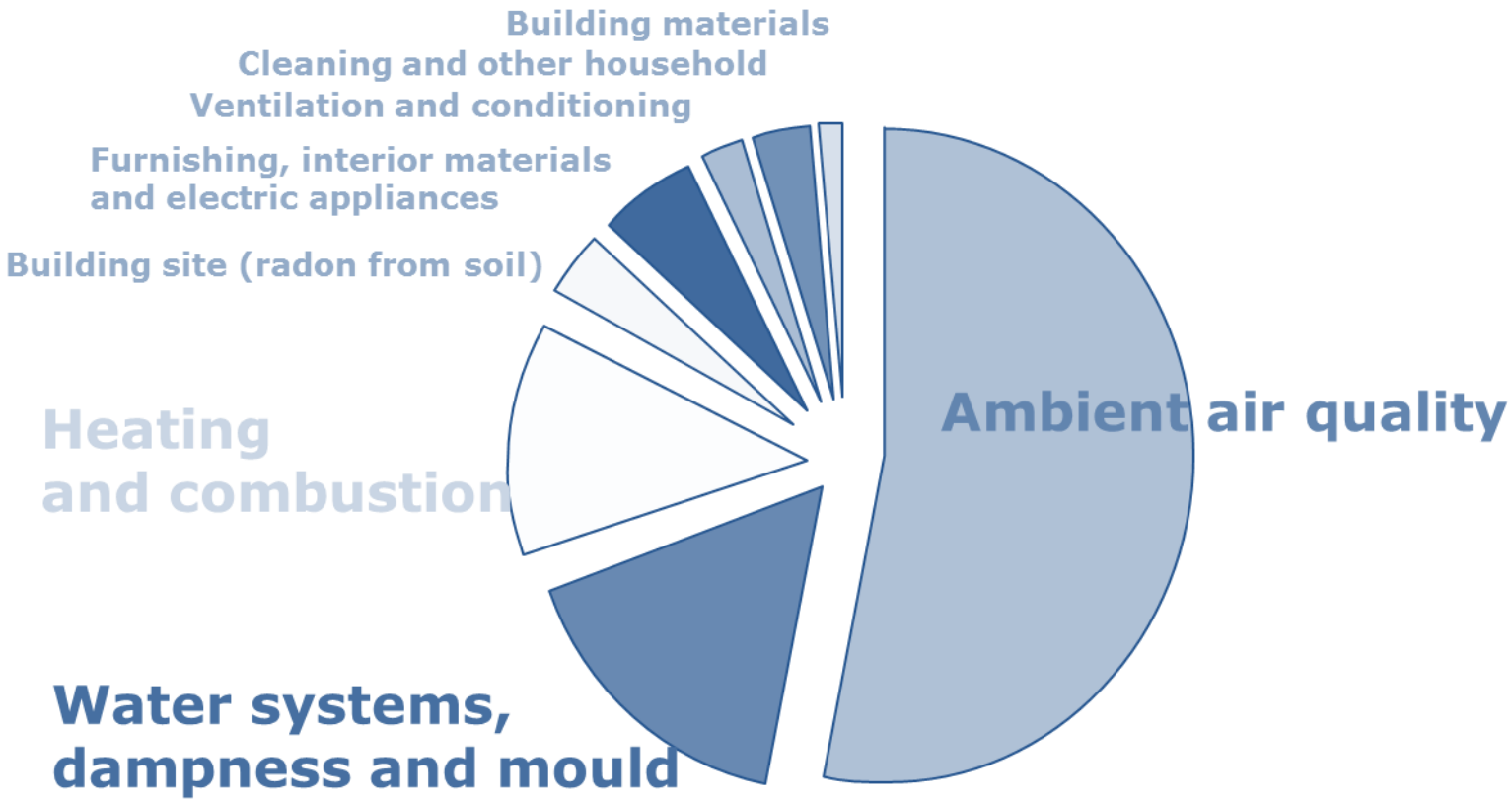
- All important ($p<0.05$)
- The most important is satisfaction with amount of space the most important regardless occupants' gender and age, type of office (single office, shared office, cubicles) and distance from a window
- Other important parameters include satisfaction with, noise level, visual privacy, colors and textures, etc.
- IEQ is not the most important

Source: Frontczak et al. (2011)

Health

BURDEN OF DISEASE (BOD)

2,000,000 healthy life years are lost every year due to exposure indoors in EU



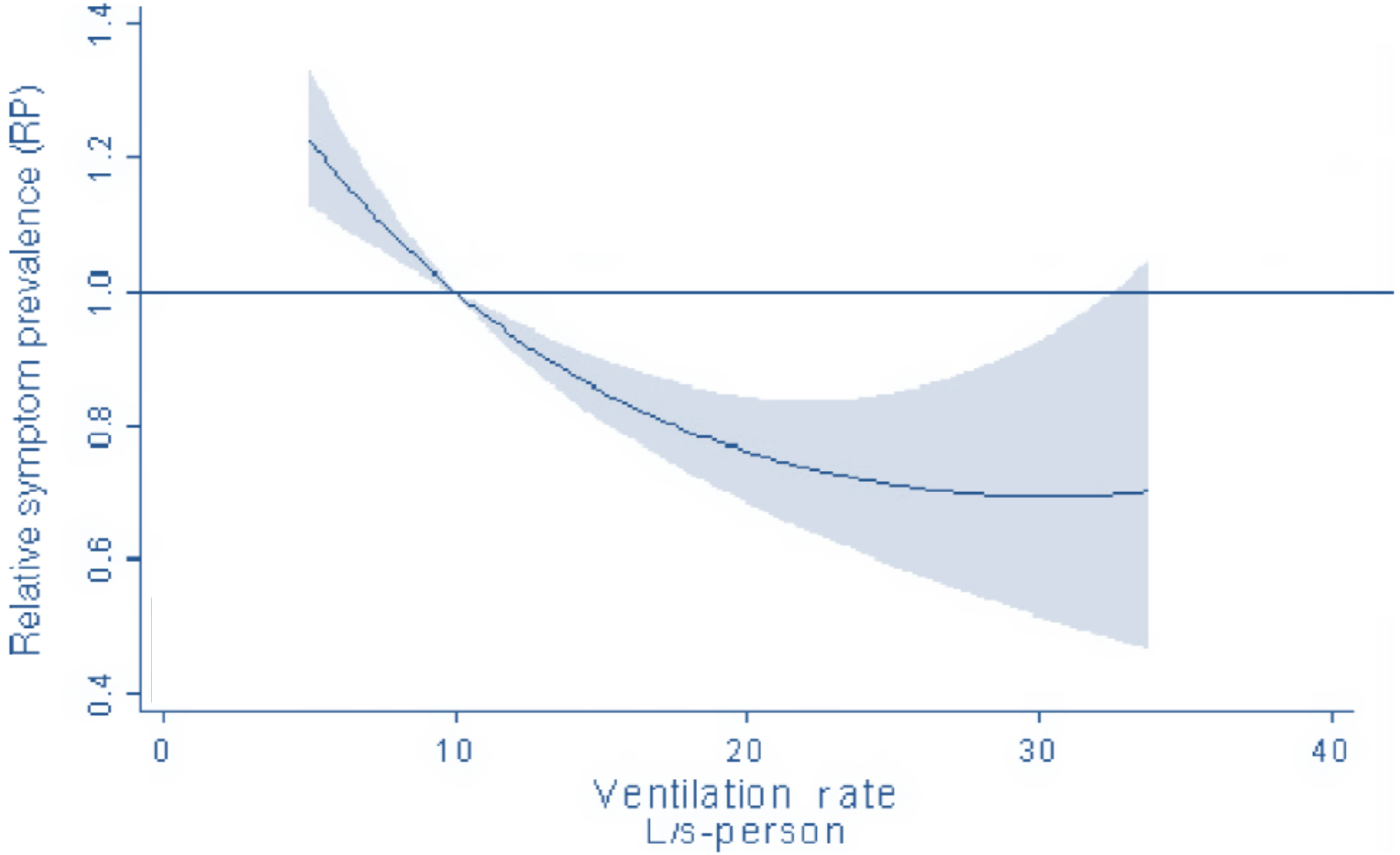
ETS excluded!

Source: EnVIE Project (2009)

CONSEQUENCES
Estimated health costs of inadequate IAQ

- Costs of IAQ are estimated to be >2 mil. DALYs (EU)
- The estimates are comparable with DALYs lost due to road traffic injuries in European region yielding 3.6 million DALYs in 2002.
- Assuming that one DALY is worth US$125k, the economic consequences are comparable with a GDP of a Cyprus.
- For example, a recent French estimation shows that socio-economic consequences in France due to indoor air pollution amount €20 billion

NON-SPECIFIC SELF-REPORTED ACUTE HEALTH SYMPTOMS (SBS)

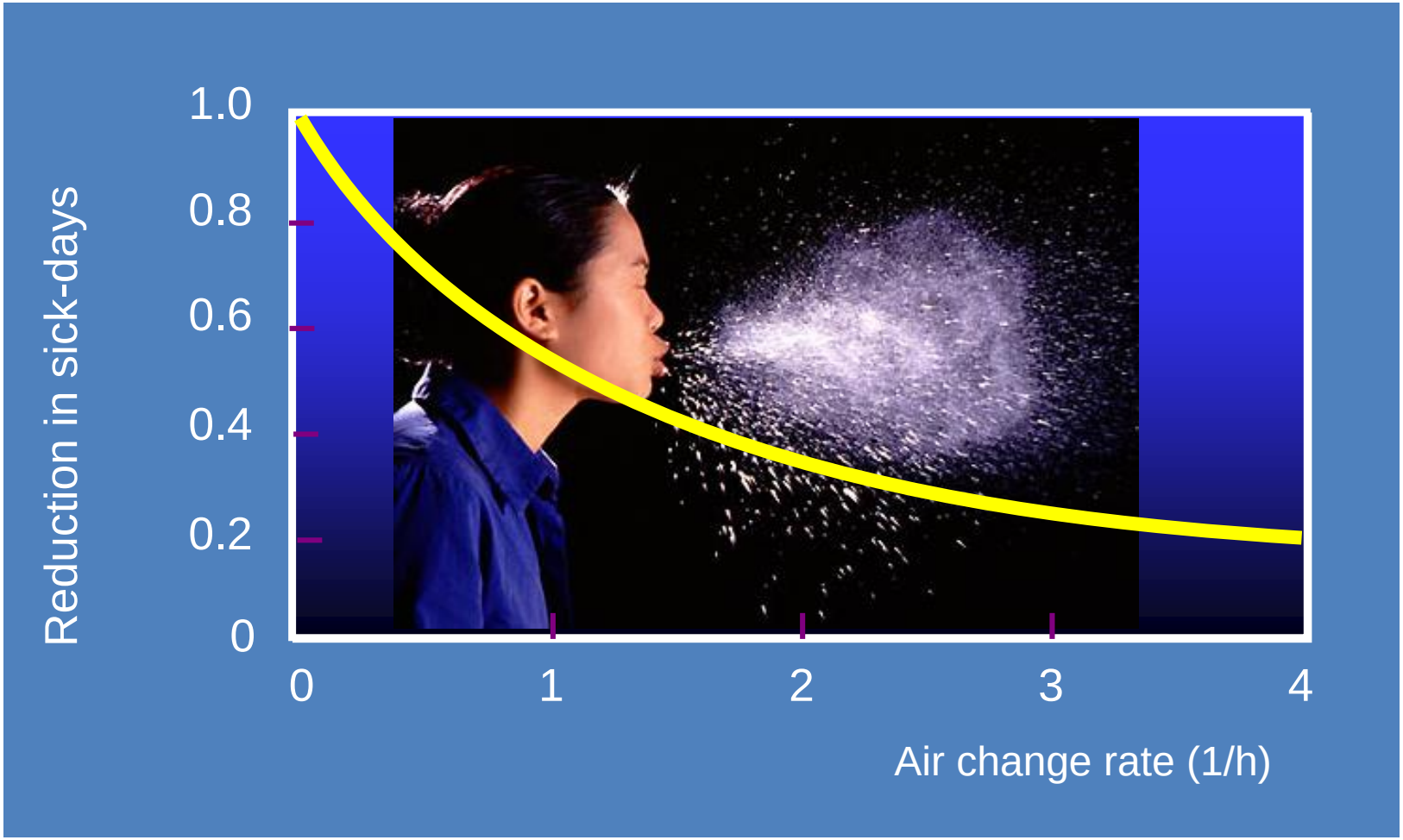


Source: Fisk et al. (2009)

ABSENCE RATES

Poor IEQ (IAQ) increases the short term sick-leave by few days, usually by 1-2 days

SHORT-TERM SICK-LEAVE AND VENTILATION



Source: Wargocki and Seppanen (2006)

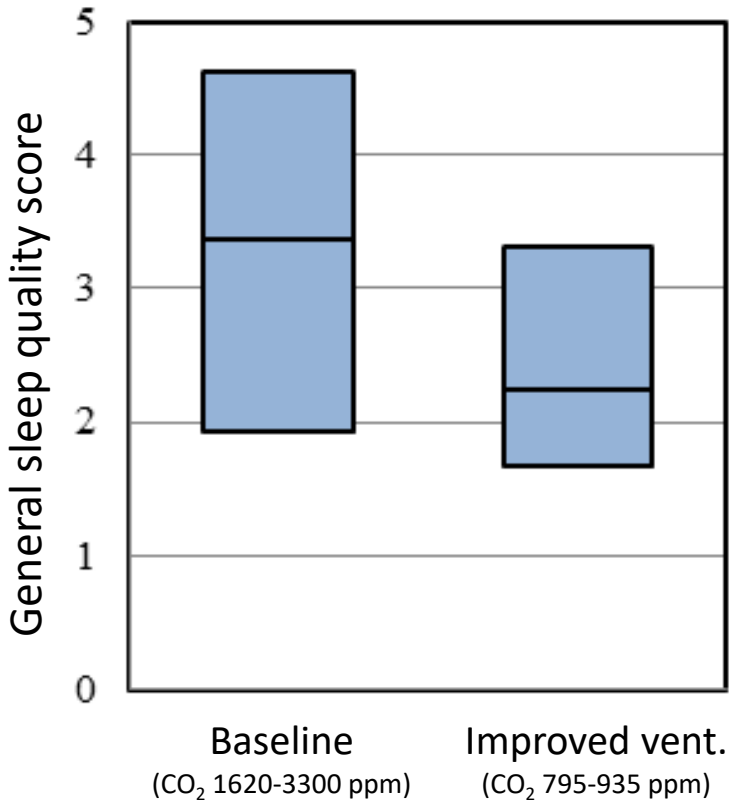
SLEEP QUALITY

- People sleep over 20 years during their life time
- High quality sleep is vital for humans
- Sleep improves cognitive performance (memory and learning, and creativity), reduce health risks (dementia, Alzheimer's disease), regulates hunger and fullness (obesity), reduce risks for car accidents, improves concentration and next-day performance
- People are getting more and more deprived of sleep, length (<7,5 hrs) and quality
- Is IEQ important?

Source: Walker (2017)

IAQ AND SLEEP

- Both sleep quality and next-day performance can be negatively affected when the outdoor air supply rate to the bedroom is reduced
- A small current of fresh air to the breathing zone seems to improve sleep quality



Source: Zhou et al. (2014); Strøm-Tejsen et al. (2016)

THANK YOU……

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