Multiple pathways from the built environment to health

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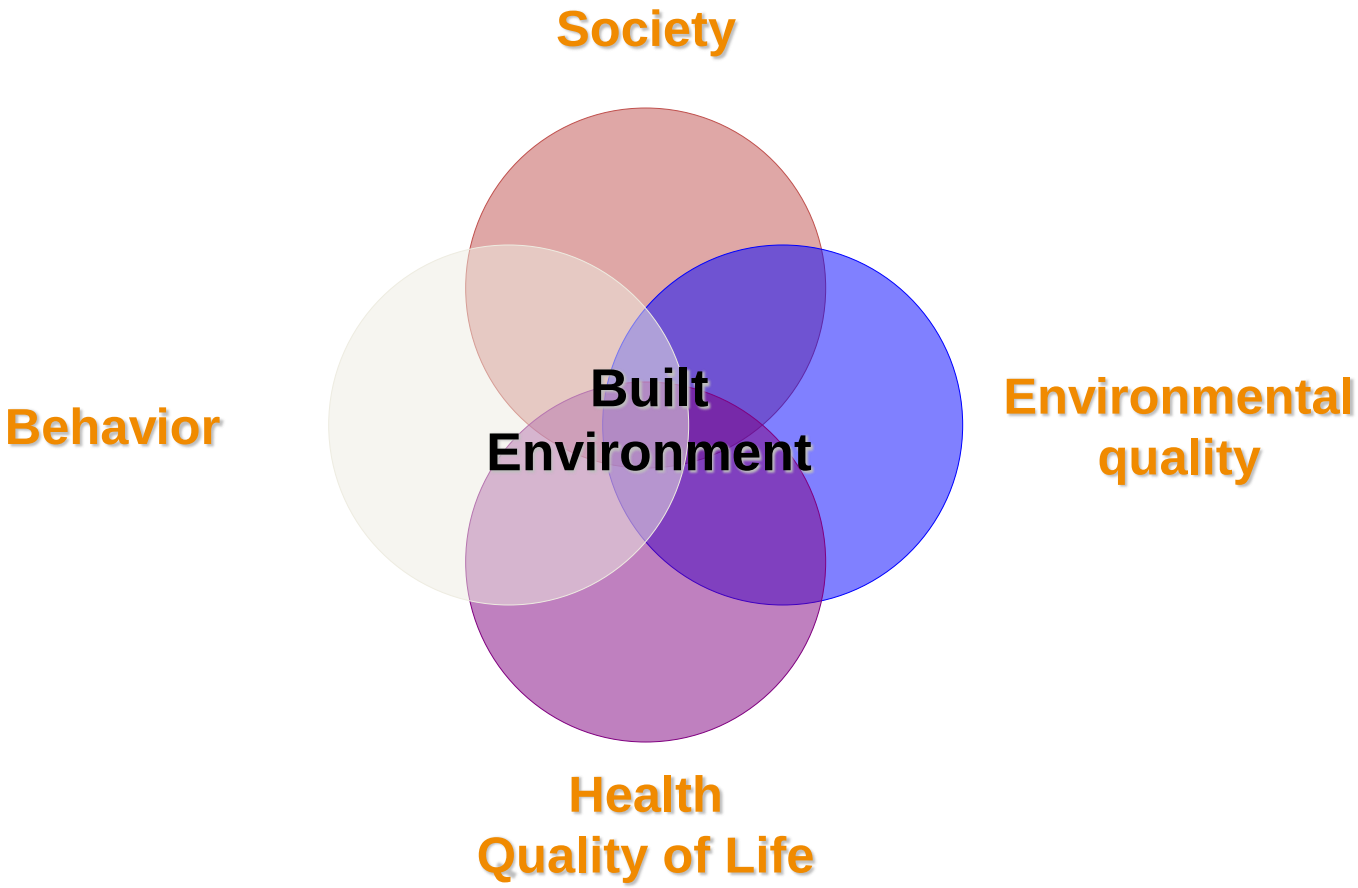
Global Health BSc

Built Environment Inter-Relationships



Photograph by Peter Turnley/CORBIS

NATIONAL GEOGRAPHIC

Urban planning and public health: Historical grounding

- Urban sanitary movement mid-19th century
  - Miasma theories - epidemics disease outbreak caused by filth and foul air
  - Frederick Law Olmsted, John H Rauch, Edwin Chadwick, Baron Haussmann, Ildefons Cerdà

- Planning focussed on the need for:
  - sunlight, ventilation, greenery, waste disposal including good drainage systems (sewers)

Empirical evidence of the built environment affecting our health

- Sprawl:
  - Obesity, overweight, BMI (Ewing et al 2003, Lopez 2004).
  - hypertension, chronic diseases (Ewing et al 2003, Sturm and Cohen 2004)
  - Traffic fatalities, especially pedestrian (Ewing et al 2003).
- Neighborhood factors (sidewalks, “walkability”, land use mix, density):
  - Overweight, obesity, BMI (Giles-Corti et al. 2003, Saelens 2003, Frank et al. 2004, Frank et al. 2007)
  - Mental health (Berke et al. 2007)
- Neighborhood “greenness”
  - Morbidity (Maas et al. 2009)
  - Obesity (Rundle et al. 2007, Tilt et al. 2007)
  - Mental health (Kaplan and Kaplan 1989, Weich et al. 2002)

Urban planning and public health: recent movements for creating healthier cities

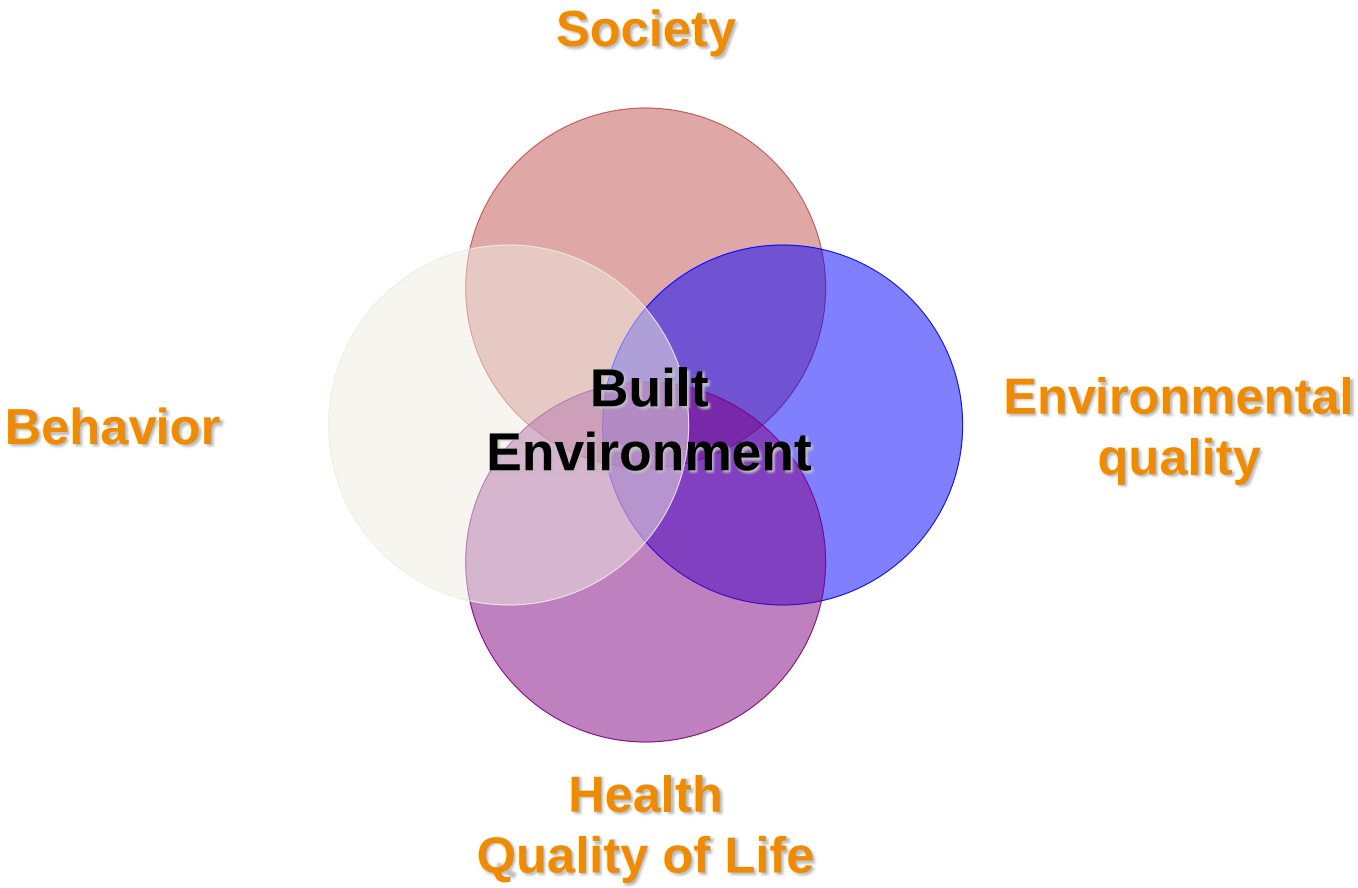
Healthy Cities,

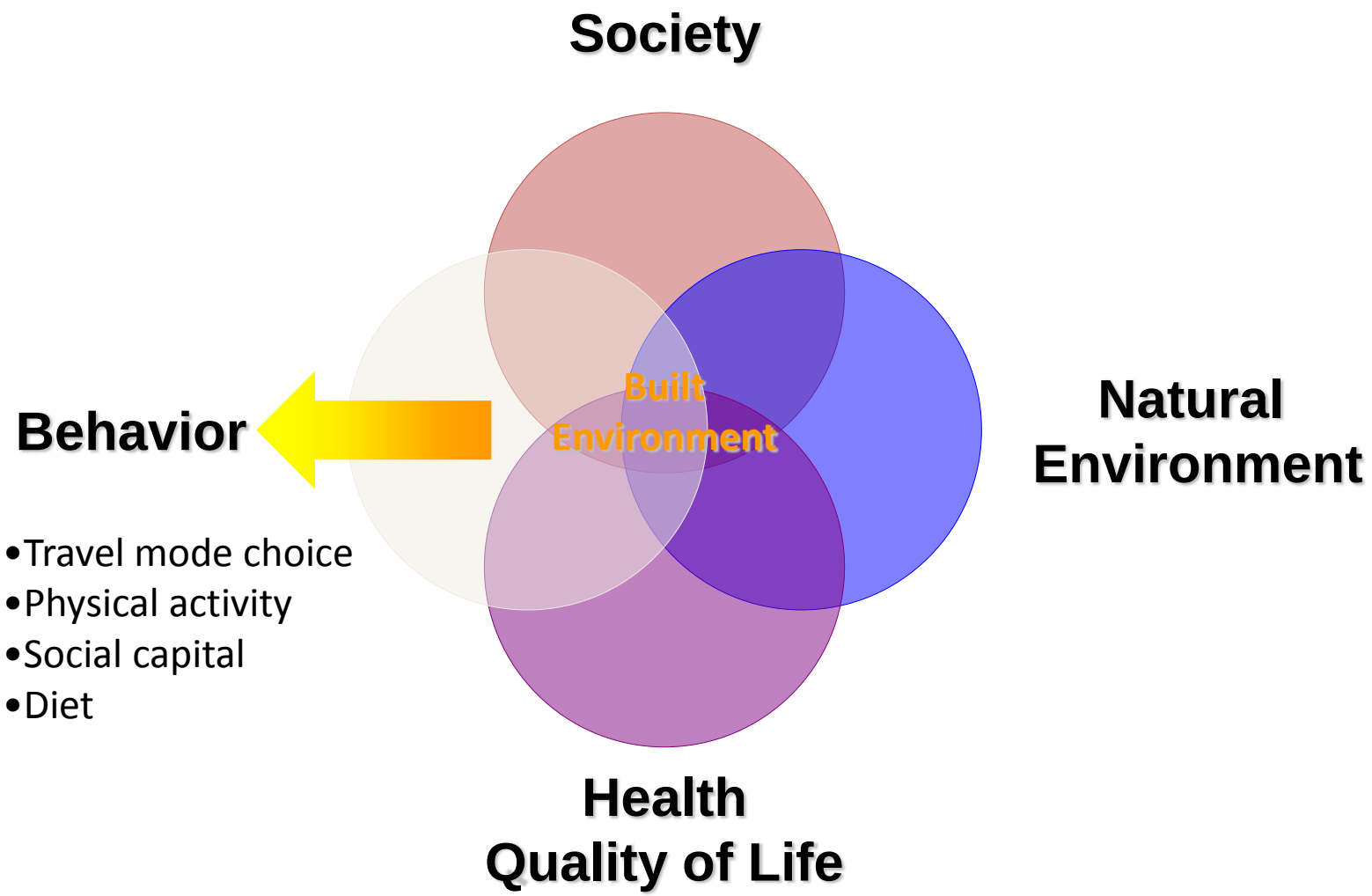
Smart Growth,

Active Living,

New Urbanism

Built Environment Inter-Relationships




Society
Behavior
Built Environment
Natural Environment
•Travel mode choice
•Physical activity
•Social capital
•Diet
Health
Quality of Life

Travel mode choice

Behavior

Determinants: 3 “D”s

- Density – dense land uses, dense and efficient transportation network
- Diversity – mix of land use types
- Design – “human scale”, building orientation, block length, parking location, landscaping, pedestrian and cycling amenities, etc

Physical activity

Behavior

- People having nearby shops, public transit, sidewalks, bicycle facilities, and recreational facilities, were 20–50% more likely to meet physical activity guidelines (Study of 11 countries, Sallis et al. 2009).

Social capital and crime

Behavior

- Social contact between neighbors is enhanced when there are opportunities for passive social contact, proximity between neighbors, and an appropriate space in which to interact

- Designs that provide “Eyes on the street” prevent crime

Behavior

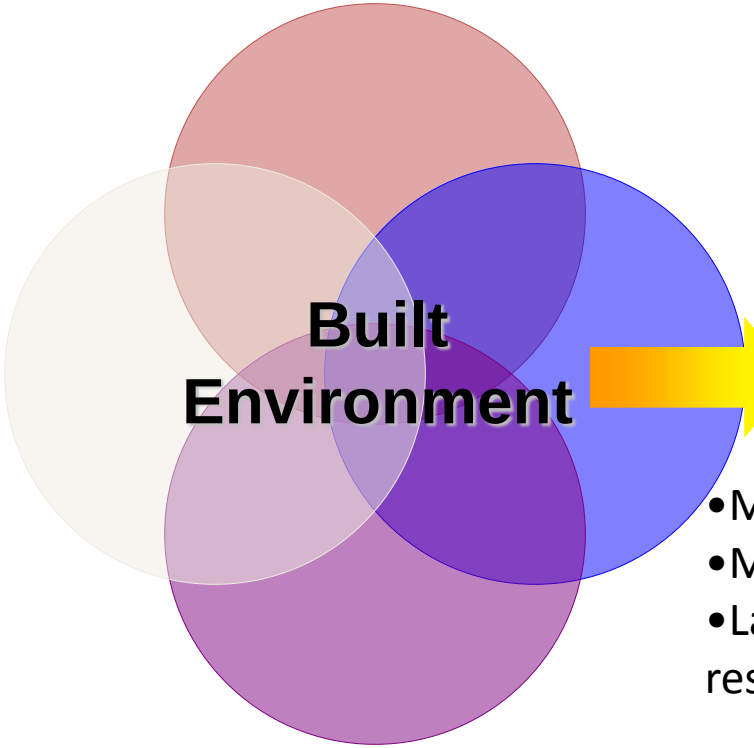
Diet and Nutrition

- Are pedestrian-friendly environments also healthy-foods environment?

- Is there an interaction between diet and activity?

Society

Behavior



Environmental Quality

- Mode choice and emissions
- Mode choice and exposures
- Land use and natural resources

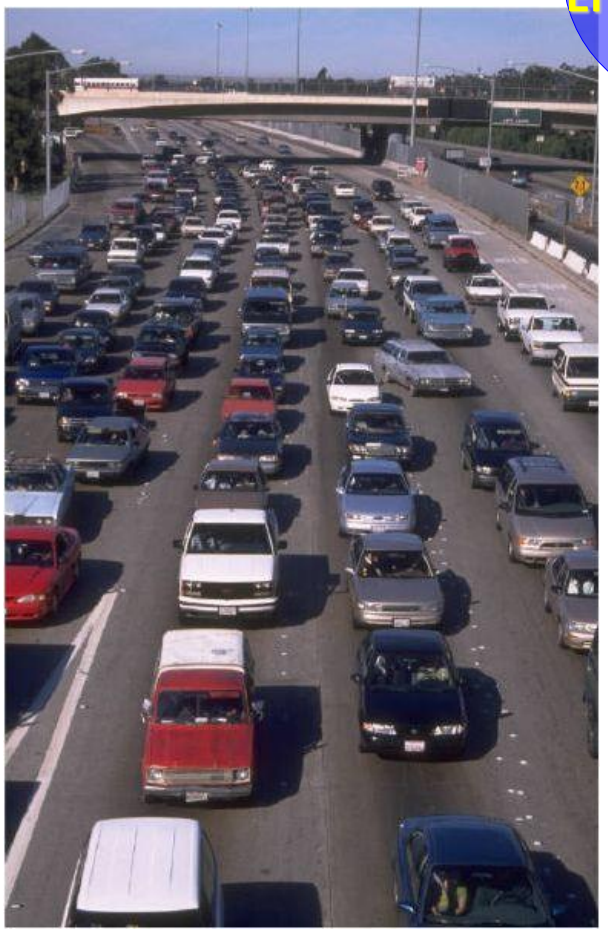
Health
Quality of Life

Transportation behavior and emissions

Natural Environment

Vehicle use generates:

- Emissions of air pollutants (typically largest contributor in urban environments)
- Green house gases (transport: 23% of emissions worldwide)
- Traffic noise



EU city scenario % reduction in pollutant emissions	CO2	CO	VOC	NOx	PM2.5
30% reduction in passenger car urban VMT	17.3	25.3	25.6	11.7	16.7

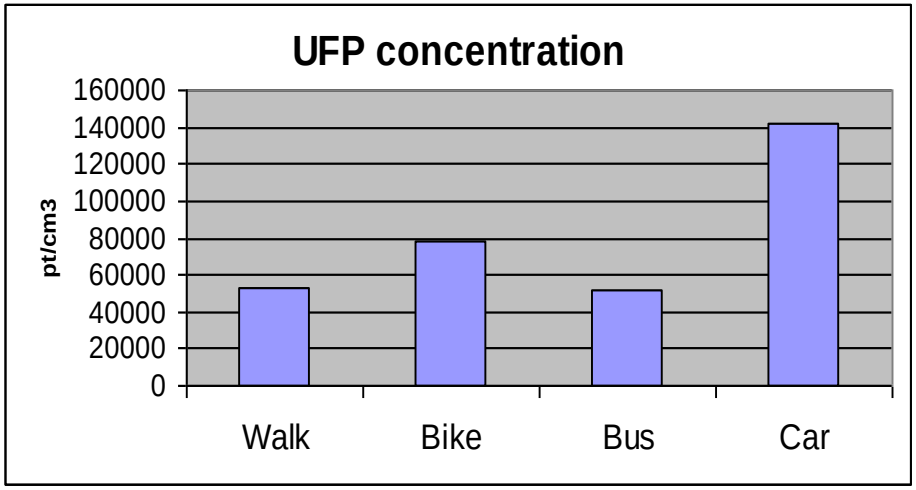
Travel mode choice and exposures

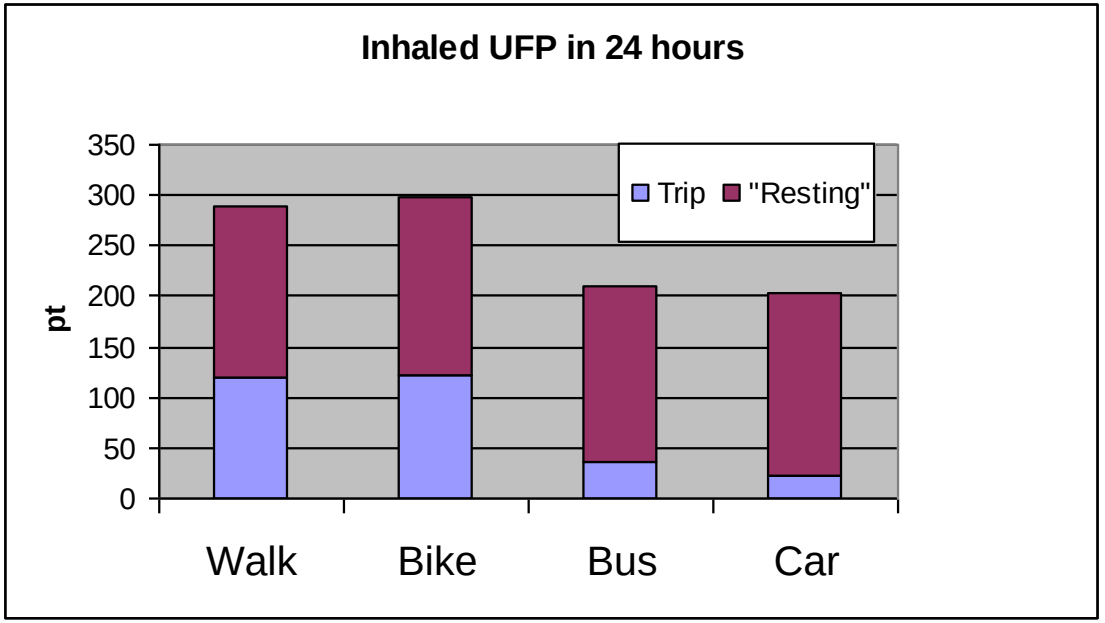
Natural Environment

Mode choice and exposures:

- Air pollution
- Noise
- UV
- heat

Exposure in travel modes in Barcelona, Spain



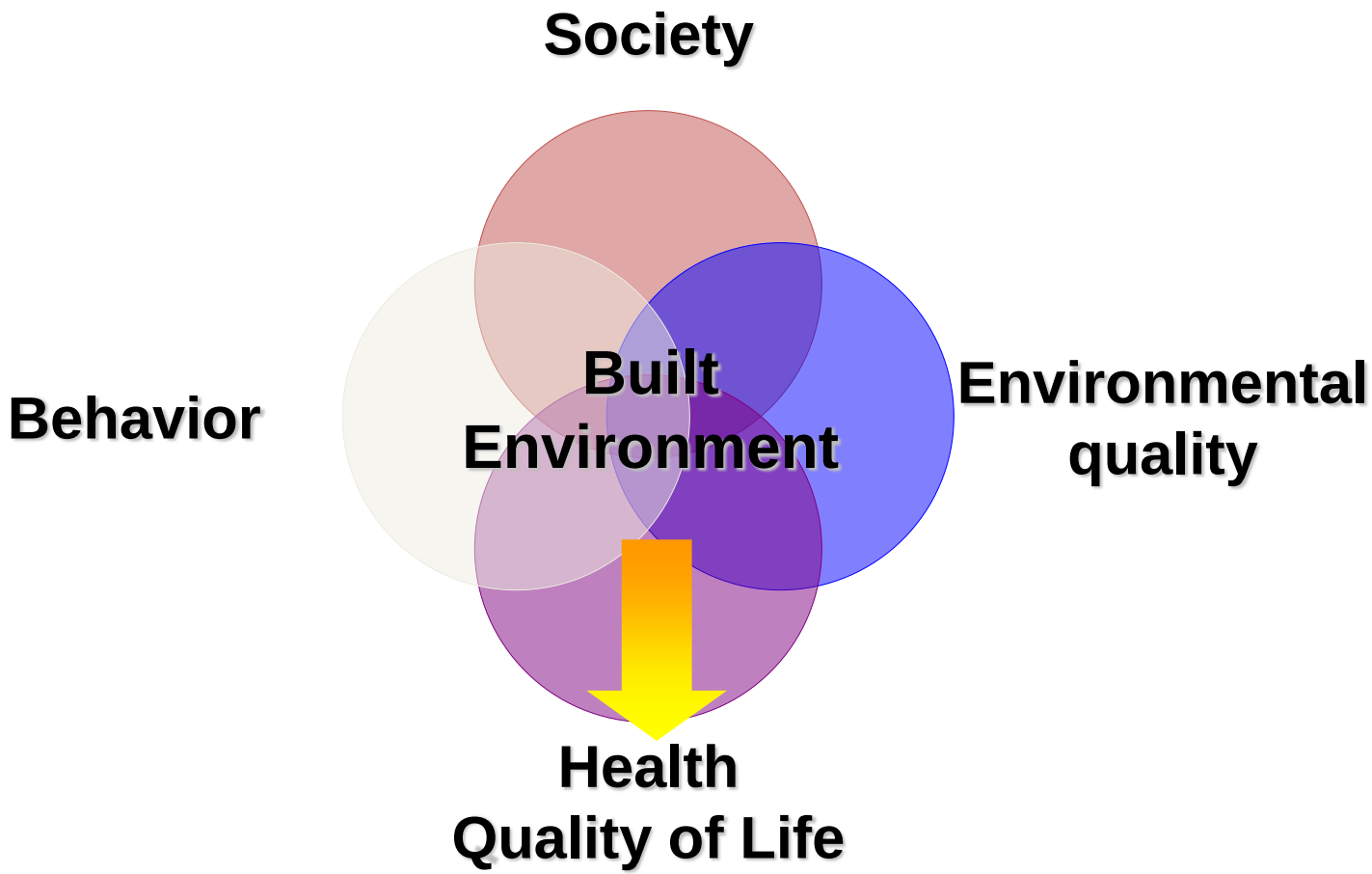


Natural Resources

Natural Environment

impacts of auto-oriented environments and urban sprawl:

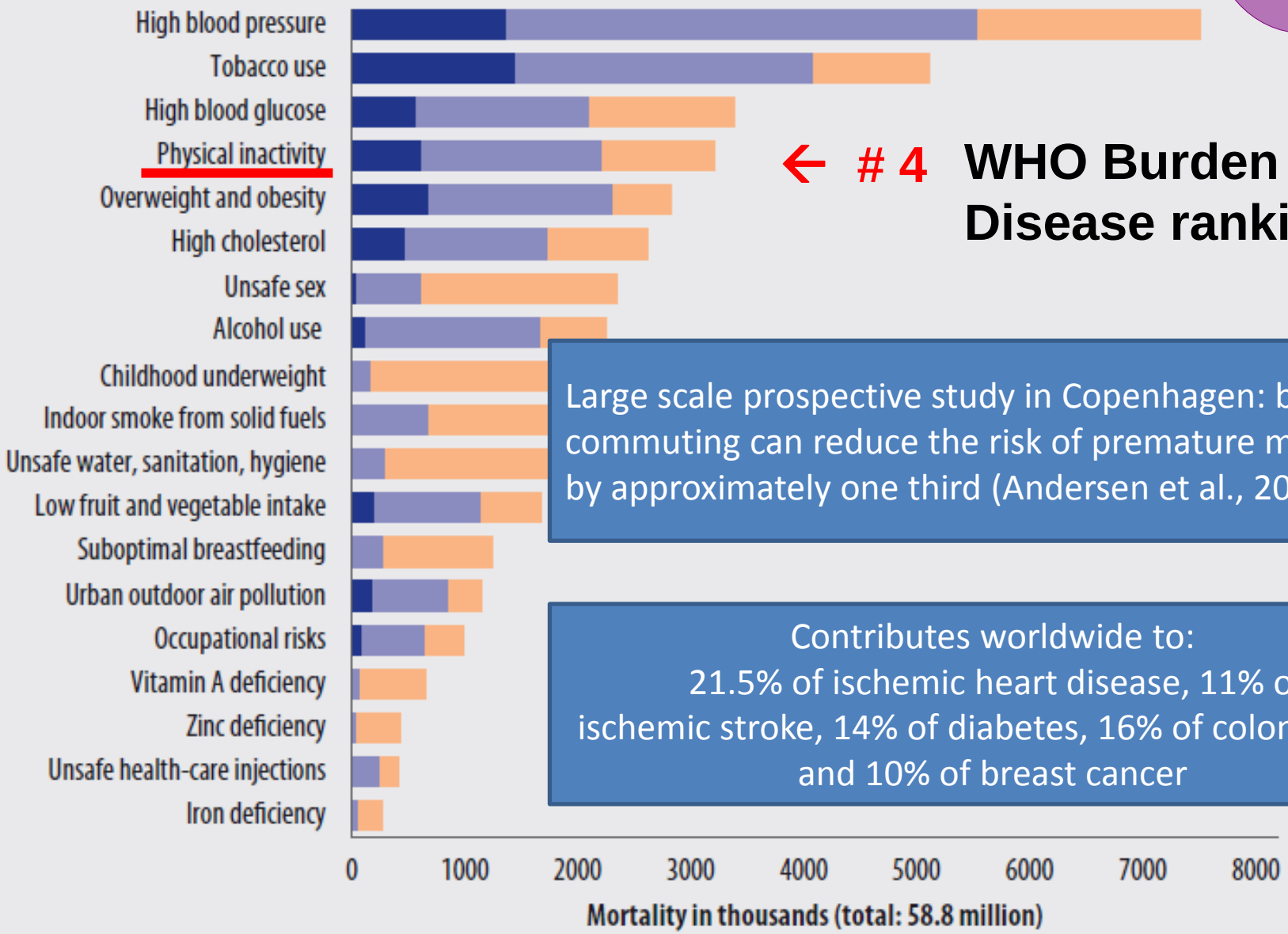
- Polluted runoff from vehicle use (e.g. heavy metals, nitrogen loads) into waterways
- Increased impervious surfaces and effects on water quality and quantity, flooding, and vectors of disease
- Loss of farmland, forests, wetlands and open space
- Land fragmentation and effects on natural habitats and vectors of disease


Society
Behavior
Built
Environment
Environmental
quality
Health
Quality of Life

Physical inactivity

Health
Quality of Life

Figure 6: Deaths attributed to 19 leading risk factors, by country income level, 2004.



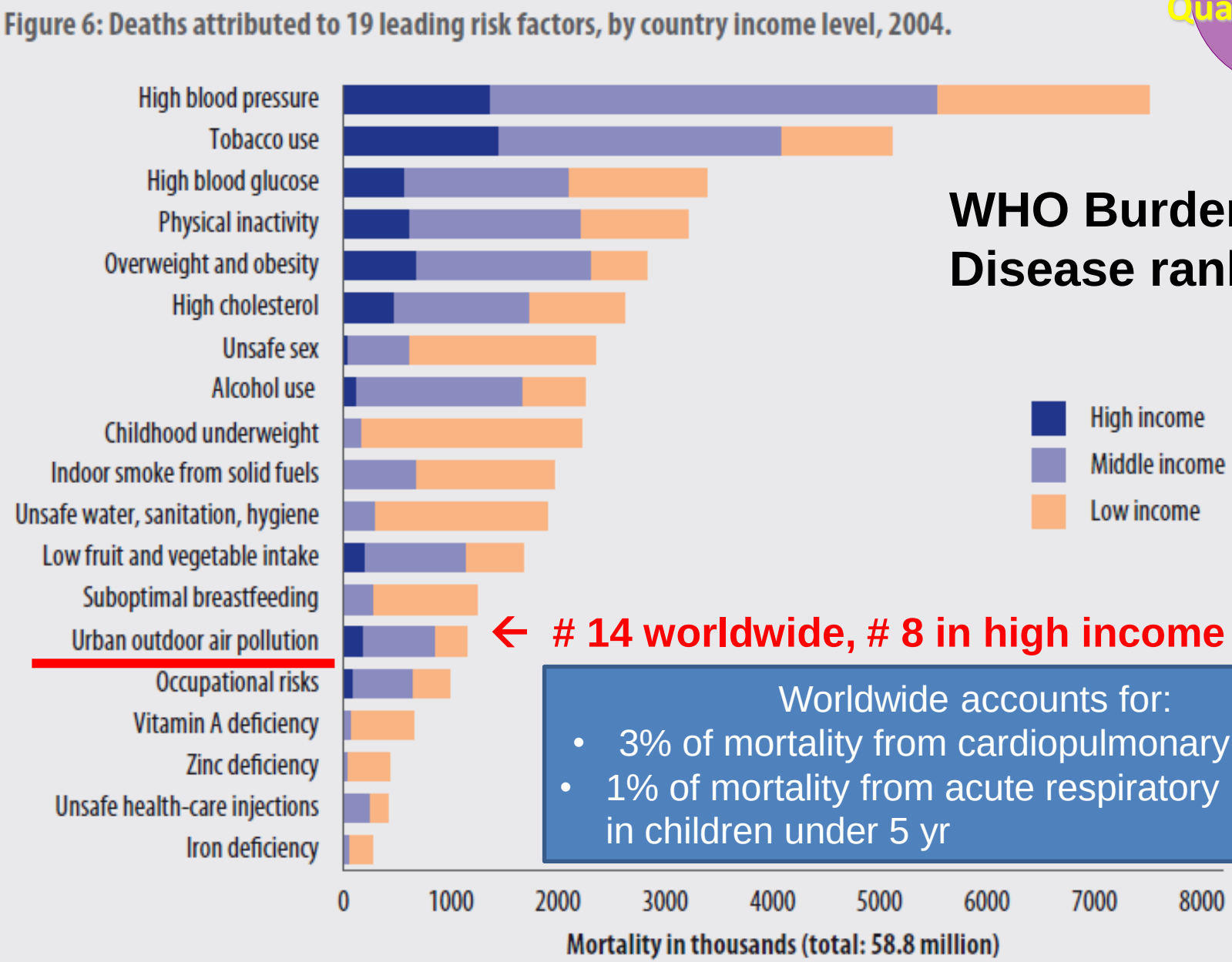
← # 4 **WHO Burden of Disease ranking**

Large scale prospective study in Copenhagen: bike commuting can reduce the risk of premature mortality by approximately one third (Andersen et al., 2000).

Contributes worldwide to:
21.5% of ischemic heart disease, 11% of ischemic stroke, 14% of diabetes, 16% of colon cancer and 10% of breast cancer

Air pollution: General population

Health
Quality of Life



WHO Burden of Disease ranking

← **# 14 worldwide, # 8 in high income countries**

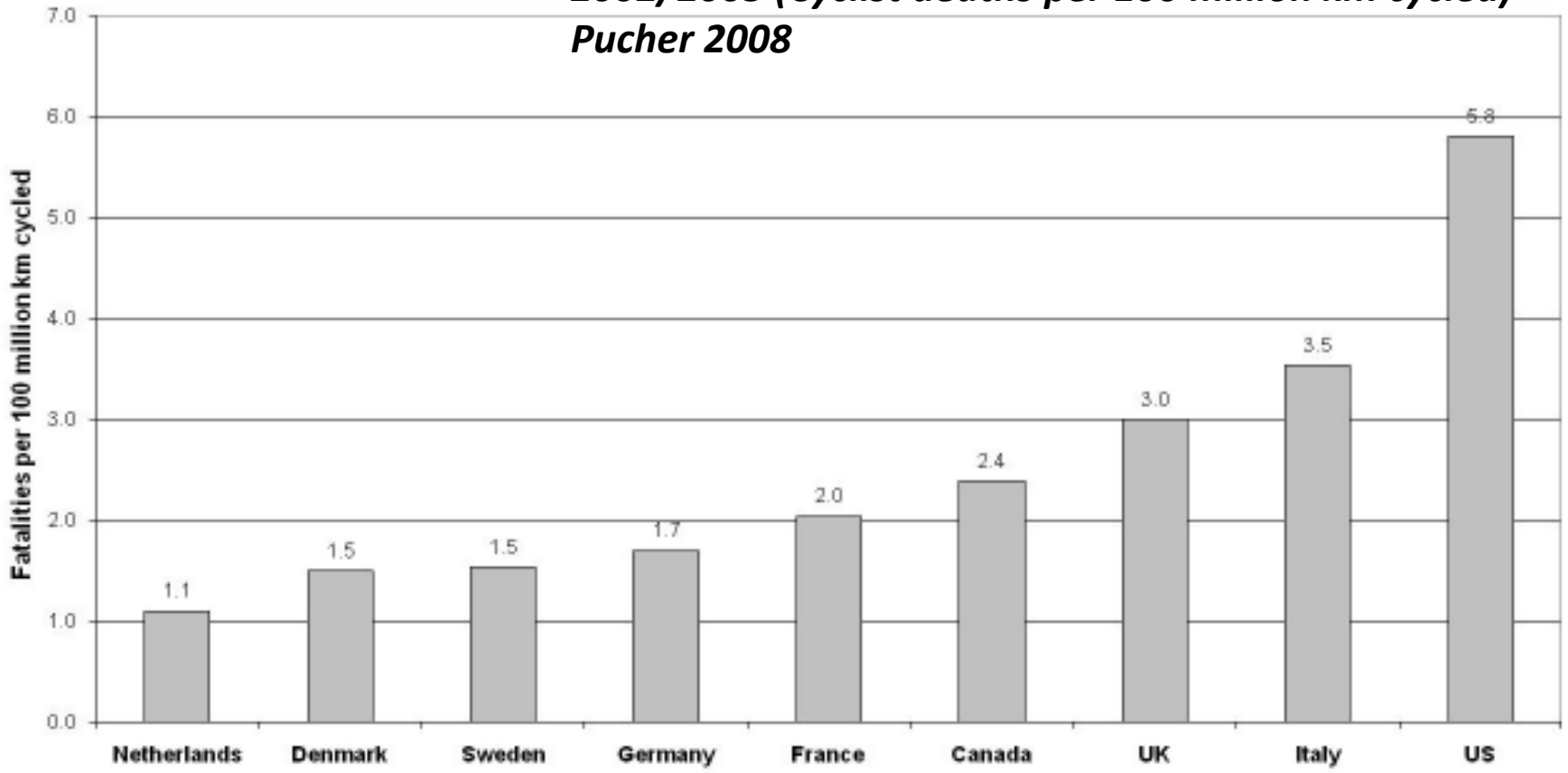
Worldwide accounts for:

- 3% of mortality from cardiopulmonary disease;
- 1% of mortality from acute respiratory infections in children under 5 yr

Traffic injuries

Health
Quality of Life

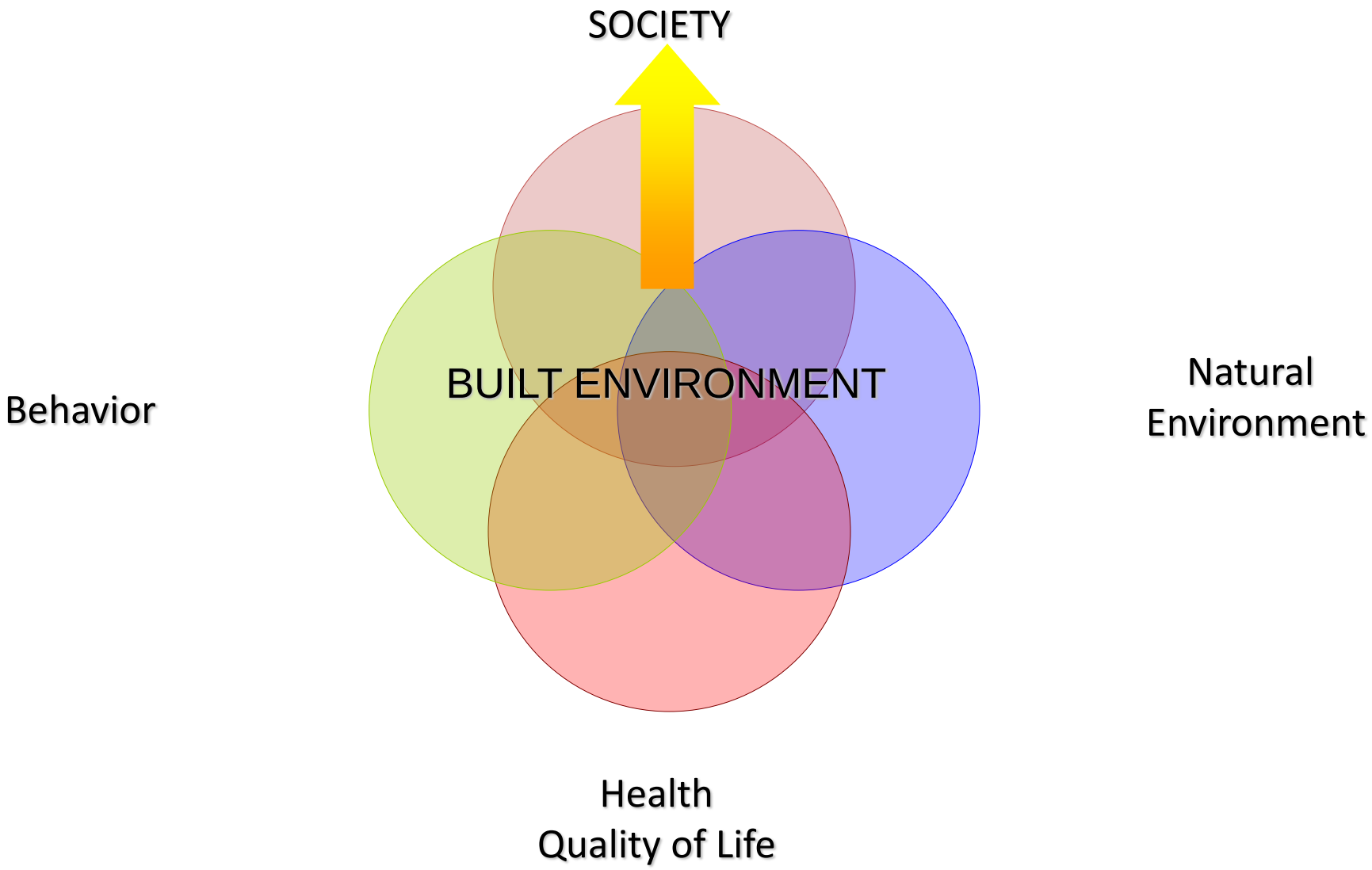
Cycling Fatality Rates in Europe and North America, 2002/2005 (Cyclist deaths per 100 million km cycled) Pucher 2008



HEALTH AND OTHER EXPOSURES

Health
Quality of Life

- Green space
- Social interaction
- Congestion
- Time spent in a car
- Diet
- Food and water contamination (from deposition on crops and waterways)
- Vectors of disease (mosquitoes, lyme disease)
- Climate change


SOCIETY
BUILT ENVIRONMENT
Behavior
Natural Environment
Health
Quality of Life

Society

- The built environment may impact the good functioning of society because of:
  - The lack of time/place for social engagement
  - social inequities it can trigger
  - The economic costs it can impose

Discussion

- Urban planning policies have multi-faceted interconnected impacts on health
- Relevant to consider the built environment holistically, as a complex system
  - Feedback effects
  - Synergies
  - Unintended consequences
- Simplifications are necessary, however
  - Lack of knowledge
  - Magnitude and importance of effect - prioritizing

Example: Barcelona BICING case study

Inaugurated March 2007

In 2009: 182 000 subscribers

6000 bikes

425 stations

BMJ

BMJ 2011;343:d4521 doi: 10.1136/bmj.d4521 Page 1 of 8

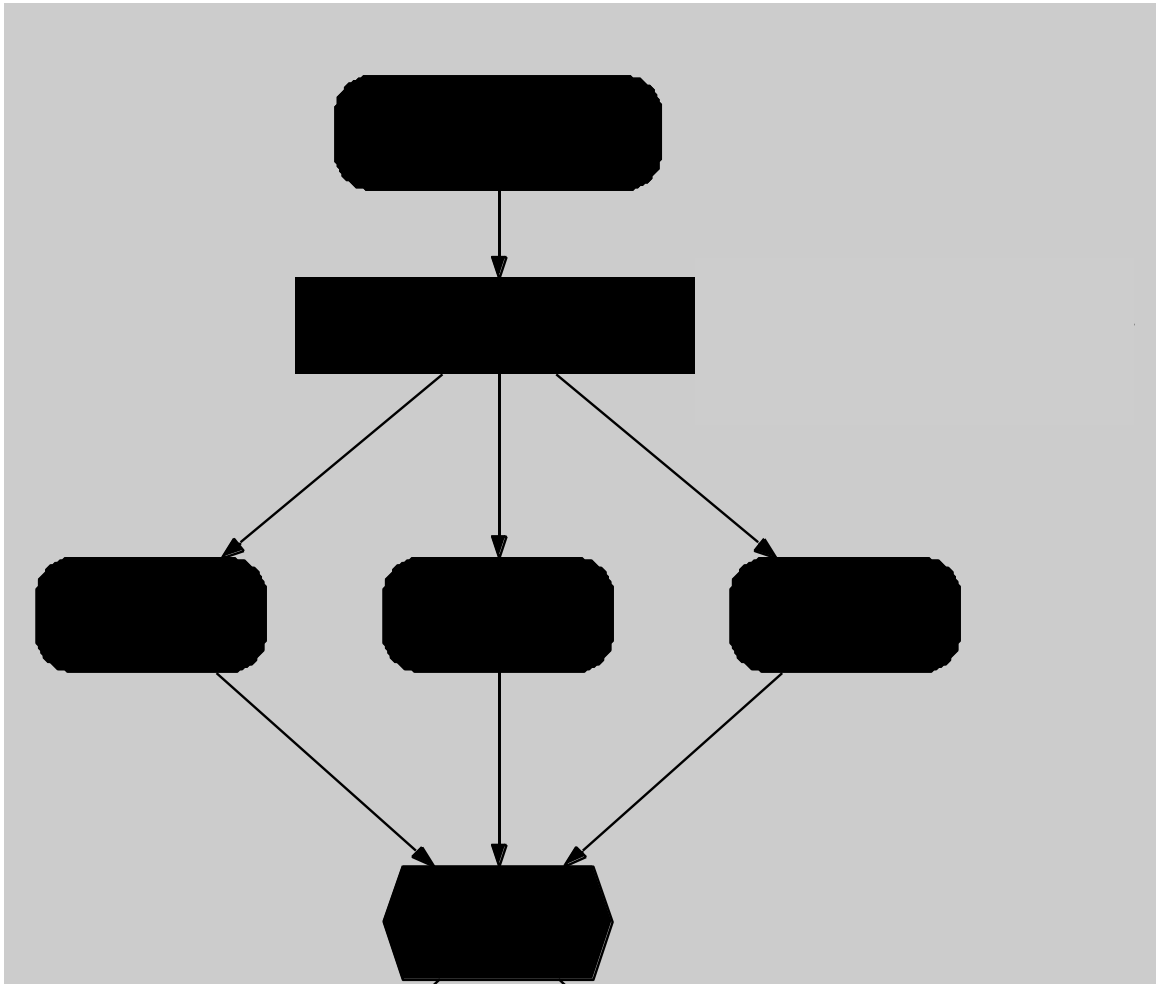
RESEARCH

The health risks and benefits of cycling in urban environments compared with car use: health impact assessment study

David Rojas-Rueda *predoctoral researcher*[1 2 3], Audrey de Nazelle *researcher*[1 2 3], Marko Tainio *researcher*[4], Mark J Nieuwenhuijsen *research professor*[1 2 3]

Simplified model: impacts of the bicing program on mortality

- Mortality impacts on Bicing users “new” to cycling:
  - 25 427 bicing users
  - 4.93 km/work-day



PhD student: David Rojas

Results: mortality in new cyclist population

	Air pollution	Traffic mortality	physical activity
Relative Risk **Bike vs Car**	1.002	1.0007	0.80
Attributable fraction of mortality	0.002	0.0007	-0.23
Deaths / year	**+0.13**	**+0.03**	**-12.46**

Comparison with other studies

scenario	physical activity	Air pollution	Traffic mortality
Our study, Barcelona: deaths in new cyclist population (25 427)			
Bicing	-12.46	+0.13	+0.03
De Hartog et al. (2010), Holland: years of life gained per 500 000 shifting mode			
mode shift car to bike	+337 896	-28 135	- 9 639
Rabl & de Nazelle (2011), Europe: mortality cost per individual who shifts from car to bike (Euros/year)			
Mode shift car to bike	+1 310	-17.5	-105

Seminar

- Comments, questions, clarifications, critiques?
- What was not covered in this overview?
  - Elements
  - Synergies, feedbacks
  - Unintended consequences
- What would be relevant to consider in your own city?
- How might improvements for health-enhancing cities come about? (how to make it happen?)
- How useful would it be to develop a comprehensive health impact assessment of planning policies in your city?