



# Physical activity and health: a micro-simulation model of active transport

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Modelling on the move 6:

Cycling and Transport Modelling

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## Physical (in-) activity

- Physical activity is defined as any bodily movement produced by skeletal muscles that requires energy expenditure
- Physical **inactivity** is one of the four **major risk factors** for non-communicable diseases, accounting for more than **3 million preventable deaths worldwide**

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## Health benefits of physical activity

There is a strong evidence of

- Increased respiratory and muscular fitness
- Healthier body mass and composition
- Improved bone health
- Improved cognitive function

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## Health benefits of physical activity

There is a strong evidence of reduced rates of

- All cause mortality
- Coronary heart disease
- High blood pressure
- Stroke
- Metabolic syndrome
- Type 2 diabetes
- Breast cancer
- Colon cancer
- Depression
- Falling

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## Physical activity in England

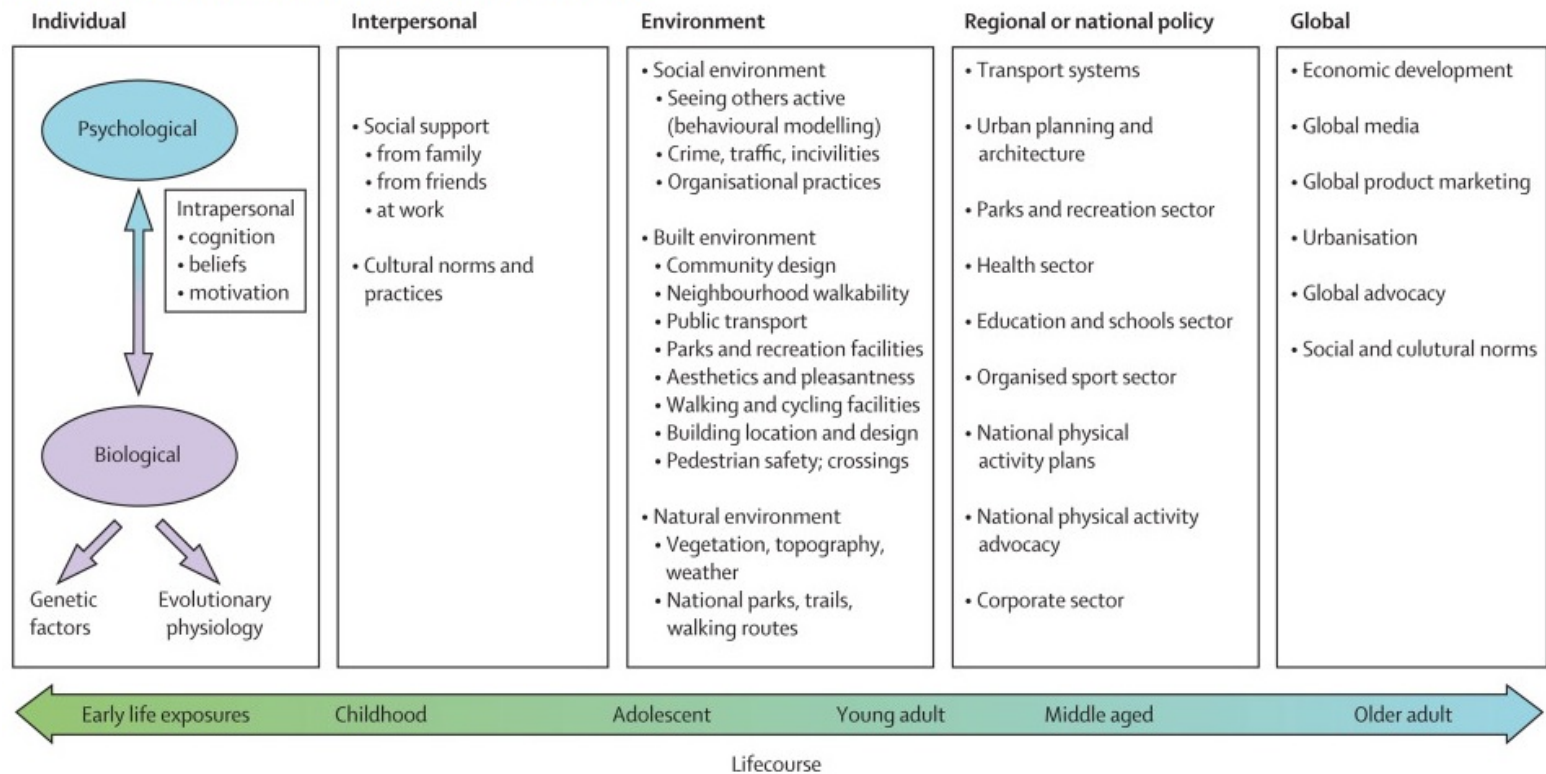
- In England in past 20-30 years **work related physical activity** was **going down**, while **leisure time physical activity (LTPA)** was **increasing**, albeit unequally, in different socio-economic strata, ethnic and age groups
- In 2012 **66% of men** and **56% of women** reported **reaching physical activity targets** as per new guidelines
- Objectively measured data are scarce. Both research and policy often have to **rely on self-report data** which are especially prone to **recall bias**

# Transferability of evidence

<b>Males</b>	<b>Reference group</b>	<b>CHD risk reduction</b>	<b>Age</b>	<b>N</b>	<b>Years follow-up</b>
walking pace 2-3 mph	<2 mph	28%	40-75	51529	475755 person-years
walking pace 3-4 mph	<2 mph	39%	40-75	51529	475755 person-years
walking pace ≥4 mph	<2 mph	49%	40-75	51529	475755 person-years
<b>Females</b>	<b>Reference group</b>	<b>CHD risk reduction</b>	<b>Age</b>	<b>N</b>	<b>Years follow-up</b>
walking pace <2mph	no regular walk	44%	45+	39 372	average 5 years
walking pace 2-3 mph	no regular walk	39%	45+	39 372	average 5 years
walking pace ≥3 mph	no regular walk	48%	45+	39 372	average 5 years

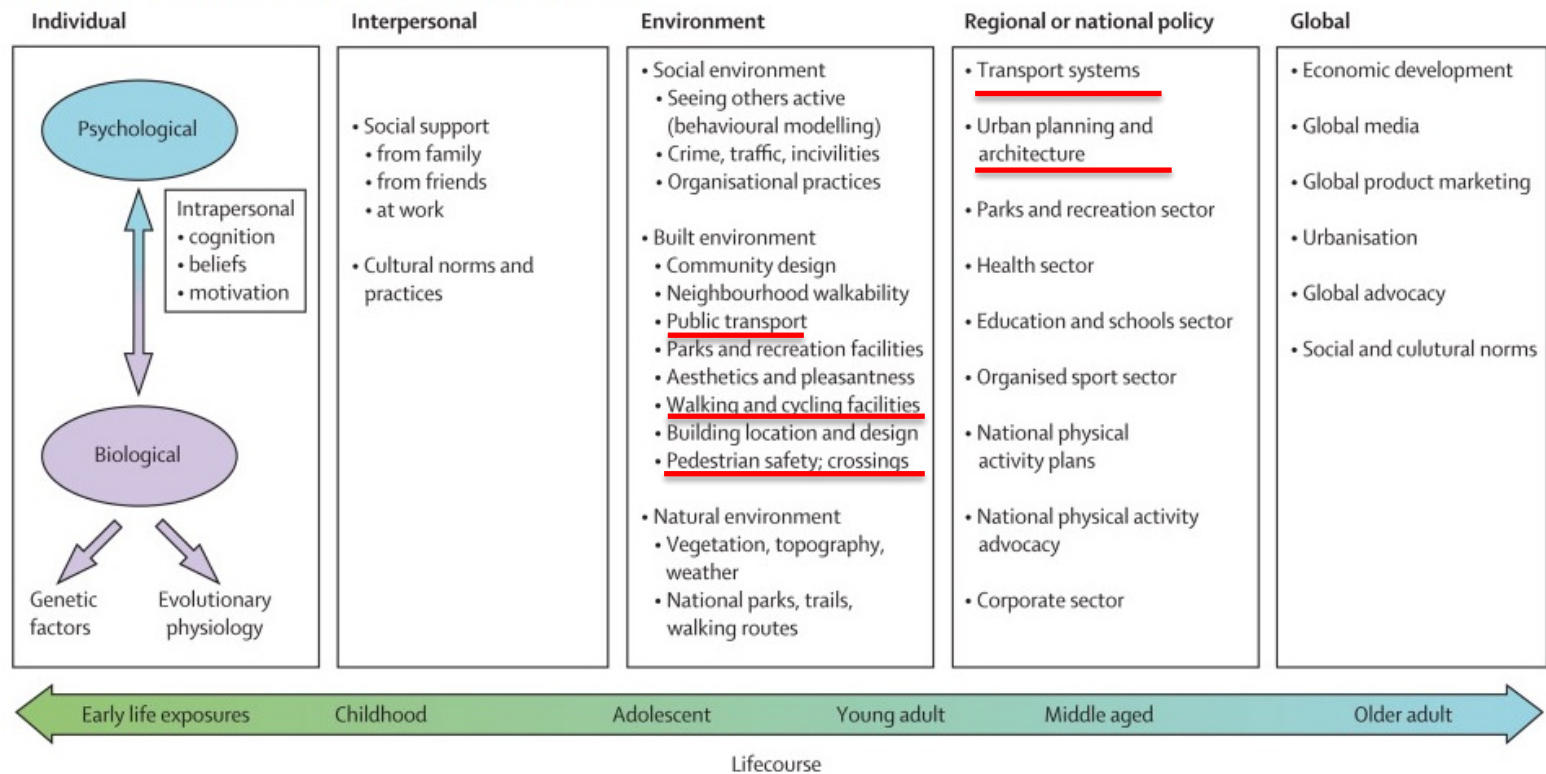
# Determinants of physical activity

**Figure 1**  
Adapted ecological model of the determinants of physical activity



# Determinants of physical activity

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Adapted ecological model of the determinants of physical activity





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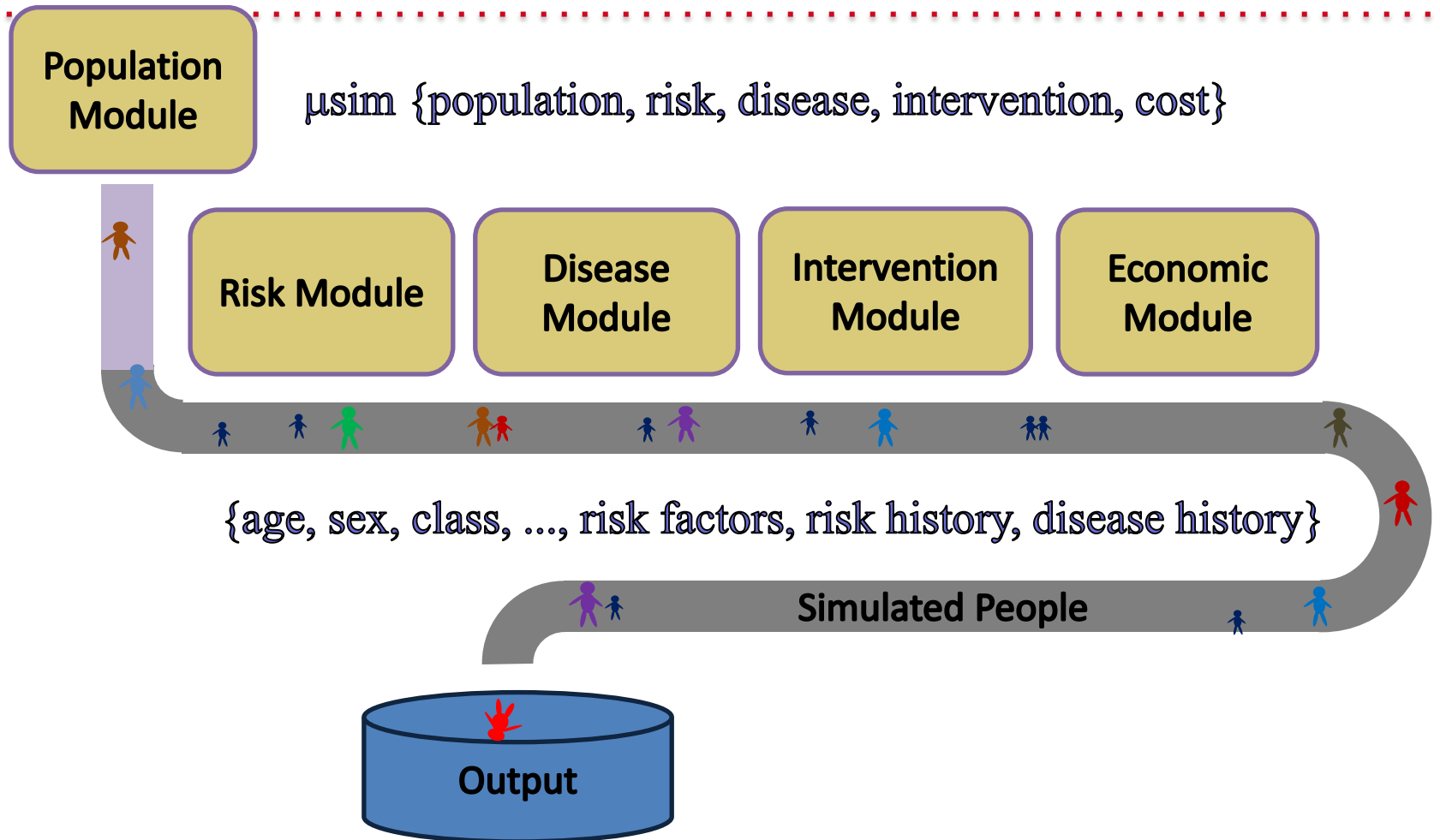
## Micro-simulation models

- Obesity (over 70 countries)
- Tobacco

### In development

- **Physical Activity – active transport**
- Alcohol
- Coronary heart disease
- Chronic obstructive pulmonary disease
- Type 2 Diabetes
- Chronic Kidney Disease
- Salt

# Micro-Simulation



# Micro-simulation Dynamic Elements

population  
model

$Population_0$ ,  $birth-rate_0$ ; birth rate, death rate, distribution by age and sex

risk model

Risks factors: BMI, tobacco, alcohol, salt, **physical activity**

disease  
model

$Incidence_0$ ,  $survival_0$ ,  $mortality_0$ : incidence dynamic via risk distribution; incidence, survival, mortality

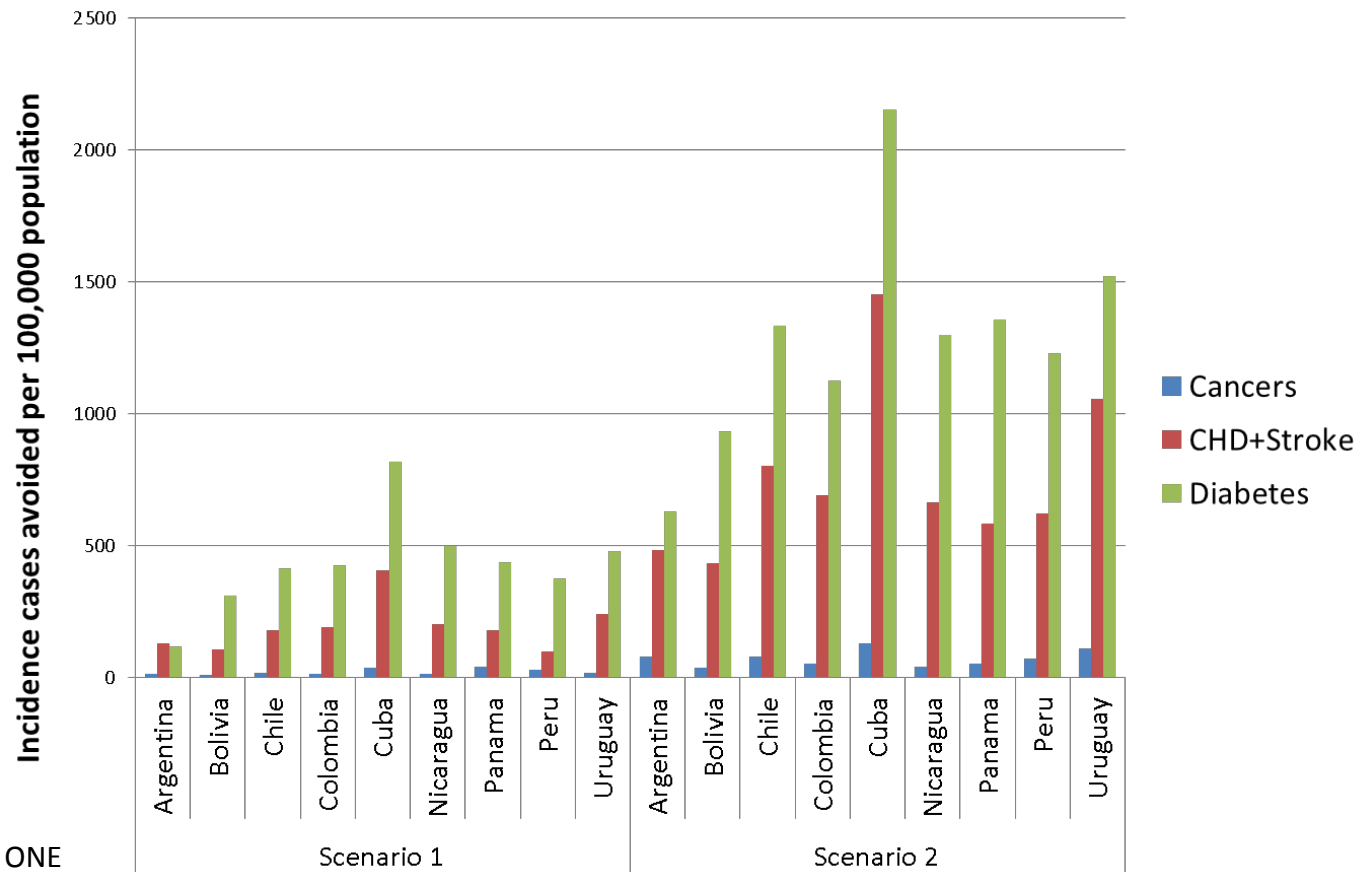
intervention  
model

Static/ Dynamic

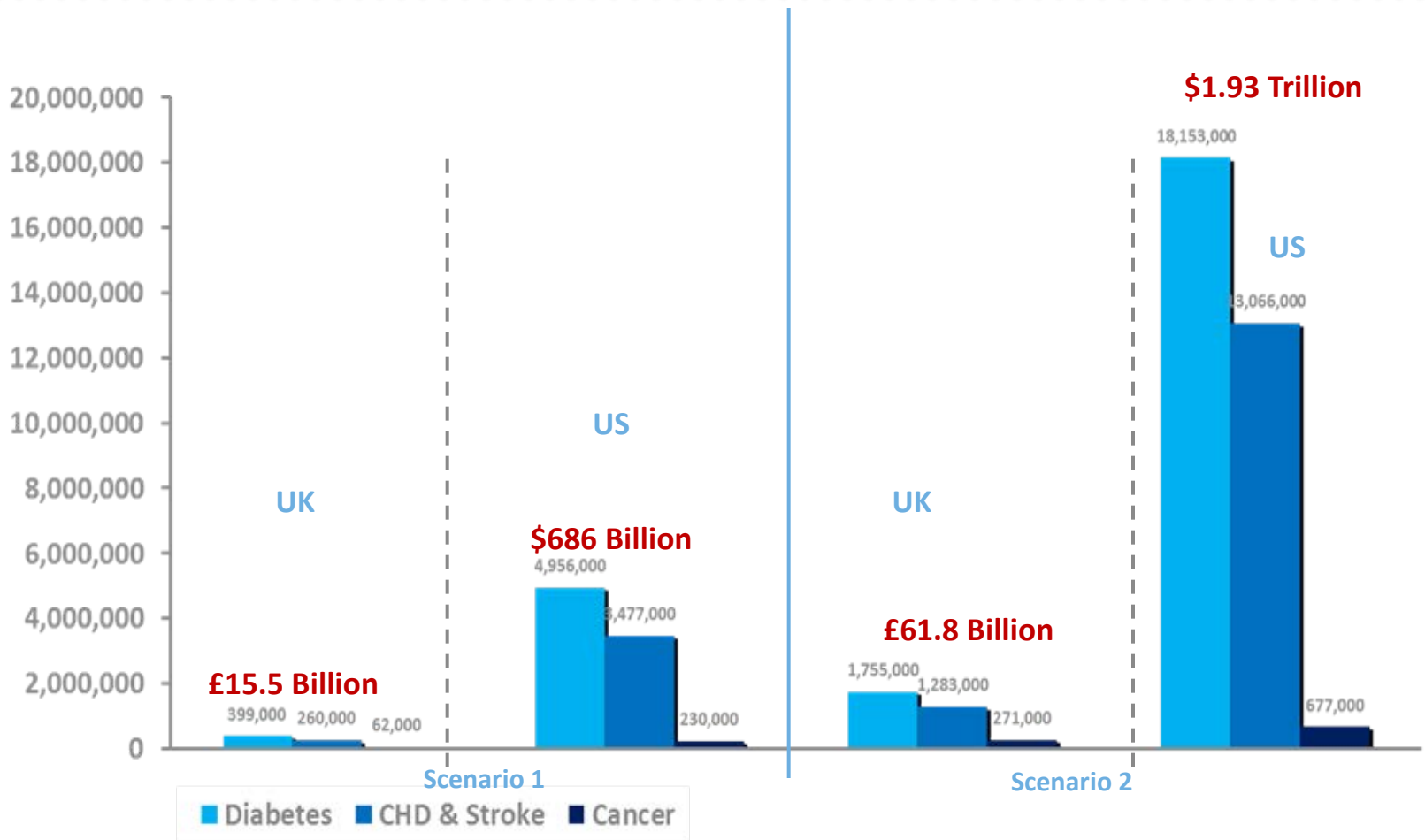
cost model

$Costs_0$ ; costs

# Interventions – example from previous work



# Healthcare costs avoided – example from previous work



Wang et al. Health and economic burden of the projected obesity trends in the USA and the UK. 2011. The Lancet.

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## Strengths and limitations

- + test what-if scenarios
- + dynamic – account for changes in disease epidemiology
- Large amount of data

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## Data requirements – active travel model

- **Population data:** births, deaths, population distribution by age and sex
- **Risk data:** active travelling distribution in population by age, sex, ethnicity and social class
- **Epidemiological data:** disease incidence, prevalence, mortality and survival
- **Evidence from intervention studies,** including uptake and sustainability. Are all the population groups equally affected?

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**Thank you!**

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## References

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