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Health-related environmental deprivation: small area measures for the UK

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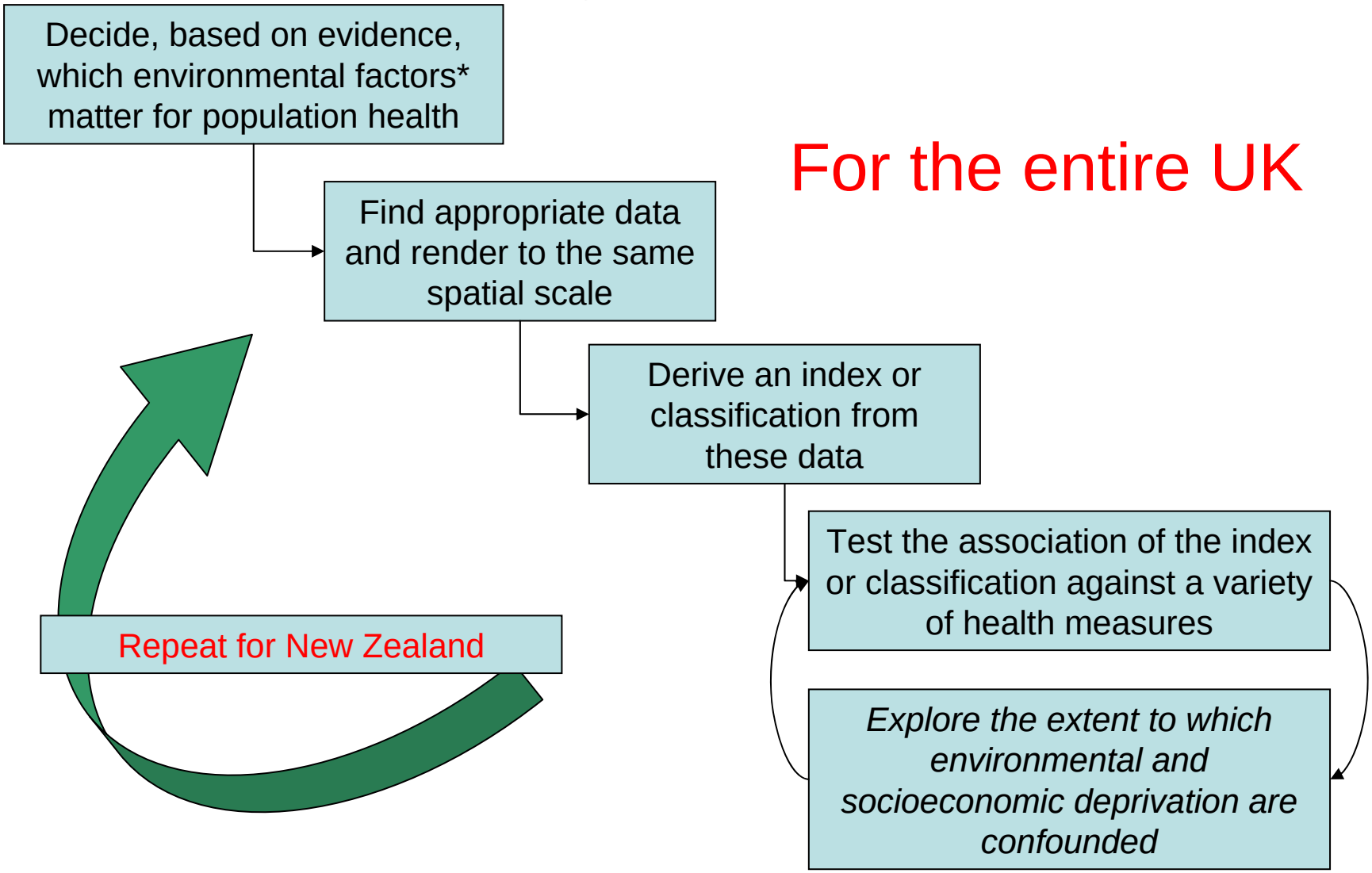
The origins of our idea: socioeconomic deprivation measures

- Epidemiology repeatedly demonstrates that socioeconomic deprivation is *the* key factor driving health inequalities
  - Direct effects (e.g. cortisol)
  - Indirect effects (e.g. smoking)
- Not unusual to see 70-80% of variation in health outcomes "explained" by socioeconomic deprivation measures
- These measures are often composite, multivariate indices or classifications of small areas

Applying this idea to physical environment

- These measures typically include unemployment, overcrowding, tenure, access to cars, low occupational class
  - Carstairs index, Index of Multiple Deprivation, Townsend score
- The purpose of these indicators is not to examine the pathways by which their constituent variables influence health, but to distinguish populations where the burden is relatively higher or lower
- Inspired by these measures, in this project we asked
  - Is it possible to construct similar health-related measures for multiple physical environmental deprivation?
  - If so, does the resulting measure help in explaining spatial health inequalities?
- NB: We care as much about how environment can help keep people healthy as we do about how it makes people sick
  - Salutogenic and pathogenic factors

Project outline



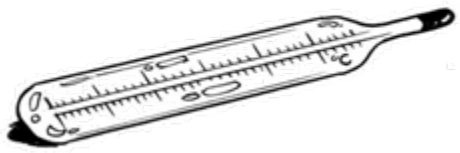
For the entire UK

* At least 10% of UK population must be exposed

Summary of the environmental characteristics included

- Pathogenic factors (i.e. BAD for you):
  - Air pollutants (NO_2, SO_2, PM_{10})
  - Proximity to industry
  - Cold climate (annual average temperature)
- Salutogenic factors (i.e. GOOD for you):
  - Solar UV radiation
  - Green space availability (% in the ward)
- Geography = UK CAS wards:
  - n = 10,654 (in 2001)
  - Average population ~5,500

Index or classification?

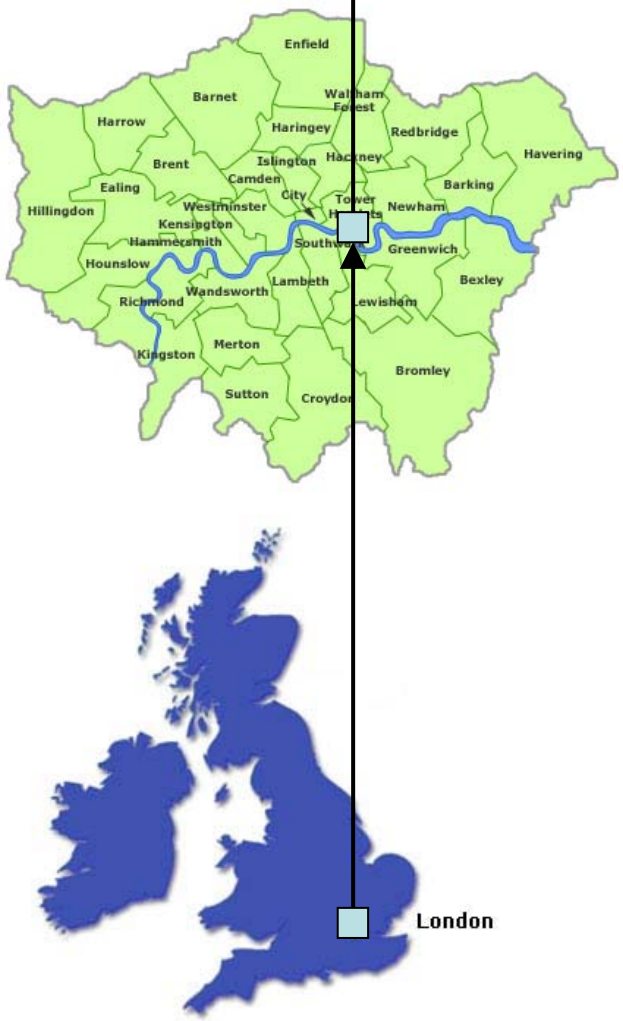


- An index
  - scale, in which increasing value reflects increasing environmental burden
- A classification
  - a label / category which reflects the presence of specific combinations of environmental characteristics
- We felt we needed to explore both

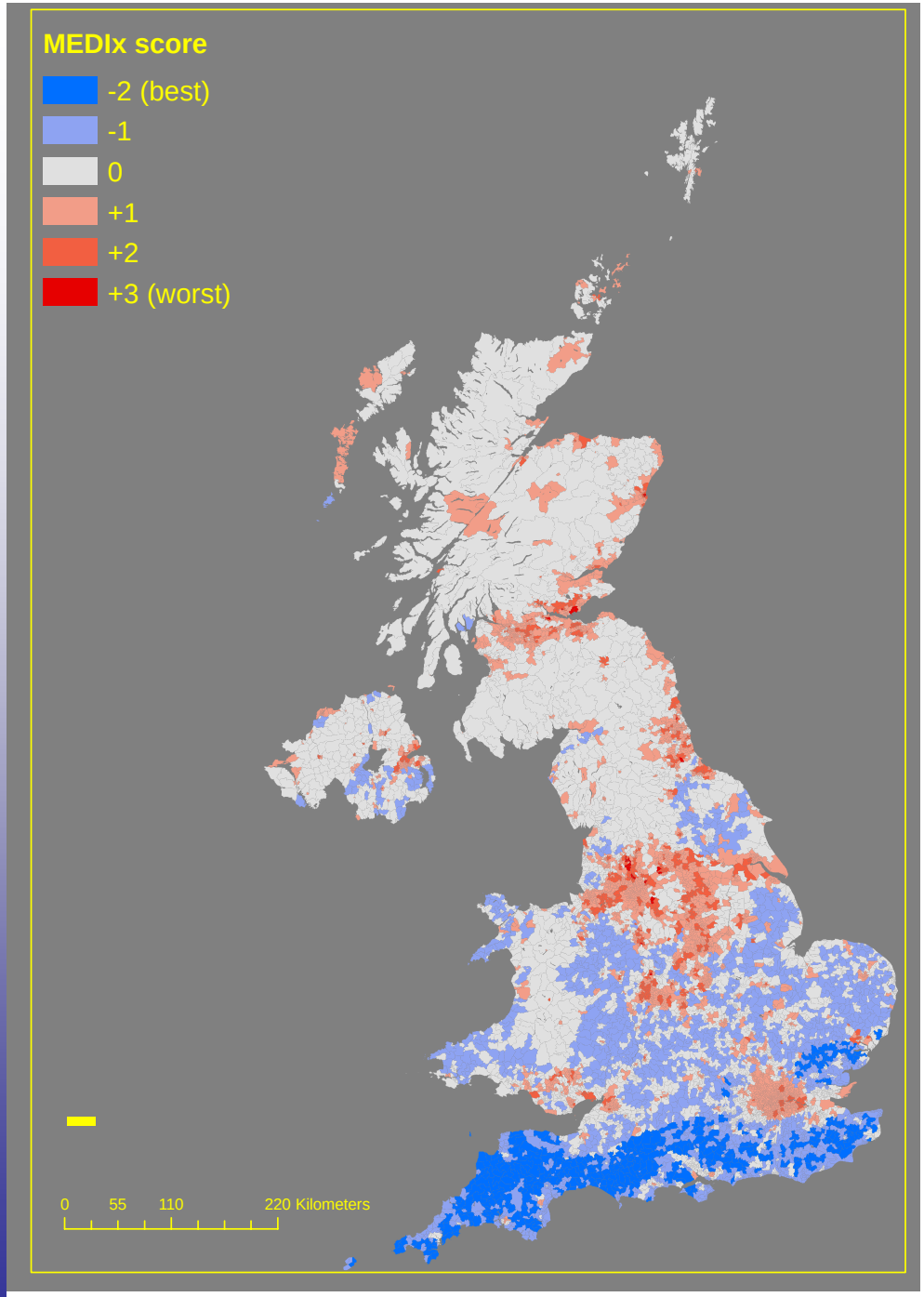
Multiple Environmental Deprivation Index (MEDIx)

- A ward scored +1 for each detrimental environmental factor it was exposed to (NB 'exposed' was defined as being in the worst quintile, or 20%, in the UK)
  - For air pollution it was highest quintile in *any* of the 3 pollutants measured
- It scored -1 for each beneficial environmental factor it was exposed to at the highest level (best quintile).
- MEDIx is simply the sum of these scores
- NB
  - we have not weighted the environmental characteristics

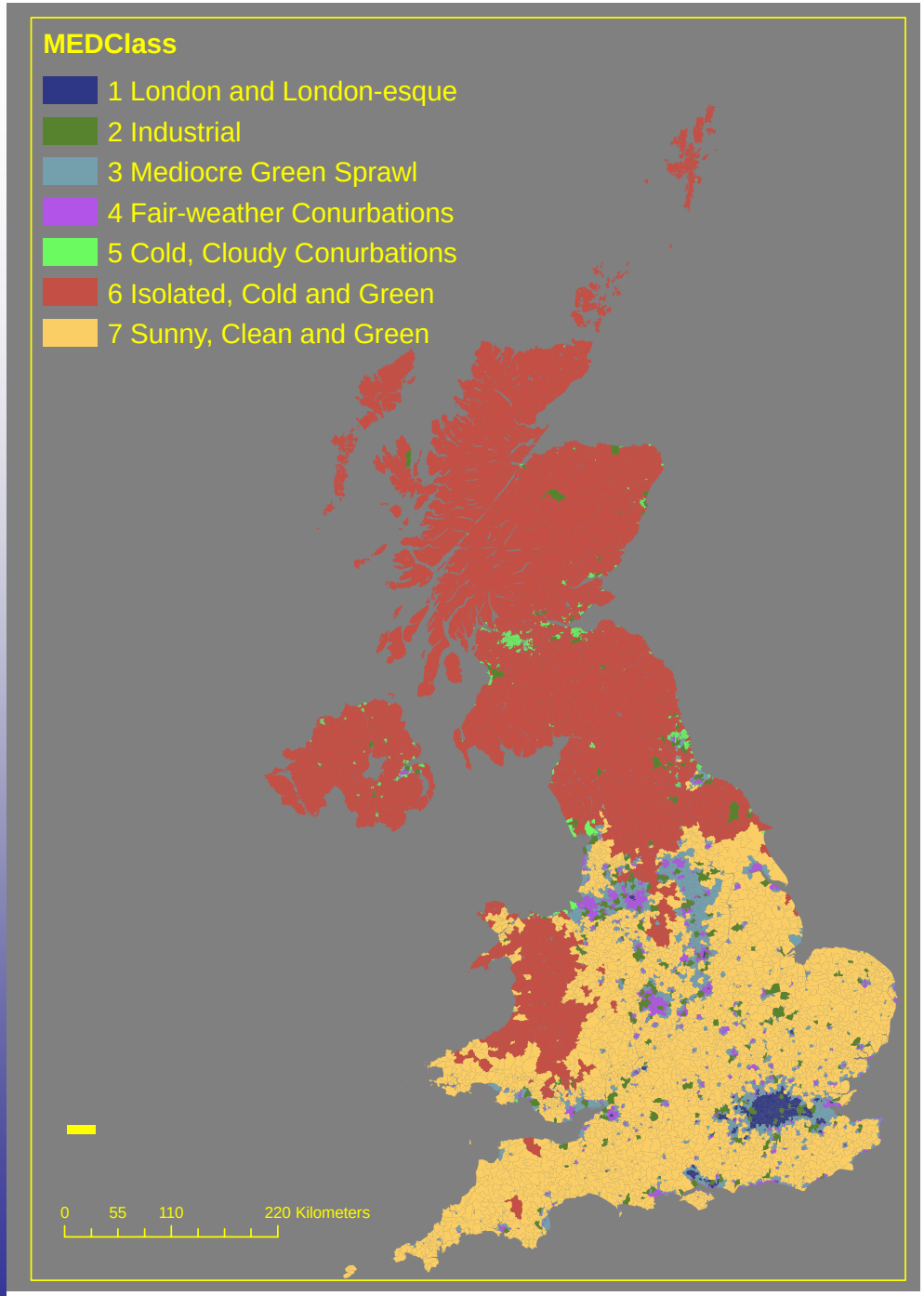
A worked example



e.g. Rotherhithe, East End of London:	
Detrimental exposures:	*Score*
Highest quintile of any air pollutant?	+1
Highest quintile of proximity to industry?	+1
Coldest quintile of avg. temperatures?	0
Beneficial exposures:	
Highest quintile of green space availability?	0
Highest quintile of UV levels?	0
MEDIx	**+2**

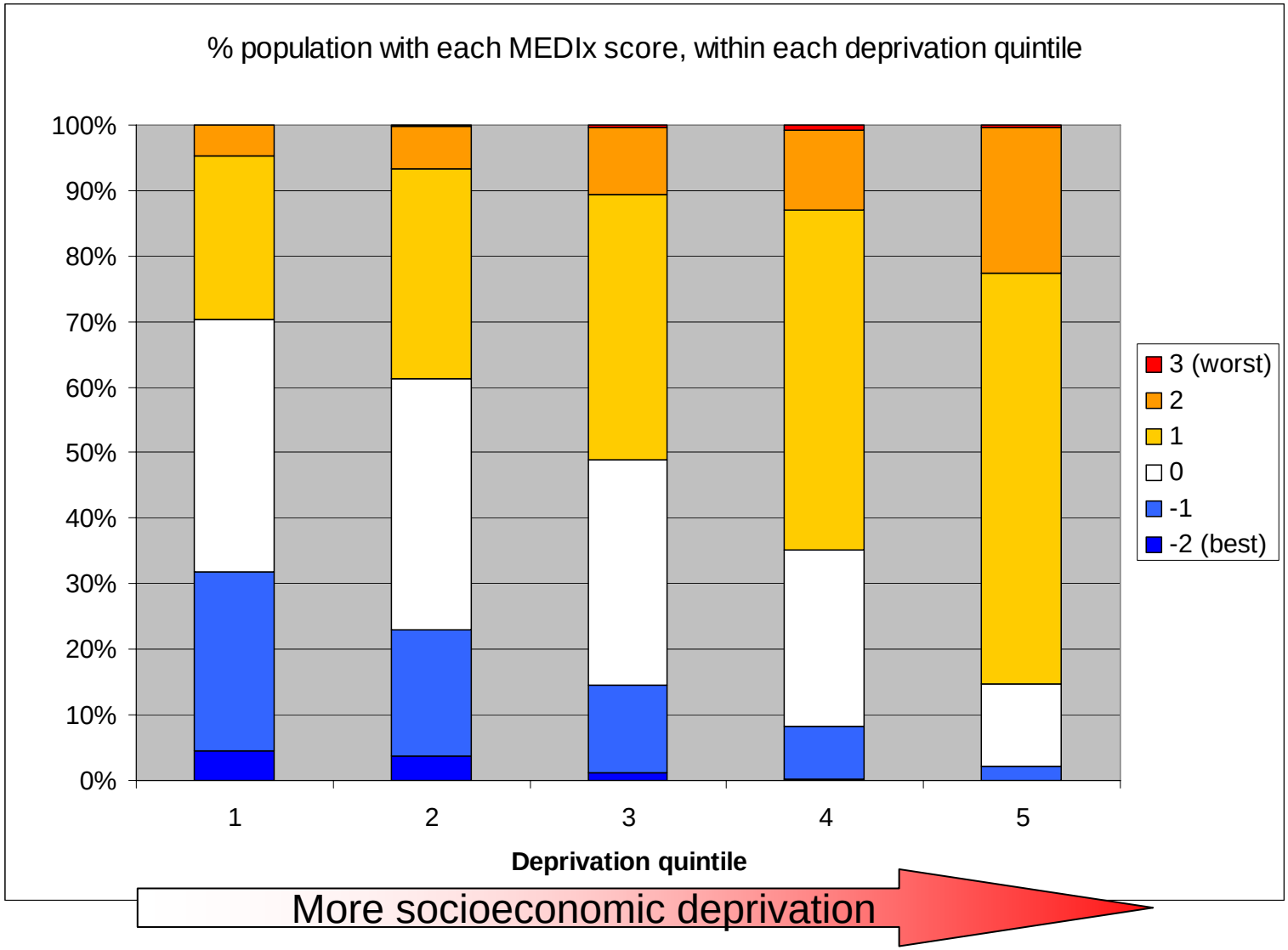


- MEDIx
  - Clear identification of a ‘best environment’ strip in southern England
  - Absence of ‘best environment’ in the north
  - Urban areas highlighted



- Multiple Environmental Deprivation Classification (MEDClass)
- Derived from an off-the-shelf classification procedure
- MEDClass also portrays a north/south difference, though not the ‘southern strip’ pattern as seen with MEDIx
- Differentiates between different types of city
- Largely lumps rural areas together as either class 6 or 7

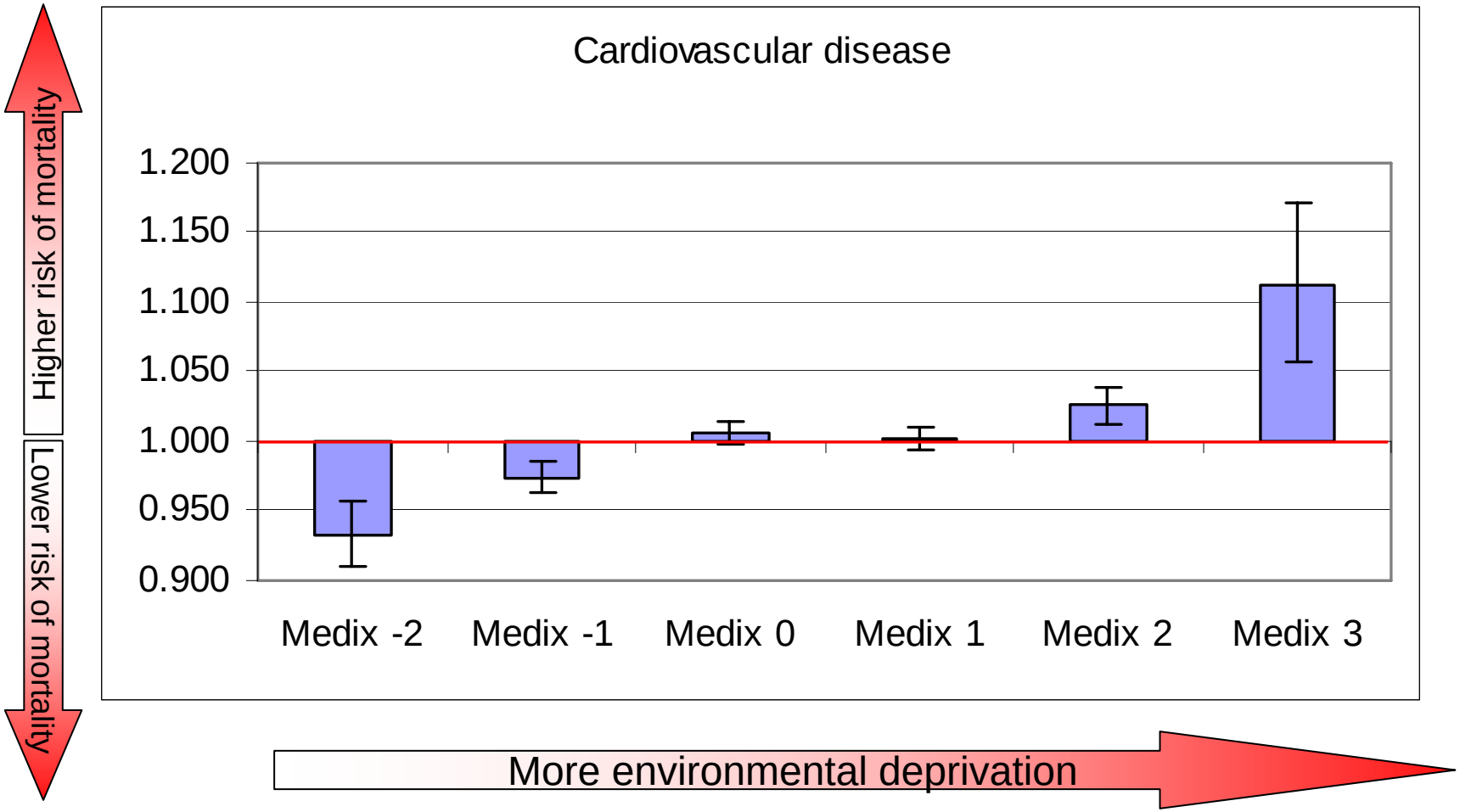
MEDIx and socioeconomic deprivation



So, what about the relationship to health?

- Which health outcomes have we explored?
- Mortality from
  - All causes excluding external causes (International Classification of Disease: ICD-9 codes <800, ICD-10 codes A00–R99)
  - All cancer (ICD-9 140-239; ICD-10 C00–D48)
  - Lung cancer (ICD-9 162; ICD-10 C33-C34)
  - Colorectal cancer (ICD-9 153-154; ICD-10 C18-C20)
  - Female breast cancer (ICD-9 174; ICD-10 C50)
  - Prostate cancer (ICD-9 185; ICD-10 C61)
  - Oesophageal cancer (ICD-9 150; ICD-10 C15)
  - Cardiovascular disease (ICD-9 390-459; ICD-10 I00-I99)
  - Respiratory disease (ICD-9 460-519; ICD-10 J00-J99).
  - Two measures of self-reported morbidity: population reporting poor health and those detailing a limiting long term illness
- Associations explored in negative binomial regression models which adjust for age, sex, and socioeconomic deprivation

What does it look like when we find an association (NB adjusted for socioeconomic deprivation)?



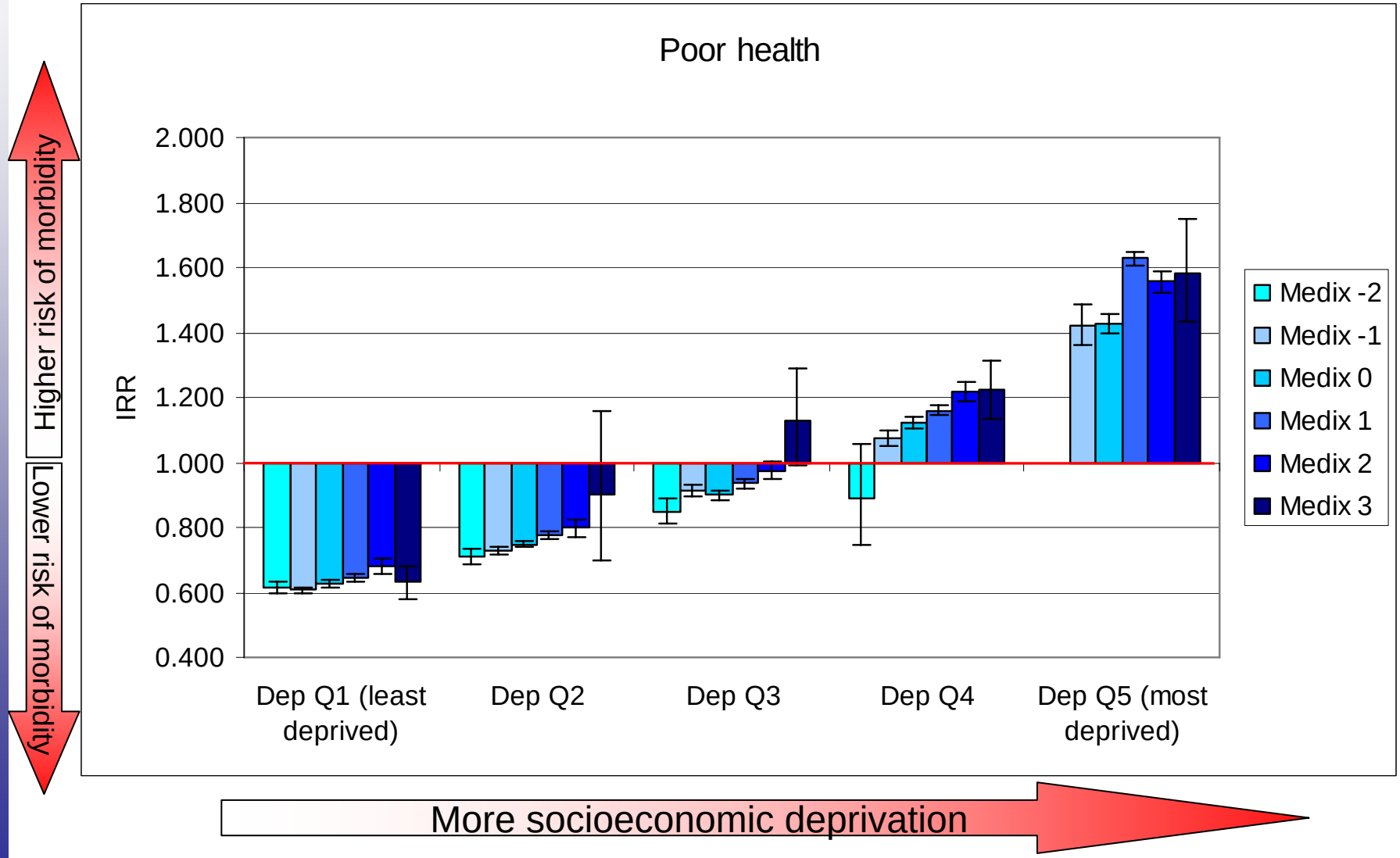
MEDIx association summary

- Is there a graded relationship?

✓ all causes (excluding external causes), all cancer, lung cancer, cardiovascular disease, respiratory disease, limiting long term illness, not good health

✗ colorectal cancer, breast cancer, prostate cancer, oesophageal cancer

People who have similar levels of socioeconomic deprivation, but differing physical environments



Caveats

- Migration
  - About 10% of people move house every year
  - The time they have spent exposed to a physical environment (in an accumulation sense and in a life stage sense) will influence any impact that environment has
  - We have not accounted for migration in this analysis
- Confounders
  - We have only controlled for socioeconomic deprivation
  - We know that this is a powerful predictor of aspects of life and lifestyle which influence health, but it is not perfect
  - The extent to which we have adequately controlled for other influences on health and thus isolated physical environmental deprivation is unknown

Summary

- Yes, it is possible to construct summary measures of multiple environmental deprivation
- You can have them!
- Pros
  - Rigorous, well-documented process ☺
  - Evidence-based in terms of characteristics included
- Cons
  - Arbitrary decisions on exposure
  - Data limitations (we wanted to include noise and water quality)
  - Weights!?