Ancillary Health Effects of Climate Mitigation Scenarios as Drivers of Policy Uptake: A Review of Air Quality, Transportation and Diet Co-Benefits Modeling Studies

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Comprehensive review

- Studies on *air quality, transportation, & diet* published since the 2009 Lancet Commission that
  - Quantified population level health outcomes
  - Related these to changes in exposure(s)
  - Correlated with a specified climate mitigation scenario or policy
- Goal was to identify opportunities for increased consistency and collaboration to better inform policy-making

Results

- 42 studies met the inclusion criteria
- Air quality, transportation, & diet scenarios ranged from specific policy proposals to hypothetical scenarios, & from global recommendations to stakeholder-informed local guidance
- Geographic & temporal scope and validity of scenarios determined policy relevance
- More recent studies tended to use more sophisticated methods to address complexity in the relevant policy system
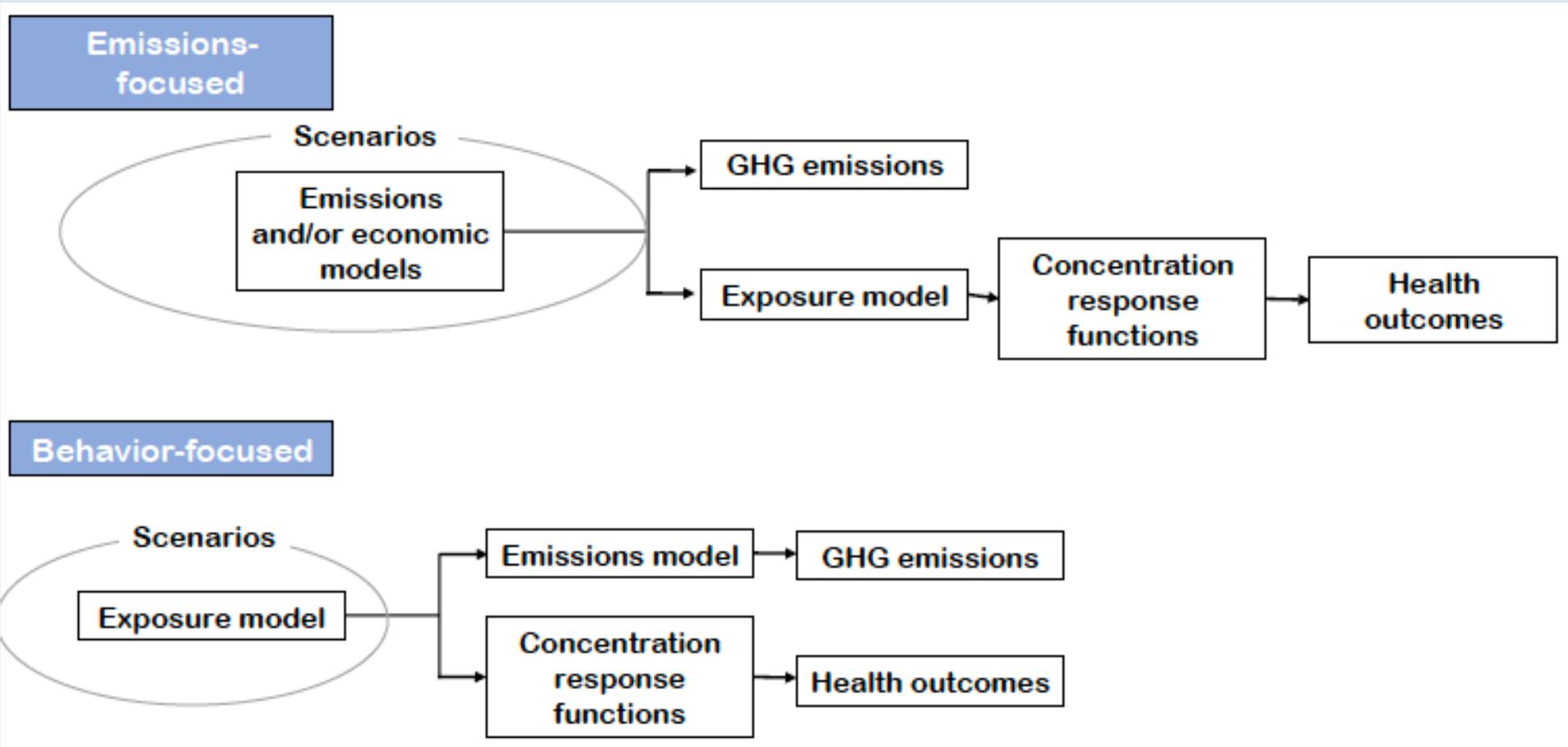
Studies

- Specified
  - Mitigation strategy
  - Association with health drivers
  - Population
  - Time scale
    - Baseline trends in demographics, health-related exposures, and health
  - Change in health driver & health outcome

- Most, but not all, conducted sensitivity or uncertainty analysis
- Just over half reported the health co-benefits in monetary terms in addition to specific health outcomes

Studies

- Utilized a range of population-specific data
- Often employed standard sector-specific economic, atmospheric, transportation, health impact, & climate models
- Relied on epidemiological literature to specify concentration response functions, often stratified by relevant population segments
  - Sometimes had to rely on epidemiological studies derived from populations other than the study population

Two basic approaches to define scenario

- Emissions-focused typical of studies of air quality
- Behavior-focused typical of studies of transport and diet
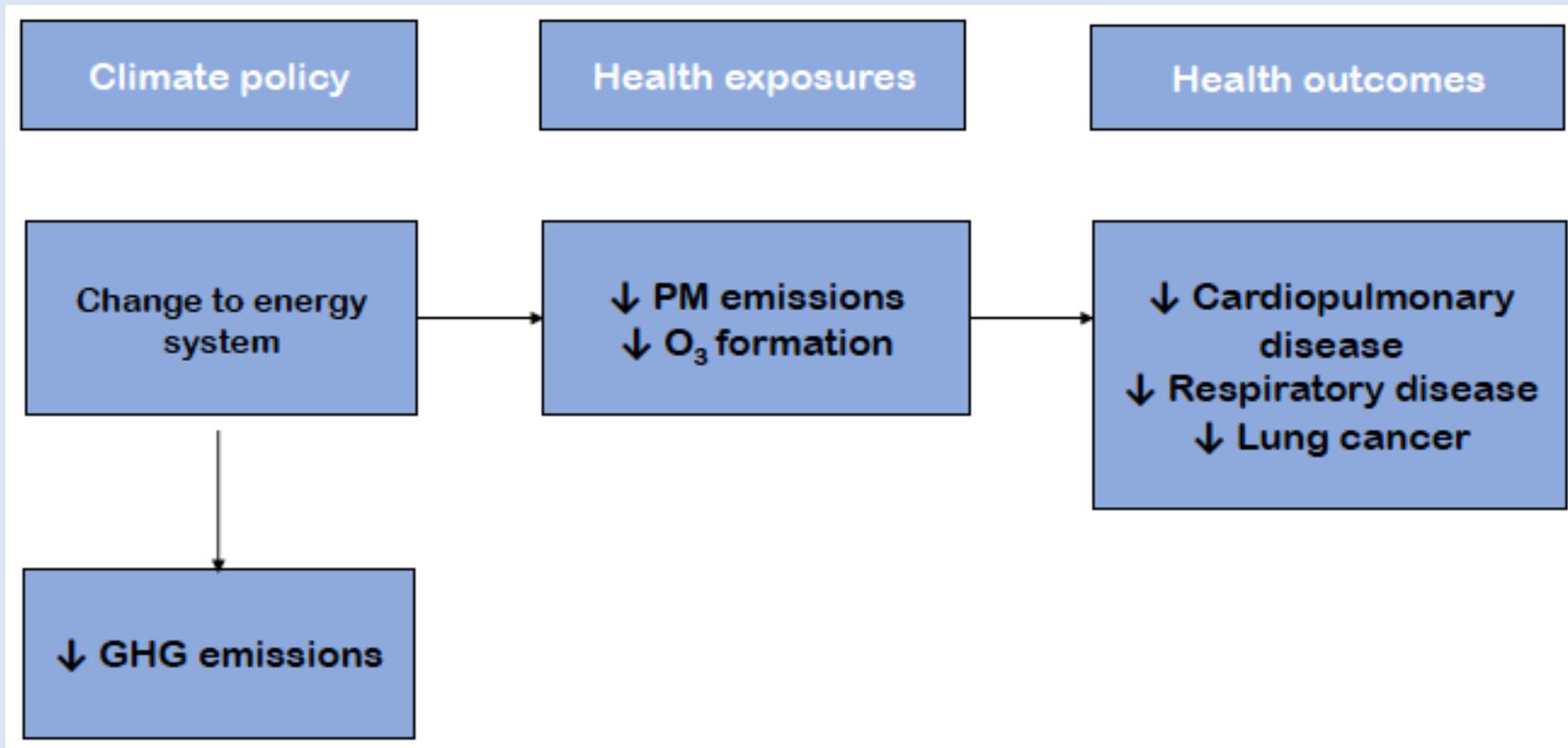
- **Combatting climate change can reduce air pollution by reducing the climate penalty on air quality and by reducing co-emitted air pollutants**
  - Power plants, certain industrial processes, mobile sources, & agricultural activities are sources of GHG emissions
- **24 studies**
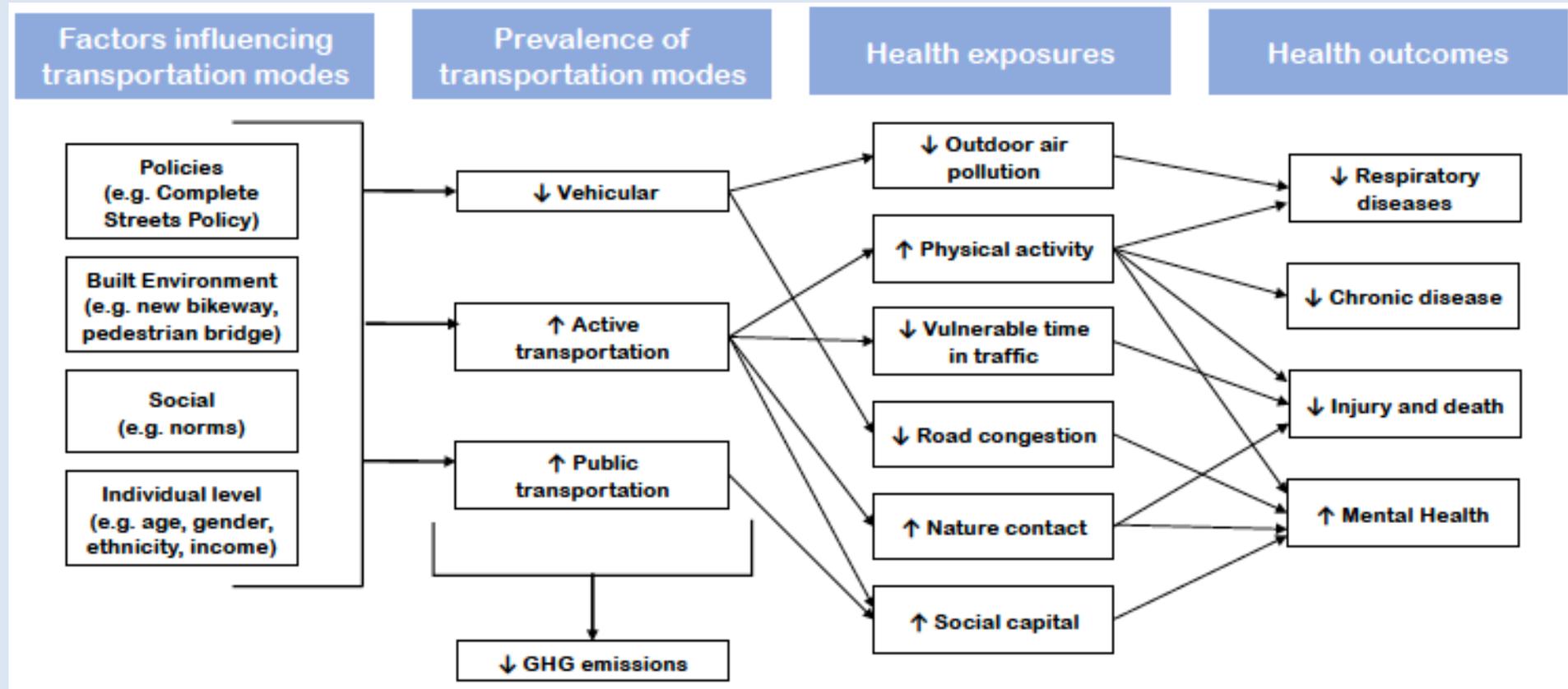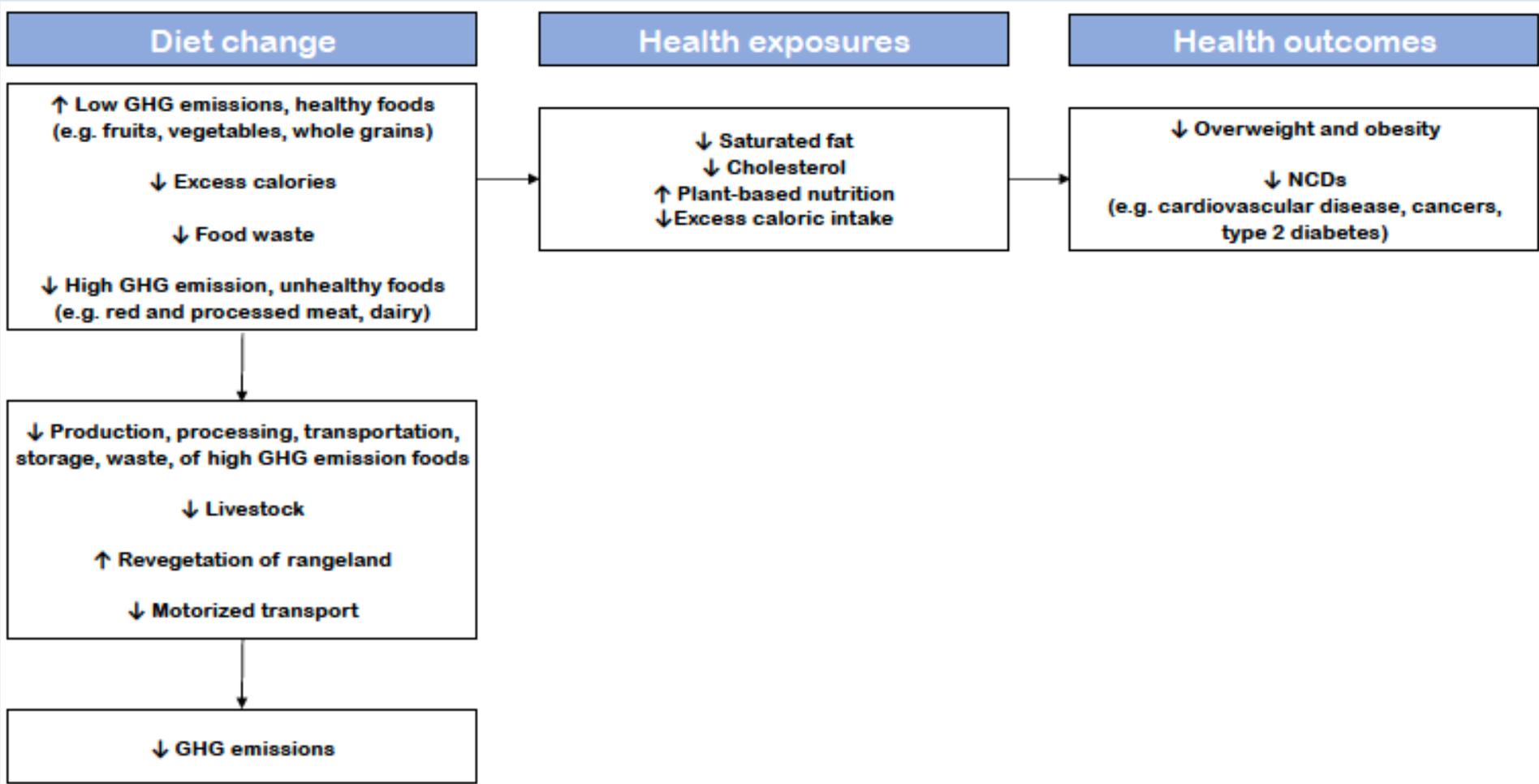
- **The proportion of emissions accounted for by transportation increases as more renewable energy is used in other sectors**
  - **Road transport responsible for about 36% of GHG emissions in California & 40% in New Zealand**
- **12 studies**

Co-benefits – early health gains from wise climate moves

Shifting 5% of short urban car trips to bicycles in New Zealand would save annually

- 22 million liters of fuel
- 116 deaths due to increased physical activity (vs. 5 extra road crash deaths)
- $200 million in health costs

ANZJPH 2011

| Diet change | Health exposures | Health outcomes |

Diet change

↑ Low GHG emissions, healthy foods (e.g. fruits, vegetables, whole grains)

↓ Excess calories

↓ Food waste

↓ High GHG emission, unhealthy foods (e.g. red and processed meat, dairy)

↓ Production, processing, transportation, storage, waste, of high GHG emission foods

↓ Livestock

↑ Revegetation of rangeland

↓ Motorized transport

↓ GHG emissions

Health exposures

↓ Saturated fat
↓ Cholesterol
↑ Plant-based nutrition
↓ Excess caloric intake

Health outcomes

↓ Overweight and obesity

↓ NCDs
(e.g. cardiovascular disease, cancers, type 2 diabetes)

- "Western" diet associated with higher NCDs
- This diet, particularly high consumption of red meat, also associated with higher GHG emissions
- 6 studies

Conclusions

- Most studies indicated significant, nearer term, local ancillary health benefits providing impetus for policy uptake & net cost savings
- However, studies were more suited to describing the interaction of climate policy & health & the magnitude of potential outcomes than to providing specific accurate estimates of health co-benefits

- Modeling the health co-benefits of climate policy provides policy-relevant information when the scenarios are reasonable, relevant, & thorough
  - And when the model adequately addresses complexity
- Greater consistency in selected modeling choices across the health co-benefits of climate mitigation research would facilitate evaluation of mitigation options particularly as they apply to the NDCs & promote policy uptake

The diversity of approaches to modeling mitigation options and their health effects inhibits meta-analyses & syntheses of results useful for policy-making

Background

- Significant mitigation efforts beyond the Nationally Determined Commitments (NDCs) under the 2015 Paris Climate Agreement are required to avoid warming of 2° C above pre-industrial temperatures

- Health co-benefits represent selected near term, positive consequences of climate policies that can offset mitigation costs in the short term before the beneficial impacts of those policies on the magnitude of climate change are evident

Requirements for co-benefits studies to support a climate policy

- Meaningful scenarios
- Translation of policy into behavior
- Influence of behavior on emissions
- Relationship of emissions to health-determinant exposures
- Quantification of health outcomes as a result of exposure
- E.g. link credible models of economic behavior, environmental processes, & health

Jack & Kinney 2010