Quantifying the Health Impacts of Active Transport :

The Integrated Transport & Health Impacts Model (ITHIM)

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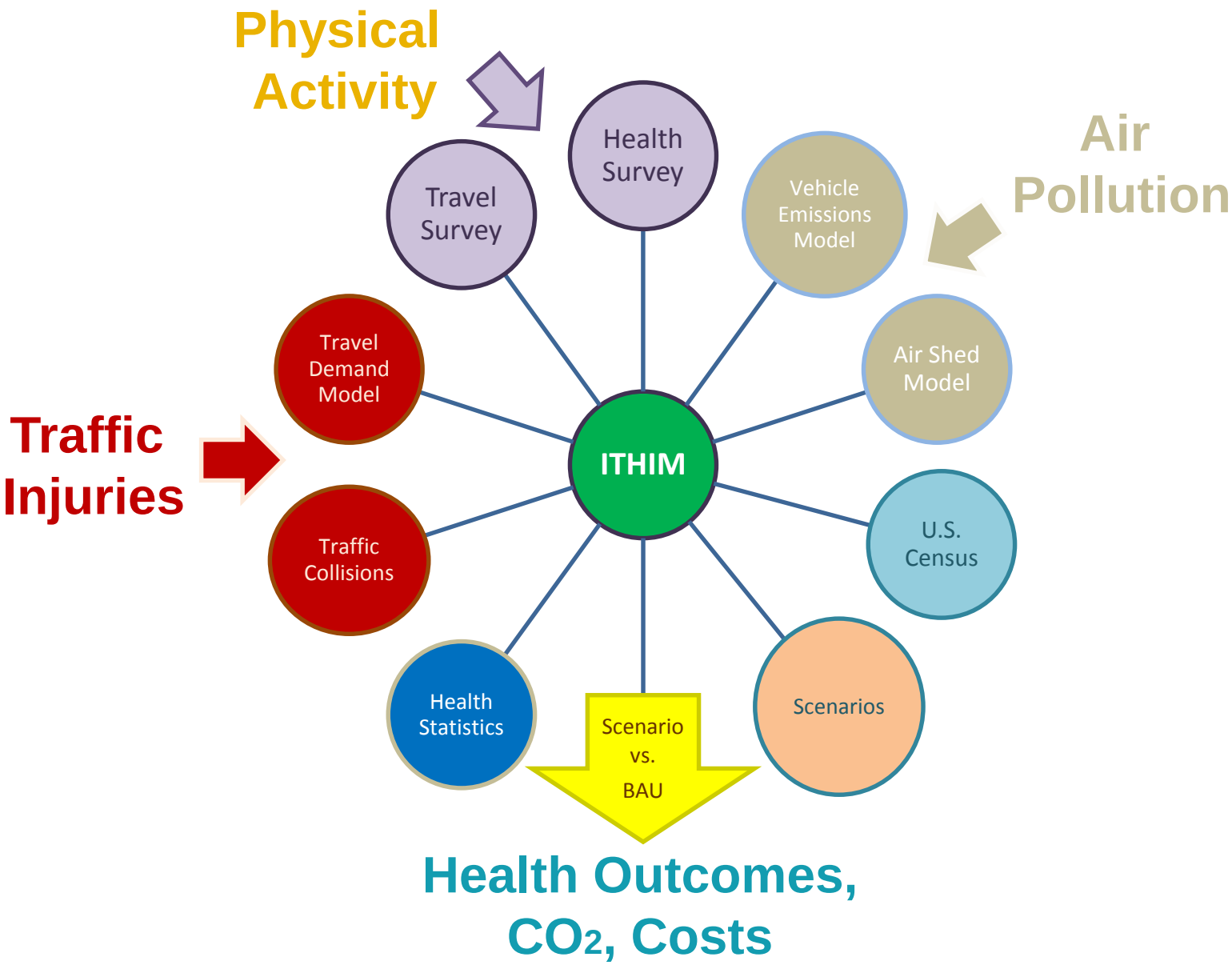
What is the Integrated Transport & Health Impacts Model (ITHIM)?

Integrated Transport & Health Impacts Model (ITHIM)



Uses for ITHIM

- ✓ Estimate the health benefits or harms of regional transportation plans/sustainable communities strategies

- ✓ Estimate the health benefits of meeting targets in transportation plans (e.g., increases in travel-related physical activity)

- ✓ Place-based assessments of health impacts, especially as it relates to environmental justice issues

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Why focus on active transportation and health?

Climate Change

- ✓ Climate change is the most significant threat to public health in the 21st century
- ✓ California is the 12th largest greenhouse gas emitter in the world
- ✓ Transportation is the largest source of GHGs in California—36% of total
- ✓ Passenger vehicles account for 25% (70% of the 36% above)
- ✓ California is already working ambitiously to reduce GHG emissions

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Chronic Diseases in California

- ✓ **8 out of 10 deaths** are due to chronic diseases (heart disease, stroke, cancer, diabetes, obesity, chronic respiratory ailments)
- ✓ More than **1 in 3 Californians** live with at least one chronic condition; more than half of those have multiple chronic conditions
- ✓ About **23,000 deaths** per year are directly attributable to lack of physical activity
- ✓ In 2010, California spent **$98 billion** treating six chronic conditions: arthritis, asthma, cardiovascular disease, diabetes, cancer, and depression

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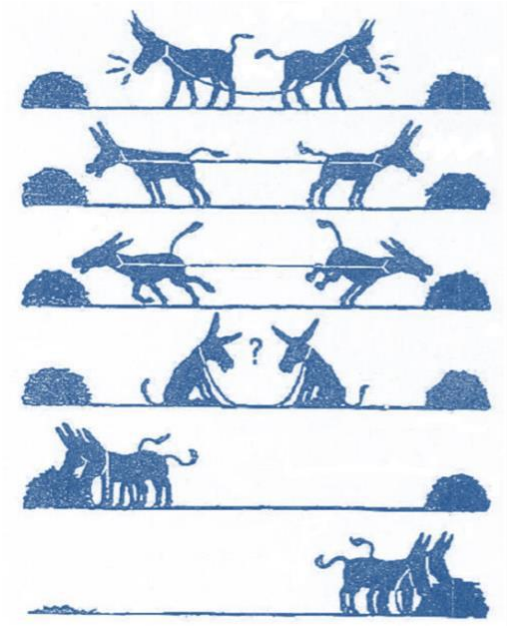
Strategies Can Address Both Problems

GHG Emissions



Chronic Disease

- Strategies to reduce GHG emissions also impact health
- Do the strategies generate health co-benefits?
- Do the strategies generate harms?
- How do we measure this?
- Find “win-win” strategies

Active Transportation Addresses Both Problems

Physical Activity

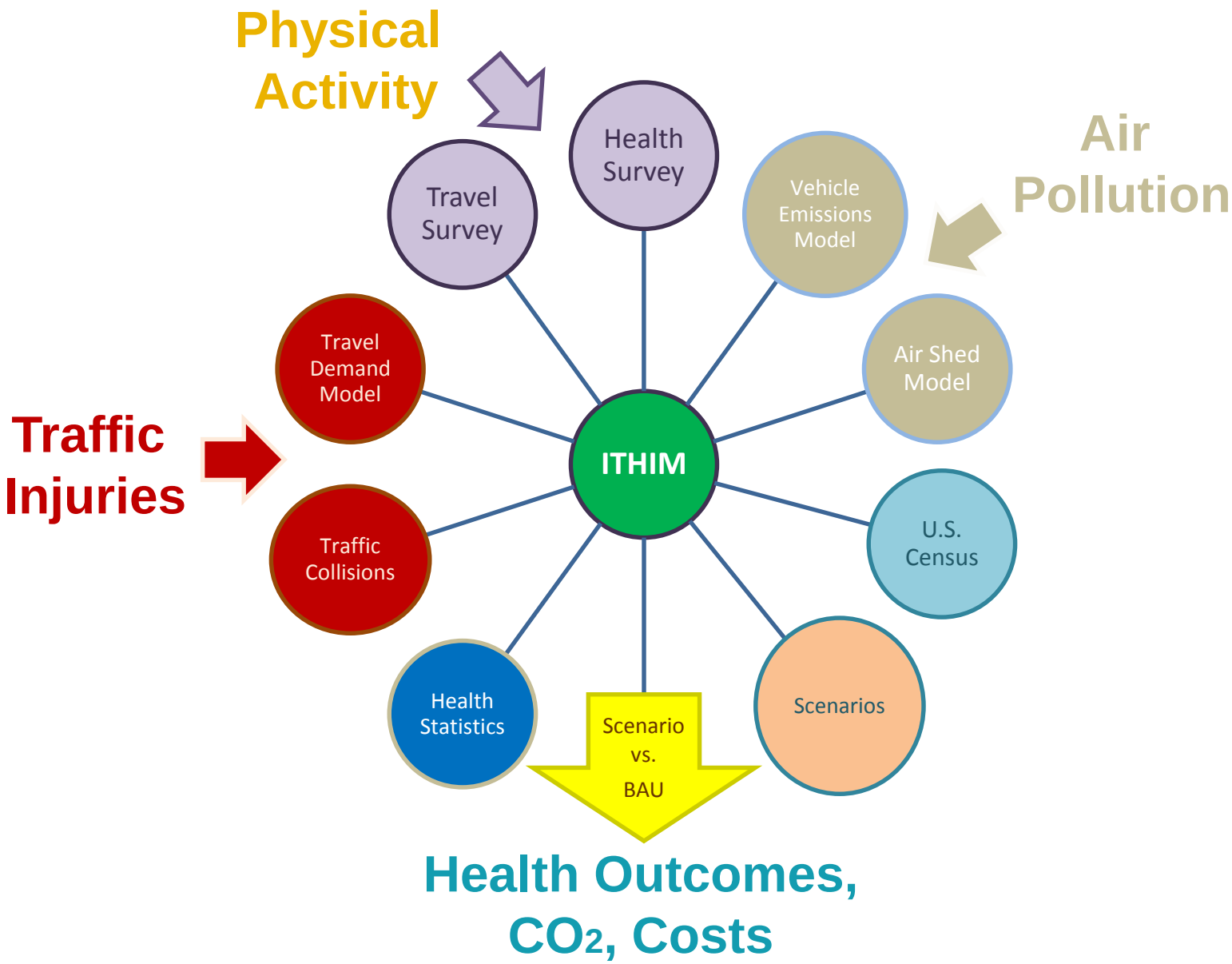
Air Pollution

GHG Emissions

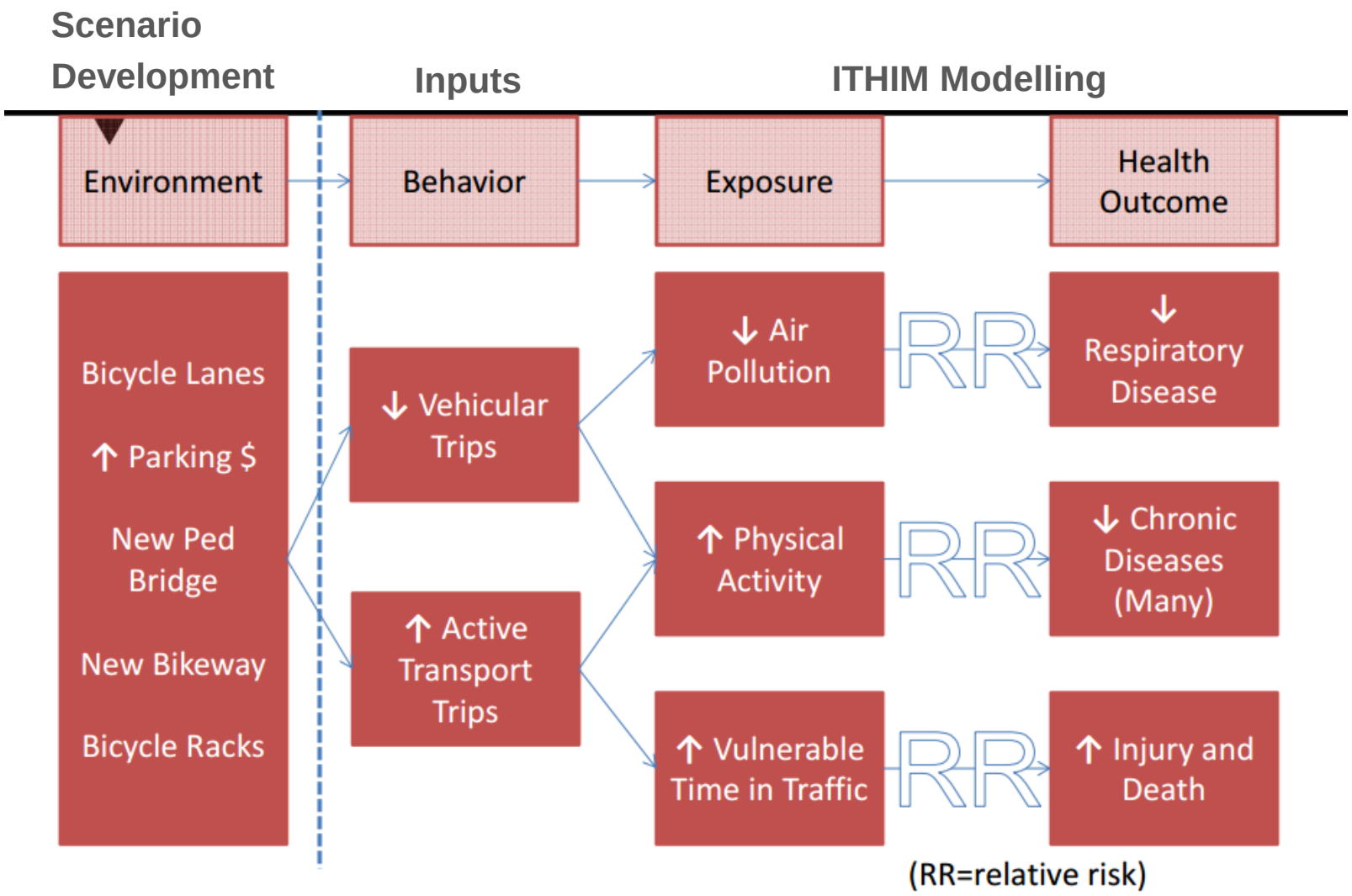
Active Transportation = Win-Win

How does the Integrated Transport & Health Impacts Model (ITHIM) work?

Integrated Transport & Health Impacts Model (ITHIM)



What ITHIM Does and Doesn't Do



ITHIM Modelling

Baseline Data:

- Physical activity (transportation)
- Disease burdens
- Air pollution
- Collision and travel history

Scenario:

- Active transportation (walking and biking)
- Vehicle/transit miles traveled

Epidemiological Calculations:

- Comparative risk assessment based on relative risk

ITHIM Health Pathways

Physical Activity – *hours per week spent walking and biking*

- Heart Disease (Ischemic and Hypertensive)
- Stroke
- Diabetes
- Dementia
- Depression
- Colon Cancer
- Breast Cancer

Air Pollution –*concentration of fine particulate matter ($PM_{2.5}$)*

- Cardio-pulmonary disease, asthma, inflammatory heart disease
- Acute respiratory diseases in children

Road Traffic Injuries – *miles traveled by parties to a collision*

- Severe and fatal injuries

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ITHIM Health Measures

- Premature Deaths
- Disability Adjusted Life Years (DALYs)
  - ✓ Years Living with Disability + Years of Life Lost
  - ✓ Expresses deaths and illness for different diseases/injuries on a common scale
- Costs

Data Sources

- **Non-travel related physical activity**
  - ✓ California Health Interview Survey (CHIS)
- **CO_2 emissions**
  - ✓ Air Resources Board (EMFAC data)
- **Disease/Injury**
  - ✓ CDPH death data
  - ✓ California Health Interview Survey (CHIS)
  - ✓ Statewide Integrated Traffic Records System (SWITRS)
- **Population**
  - ✓ CA Department of Finance
  - ✓ US Census
- **Travel (mean distances, times, etc.)**
  - ✓ California Household Travel Survey (CHTS)
  - ✓ Travel demand model or travel survey

Strengths of ITHIM

- Established evidence-based relationship between physical activity and health outcomes
- Methodology well-established and part of public health practice
- Measures put all health outcomes on a common scale
- Assumptions incorporate what is empirically observed from the literature
- Fast, free, open source
- Extensive documentation on model development, calibration, use, and training

Limitations of ITHIM

- Geographic Scale
  - Sub-county data and rural data often sparse
- Equity
  - Not broken down by race/ethnicity, income, or other measures of social disadvantage
- Snapshot in Time *(for the results presented here)*
  - Changes are assigned to baseline as if changes happened at one time
- Model vs. Real Life
  - Outcomes will differ with changes in actual implementation

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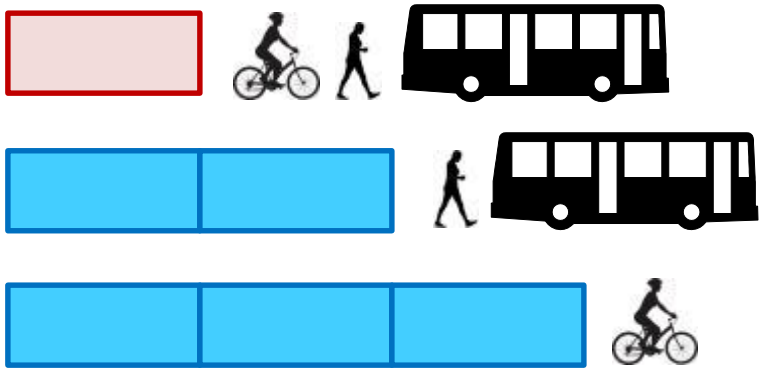
Example of ITHIM Used at the State Level

Statewide Analysis of Active Transport Scenarios

1. CalTrans Strategic Management Plan, 2015-2020 (CSMP2020)

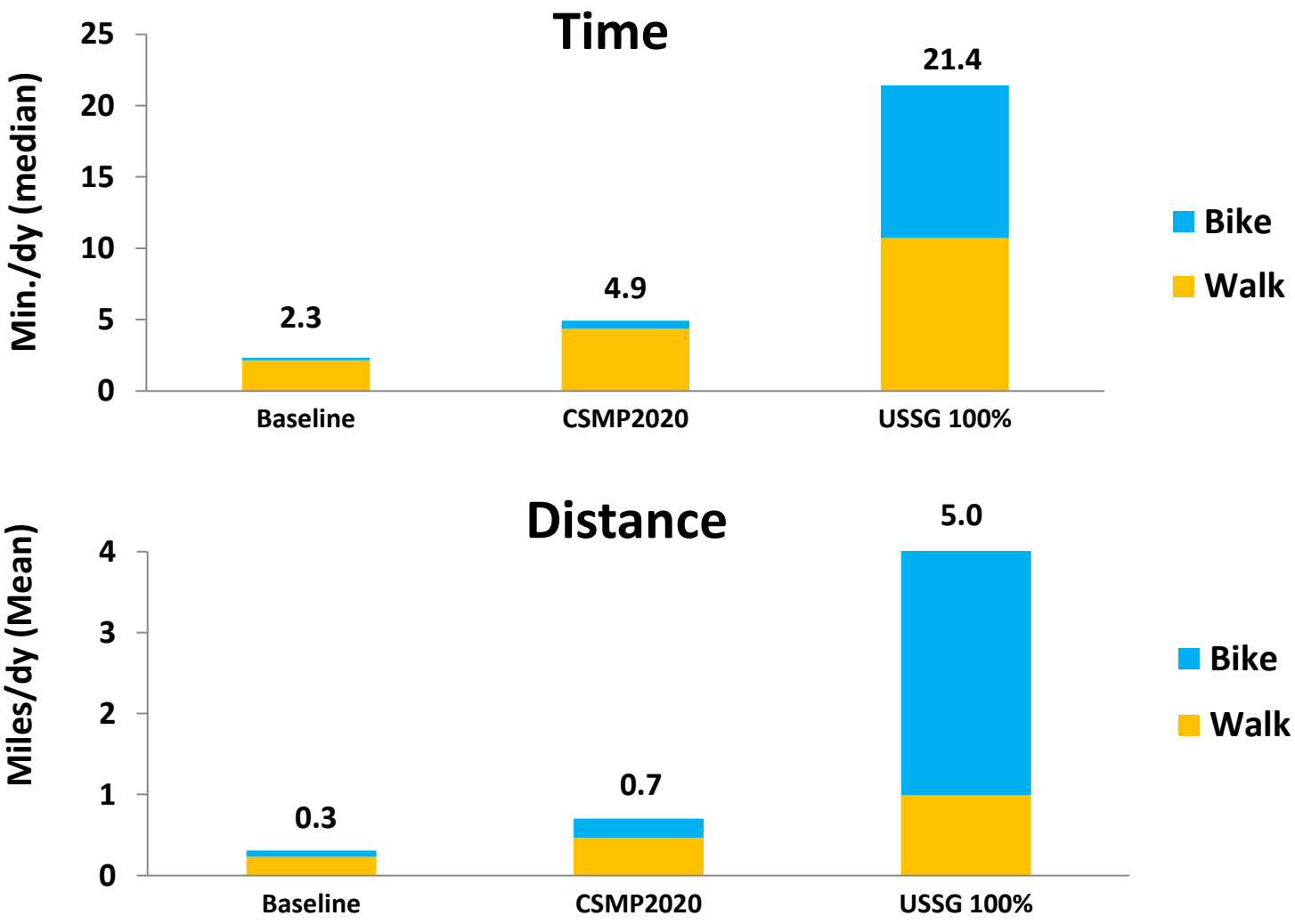
- **Double** walking and transit and **triple** bicycling by **2020**



2. U.S. Surgeon General (USSG) Phys. Activity Recommendations (USSG 100%)

- Increase active transport so that **50% of California adults get 150 minutes** of weekly physical activity from active transport

Daily Active Travel Times and Distances



Daily Active Travel Times and Distances for a Typical Californian by Active Transport Scenario.

Health Impacts of Active Transport Scenarios

	Change in disease burden*	Annual change in premature deaths
Cardiovascular Dis.	3–13%	1,583 – 6,376
Diabetes	3–13%	190 – 789
Depression	1–4%	<1
Dementia	3–7%	488 – 1,288
Breast cancer	1–3%	36 – 112
Colon Cancer	1–4%	48 – 174
Road traffic crashes	8–24%	254 – 690

** Range reflects range of physical activity in scenarios (CSMP2020 vs. USSG 100%)*

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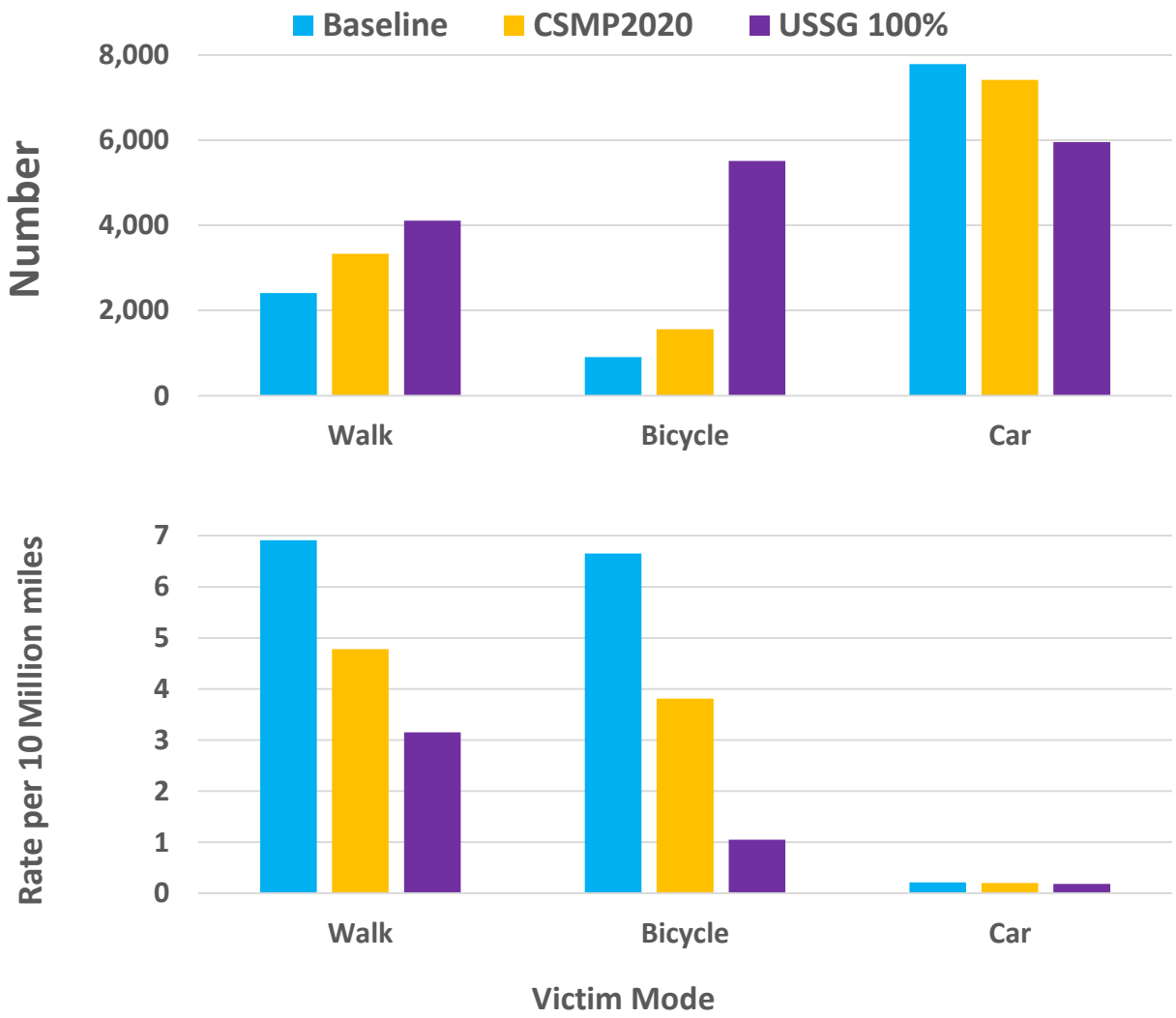
Fatal and Serious Road Traffic Injuries



Annual Number and Rate per Mile Travelled of Fatal and Serious Road Traffic Injuries by Victim Mode and Active Transport Scenario, California

Impacts of Active Transport Scenarios

Costs:

- Direct and indirect costs of illnesses reduced by **$1-6 billion**

Carbon Emissions:

- Car carbon emissions reduced by **3-14%**

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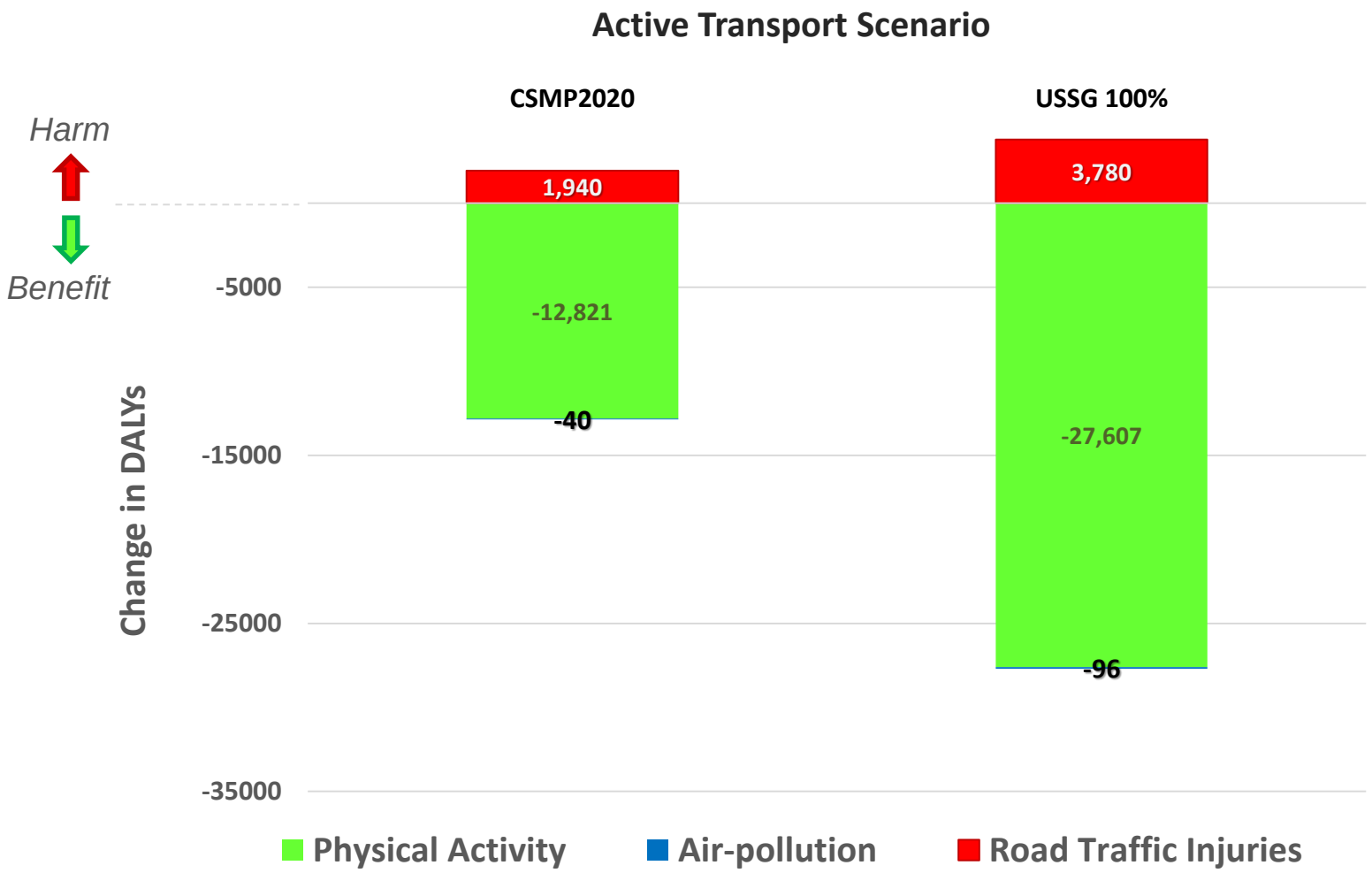
BAY AREA ANALYSIS, INCLUDING AIR POLLUTION



Annual Change in the Burden of Disease and Injury (DALYs) by Source of Health Benefit/Harm by Active Transport Scenario, Bay Area

SUMMARY OF FINDINGS

Active transportation that replaces vehicular trips and reduces VMT, can significantly improve overall health, prevent or reduce the risk of developing many chronic conditions, reduce billions per year in statewide health care costs, and cut GHG emissions.

- **Disease reductions**
  - ↓ 3-13% of heart disease, stroke, and diabetes
  - ↓ 1-4% of depression
  - ↓ 3-7% of dementia
  - ↓ 1-3% of breast cancer
  - ↓ 1-4% of colon cancer
  - ↓ 2,000-8,000 fewer annual deaths
  - ↓ 30,000-142,00 fewer years of life lost and disability

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ITHIM Implementation and Expansion

ITHIM Training and Implementation Sites

- **Trainings**
  - ✓ Transportation and health professionals
  - ✓ Metropolitan Planning Organizations (MPOs)
  - ✓ State departments and agencies
  - ✓ Local health departments
  - ✓ Others

- **Implementations**
  - ✓ MTC
  - ✓ FresnoCOG
  - ✓ SANDAG
  - ✓ Nashville, TN MPO
  - ✓ Portland, OR

Expansion of ITHIM

- International ITHIM working group and implementation
- Open source R language development
- Web-based user interface
- Spatial microsimulations for smaller geographic levels

Thank you!

Full California Statewide Analysis - ITHIM Technical Report available on our website:
https://www.cdph.ca.gov/programs/Pages/ClimateChange.aspx

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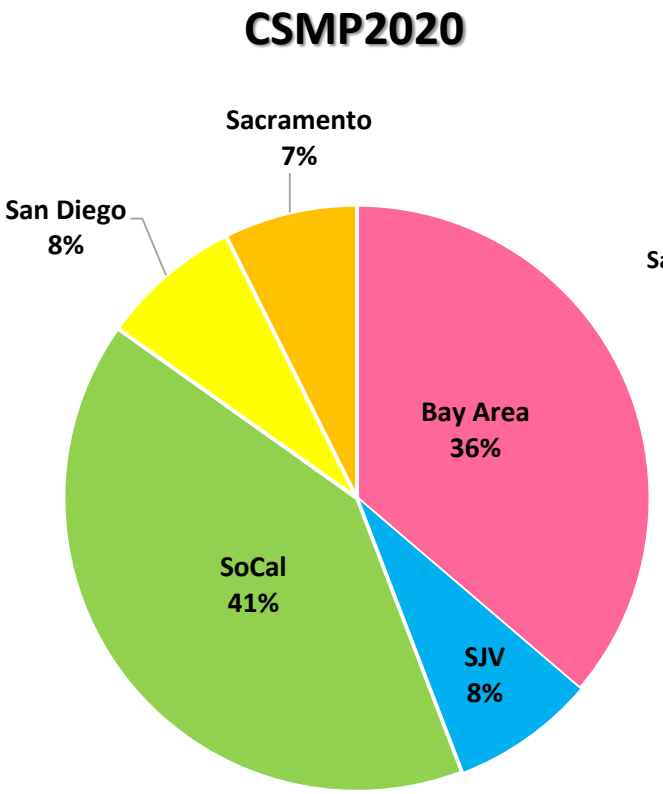
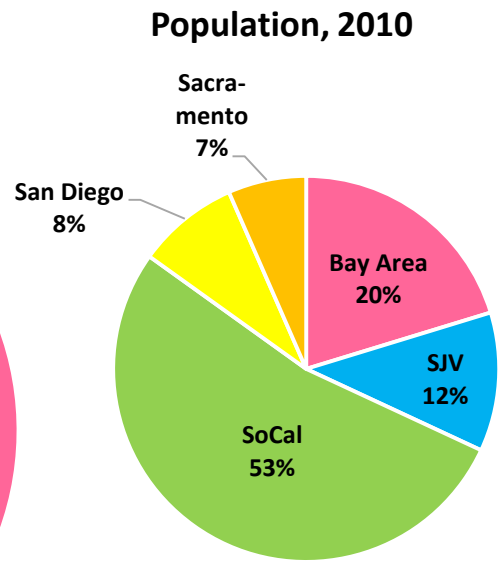
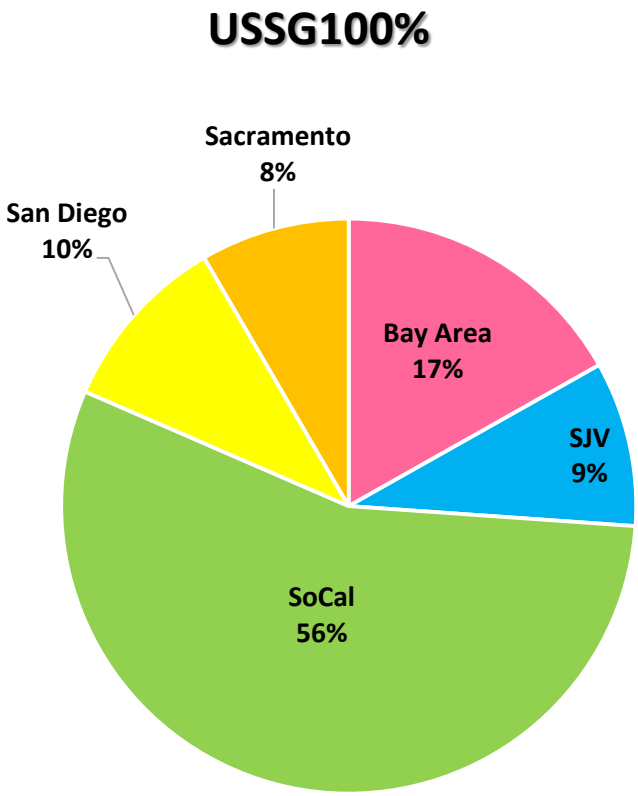
Extra slides below

DALYS BY ACTIVE TRANSPORT SCENARIO & REGION







-30,124 DALYs

-142,101 DALYs

Annual Number and Percentage of DALYs by Active Transport Scenario and Region, California (Editorial – has equity implications)

San Francisco Bay Area counties: Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, Sonoma
Southern California: Imperial, Los Angeles, Orange, Riverside, San Bernardino, Ventura
San Joaquin Valley: Fresno, Kern, Kings, Madera, Modesto, Stanislaus, San Joaquin, Tulare
Sacramento Area: El Dorado, Placer, Sacramento, Sutter, Yolo, Yuba

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