Health and Greenhouse Gas Mitigation Benefits of Active Travel in California Sustainable Community Strategies and Ambitious Scenarios

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Sacramento, CA, July 18, 2017
Key Research Questions to Inform Co-Benefits Strategies in Transportation

- What is the statewide health impact of the preferred SCSs of major California regional transportation planning agencies?
- How do the preferred SCSs compare on health and carbon impacts with ambitious levels of walking, cycling, and transit?
ITHIM Integrates Data on Health and Travel

**Physical Activity**
- Travel Survey
- Health Survey

**Air Pollution**
- Vehicle Emissions Model
- Air Shed Model
- U.S. Census
- Scenarios

**Traffic Injuries**
- Travel Demand Model
- Traffic Collisions
- Health Statistics

**Health Outcomes, CO₂, Costs**

Scenario vs. BAU
ITHIM Model Outcomes

**Health**

- Annual Number of Deaths
- Annual Disability Adjusted Life Years (DALYs)
- Specific causes related to *physical activity*:
  - Heart Disease (ischemic HD., hypertensive HD, stroke)
  - Diabetes
  - Dementia (Alzheimer’s)
  - Depression
  - Colon and Breast Cancer
- Road Traffic Injuries (RTIs)
- Air pollution (Bay Area only)

**Monetary Value of Health Outcomes**

- Cost of illness (direct, indirect costs)
- Value of a Statistical Life (intangibles)

**Car carbon emissions**
Attributable Fraction of Disease Burden Due to . . .

- $\Delta$ Burden of Disease (deaths and DALYs)
- $\Delta$ travel patterns from a baseline to a scenario
- $\Delta$ daily min. of travel-related walking & cycling
- $\Delta$ in miles traveled across all modes at risk of a road traffic injury
- $\Delta$ in PM$_{2.5}$ concentrations from change in per capita miles car miles traveled
- Dose-response relationships
- $\Delta$ in disease rate or mortality per min. of PA
- $\Delta$ in road traffic injuries per mile traveled
- $\Delta$ in airborne PM$_{2.5}$ per change in car VMT
### Data Sources and Calibration

<table>
<thead>
<tr>
<th>Class of Parameter (N=15)</th>
<th>Data Sources (N=8)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Travel distance, time, &amp; speed for active travel</td>
<td>Travel Survey (CHTS 2012)</td>
</tr>
<tr>
<td>PMT/VMT by motorized mode &amp; facility type</td>
<td>Statewide, Regional Travel Demand Models (4-step/ABMs)</td>
</tr>
<tr>
<td>Road traffic injuries</td>
<td>Road Traffic Collisions (SWITRS)</td>
</tr>
<tr>
<td>Non-travel physical activity</td>
<td>Health Surveys (CHIS 2009)</td>
</tr>
<tr>
<td>County-, region-specific DALYs from GBD</td>
<td>Death certificates, population data (Census, CA Finance Dept.)</td>
</tr>
<tr>
<td>CO₂ car emissions factor</td>
<td>EMFAC2014</td>
</tr>
<tr>
<td>Scenarios</td>
<td>EIRs to support approved SCSs</td>
</tr>
</tbody>
</table>
Scenarios

- Preferred SCSs in large MPO regions 97% of CA pop.
  - Bay Area (2015)
  - Sacramento Area (2016)
  - Southern California (2016)
  - San Diego County (2011)
  - San Joaquin Valley (2014)

- Scenarios to optimize physical activity at population median of 22 min/person/day
  1. Walking, independent of transit and cycling
  2. Bicycling, independent of transit and walking
  3. Walking/Bicycling from large transit increases
  4. Blend of above in equal parts (time)
## Change in Per Capita Travel from Baseline to Preferred Scenario

### Per Capita Median Weekly Active Travel by Scenario

<table>
<thead>
<tr>
<th>Mode</th>
<th>Bay Area</th>
<th>Sacramento Area</th>
<th>San Joaquin Valley</th>
<th>Southern California</th>
<th>San Diego Co.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walk</td>
<td>+11%</td>
<td>+16%</td>
<td>+31.7%</td>
<td>+27%</td>
<td>+88%</td>
</tr>
<tr>
<td>Bicycle</td>
<td>+19%</td>
<td>+11%</td>
<td>+31.7%</td>
<td>+69%</td>
<td>+88%</td>
</tr>
<tr>
<td>Car</td>
<td>-9%</td>
<td>-10%</td>
<td>-11%</td>
<td>-7%</td>
<td>-11%</td>
</tr>
<tr>
<td>Bus</td>
<td>+40%</td>
<td>+145%</td>
<td>+50%</td>
<td>+7%</td>
<td>+73%</td>
</tr>
<tr>
<td>Rail</td>
<td>+40%</td>
<td>+145%</td>
<td>+50%</td>
<td>+94%</td>
<td>+73%</td>
</tr>
</tbody>
</table>

* Per capita daily trips

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- **Baseline:**
  - **Walking:** 19 min/person/wk
  - **Cycling:** 26 min/person/wk
- **SCSs:**
  - **Walking:** 152 min/person/wk
  - **Cycling:** 96 min/person/wk
- **Walk:**
  - **Median min/person/wk:** 154
- **Cycle:**
  - **Median min/person/wk:** 154
- **Transit:**
  - **Median min/person/wk:** 39
- **Blend:**
  - **Median min/person/wk:** 96

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*The chart illustrates the change in per capita active travel median minutes per person per week across different scenarios.*
Net Change in DALYs (Deaths) by Scenario, California, 2040

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Annual Change in DALYs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cycle</td>
<td>(-8,543)</td>
</tr>
<tr>
<td>Walk</td>
<td>(-8,104)</td>
</tr>
<tr>
<td>Blend</td>
<td>(-6,363)</td>
</tr>
<tr>
<td>Transit</td>
<td>(-2,257)</td>
</tr>
<tr>
<td>SCSs</td>
<td>(-909)</td>
</tr>
</tbody>
</table>

Graph showing annual change in DALYs for each scenario.
Annual Number and Rate of Fatal and Serious Road Traffic Injuries by Scenario, California, 2040

![Graph showing the annual number and rate of fatal and serious road traffic injuries by scenario, California, 2040.](image-url)

- **Rate/10^7 mi/yr**
  - Pedestrian
  - Cyclist
  - Car Occupant

- **Number/yr**
  - Pedestrian
  - Cyclist
  - Car Occupant

Victim Mode: Baseline, SCS, Walk, Cycle, Transit
Annual Car Carbon Emissions by Scenario, California, 2040*

<table>
<thead>
<tr>
<th>Scenario</th>
<th>MMT CO₂ Eq/y</th>
<th>Percent reduction from 2000 baseline</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCSs</td>
<td>+2%</td>
<td>113 MMT Baseline, 2000</td>
</tr>
<tr>
<td>Cycle</td>
<td>-3%</td>
<td></td>
</tr>
<tr>
<td>Transit</td>
<td>-1.2%</td>
<td></td>
</tr>
<tr>
<td>Blend</td>
<td>-0.4%</td>
<td></td>
</tr>
<tr>
<td>Walk</td>
<td>+21%</td>
<td></td>
</tr>
</tbody>
</table>

* Includes population growth at 2040
Summary/Conclusions

- Active transportation strategies that emphasize bicycling optimize health and carbon reduction, but they must ensure safety to pedestrians and cyclists.

- Strategies that emphasize walking generate large health benefits, but must be combined with bicycling, transit, and low carbon driving to achieve carbon reductions.

- Active-travel associated with transit expansion generates modest health benefits (path of MPOs).

- California MPOs have yet to tap the health co-benefits potential for active travel.
  - Large relative increases, but from low absolute baselines.

- Given the urgency to curb carbon emissions, “Peddle now, or paddle later” should be the mantra.
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In memoriam

Full article available free at: http://dx.doi.org/10.1016/j.jth.2017.04.011

Acknowledgement

Thanks for listening! We gratefully acknowledge the assistance of staff from FresnoCOG, MTC, and SCAG, who provided some of the calibration data. This work was non-sponsored and builds on published research of the California Department of Public Health and the Centre for Diet and Activity Research (CEDAR), a UKCRC Public Health Research Centre of Excellence, which is supported by multiple UK governmental and philanthropic organizations.