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

Neil Maizlish, PhD, MPH
Epidemiologist

Nicholas J. Linesch, MS
Transportation Planner

James Woodcock, PhD
University of Cambridge, UK

Public Health Work Group
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

Vehicle Emissions Model

Air Shed Model

U.S. Census

Scenarios

Traffic Demand Model

Traffic Collisions

Health Statistics

Scenario vs. BAU

Health Outcomes, CO₂, Costs
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

<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

**Per Capita Median Weekly Active Travel by Scenario**
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>

Cycle > Walk > Blend > Transit > SCSs
Annual Number and Rate of Fatal and Serious Road Traffic Injuries by Scenario, California, 2040

<table>
<thead>
<tr>
<th>Victim Mode</th>
<th>Baseline</th>
<th>SCS</th>
<th>Walk</th>
<th>Cycle</th>
<th>Transit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pedestrian</td>
<td>6</td>
<td>4</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Cyclist</td>
<td>8,000</td>
<td>6,000</td>
<td>4,000</td>
<td>2,000</td>
<td>0</td>
</tr>
<tr>
<td>Car Occupant</td>
<td>10</td>
<td>8,000</td>
<td>6,000</td>
<td>4,000</td>
<td>2,000</td>
</tr>
</tbody>
</table>
Annual Car Carbon Emissions by Scenario, California, 2040*

Percent reduction from 2000 baseline

113 MMT Baseline, 2000

Scenario

* 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.
Contact Information

Neil Maizlish, PhD, MPH
nenil3971@comcast.net

James Woodcock, PhD
jw745@medschl.cam.ac.uk

Nicholas J. Linesch, MS
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.