



Carbonless Footprints: Health and Environmental benefits of Active Transportation

WALK 21 VANCOUVER!

**Dr. Lawrence Frank, Professor and Bombardier Chair in
Sustainable Transportation - University of British Columbia
Health and Community Design Lab www.act-trans.ubc.ca**

THE GLOBAL WARMING GAMBLE



FUEL MIX



VEHICLE
EFFICIENCY



DEMAND

Policy Levers to Reduce
Transportation - Related CO₂ emissions



Philosophical Approach

- ▣ Bridging knowledge and action
 - Applied Policy Research
- ▣ Working across disciplines
 - Connecting Health, Environmental, and Transportation Sectors
- ▣ Building an evidence base on the impacts of community design on health and environmental outcomes
 - Quantifying the externalities
- ▣ Finding strategic opportunities to intervene
 - Evaluating the effects of changes to the built environment

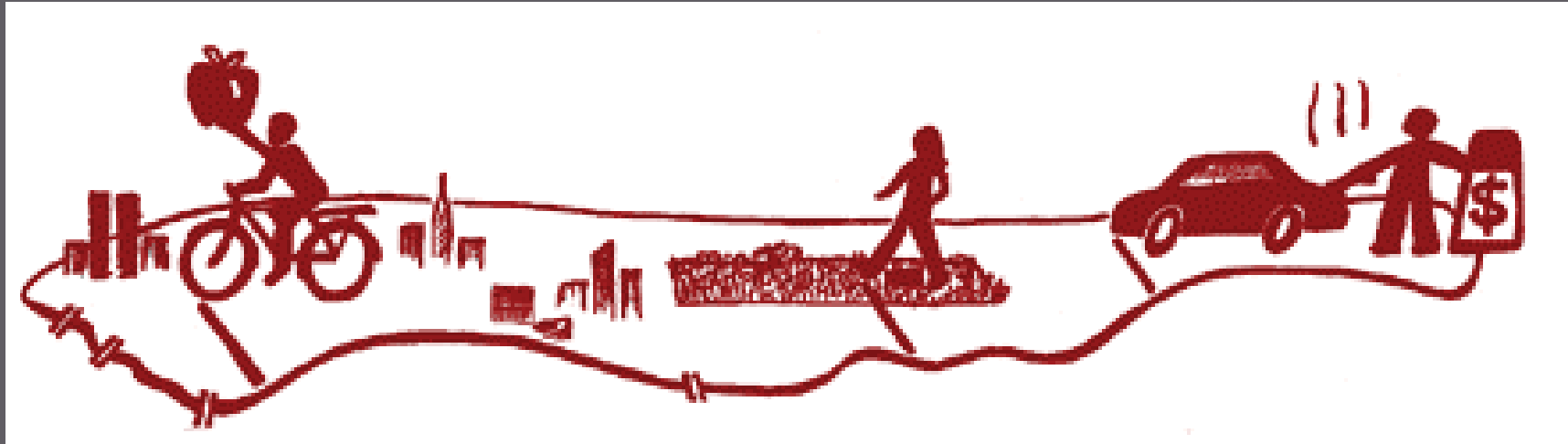
**Quality
of Life**

Environmental Quality
Air Quality and Greenspace

Human Behavior
Travel Patterns and Physical Activity

Built Environment
Transportation Investments and Land Use

It's All About Energy



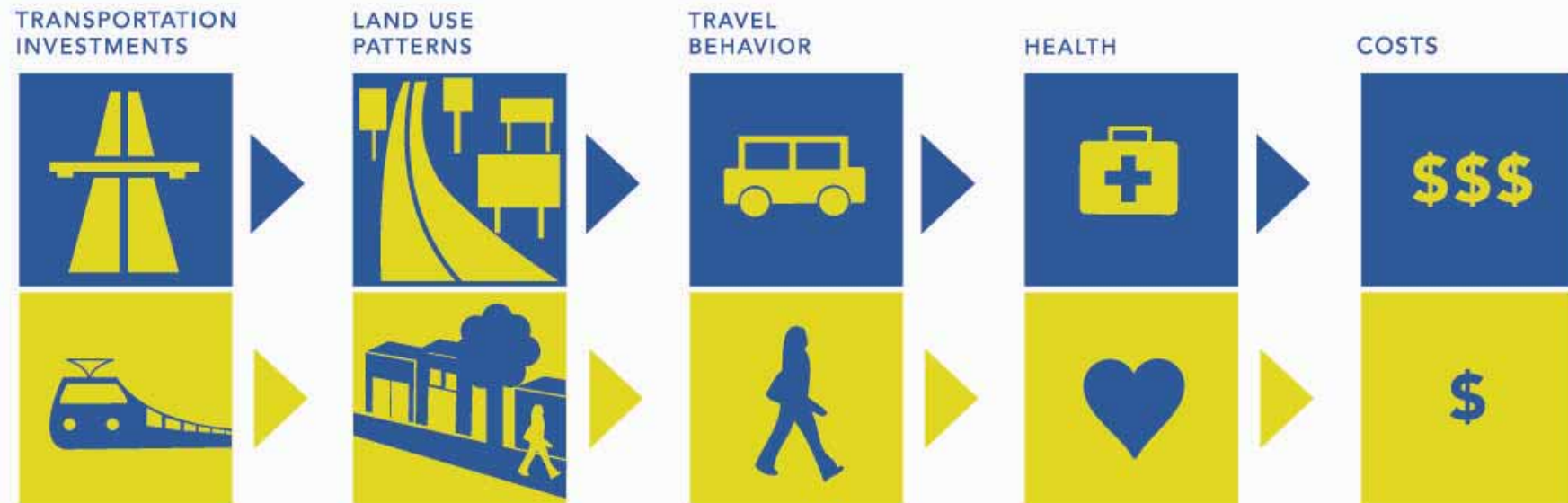
On 350 calories — one apple tart or a “special” slice of Ray's Pizza — a cyclist can travel 10 miles, a pedestrian 3.5 miles, and an automobile 100 feet.

Transportation Alternatives, Bicycle Blueprint, 1998

“Carbonless Footprints” Paper in Preventive Medicine

TRANSPORTATION ENERGY INDEX

HOW TRANSPORTATION IMPACTS HEALTH COSTS






“The Hidden Health Costs of Transportation” –
Frank et al 2010
American Public Health Association

Obesity Trends* Among Canadian Adults

HPS, 1985

(*BMI \geq 30, or ~ 30 lbs overweight for 5'4" woman)

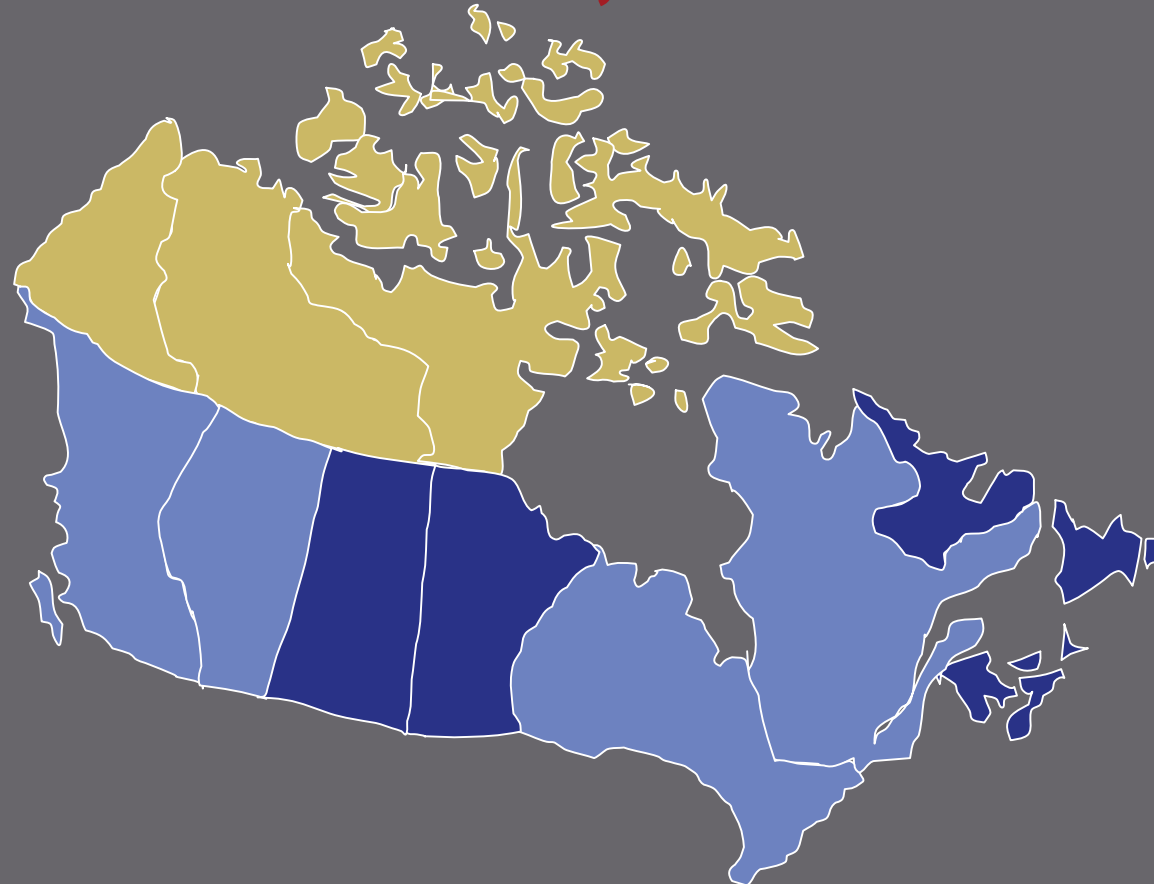


No Data  <10%  10%-14%  15-19%  \geq 20% 

Source: Katzmarzyk PT. *Can Med Assoc J* 2002;166:1039-1040.

Obesity Trends* Among Canadian Adults

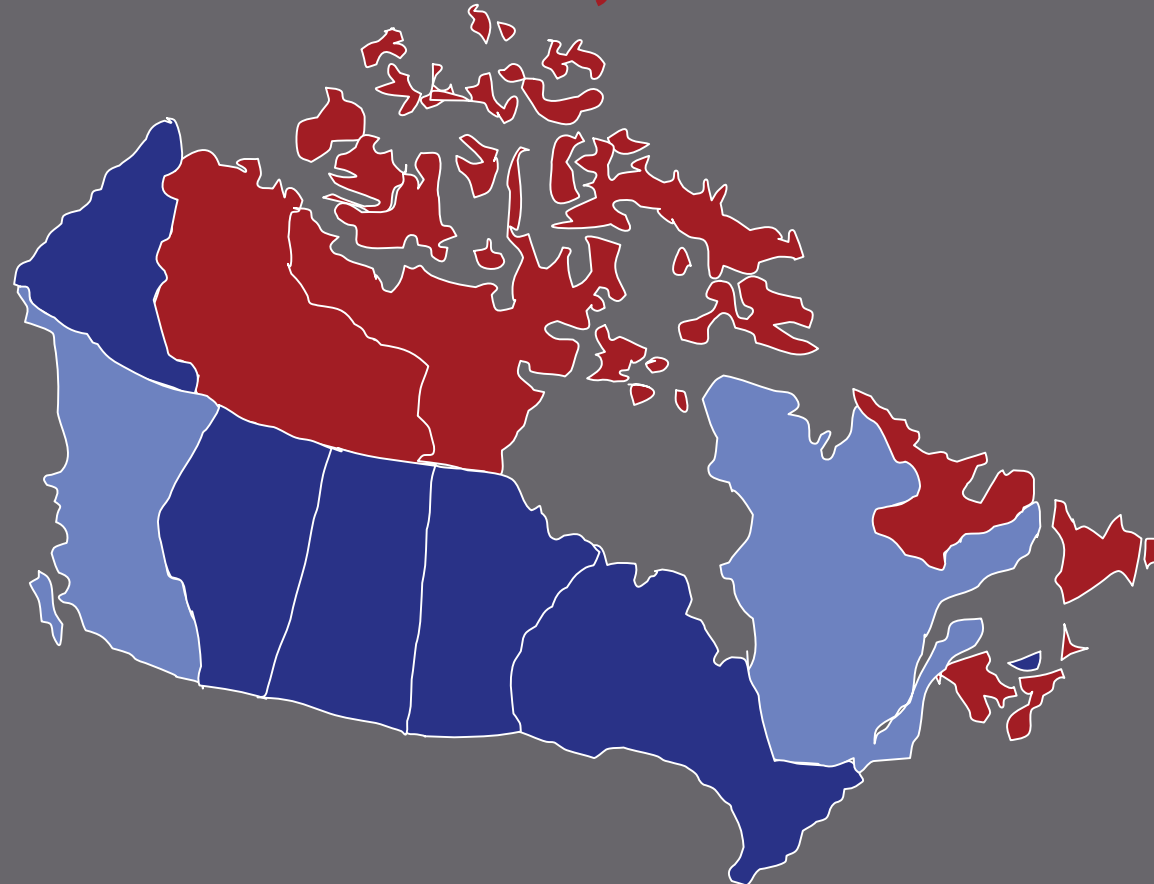
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Obesity Trends* Among Canadian Adults

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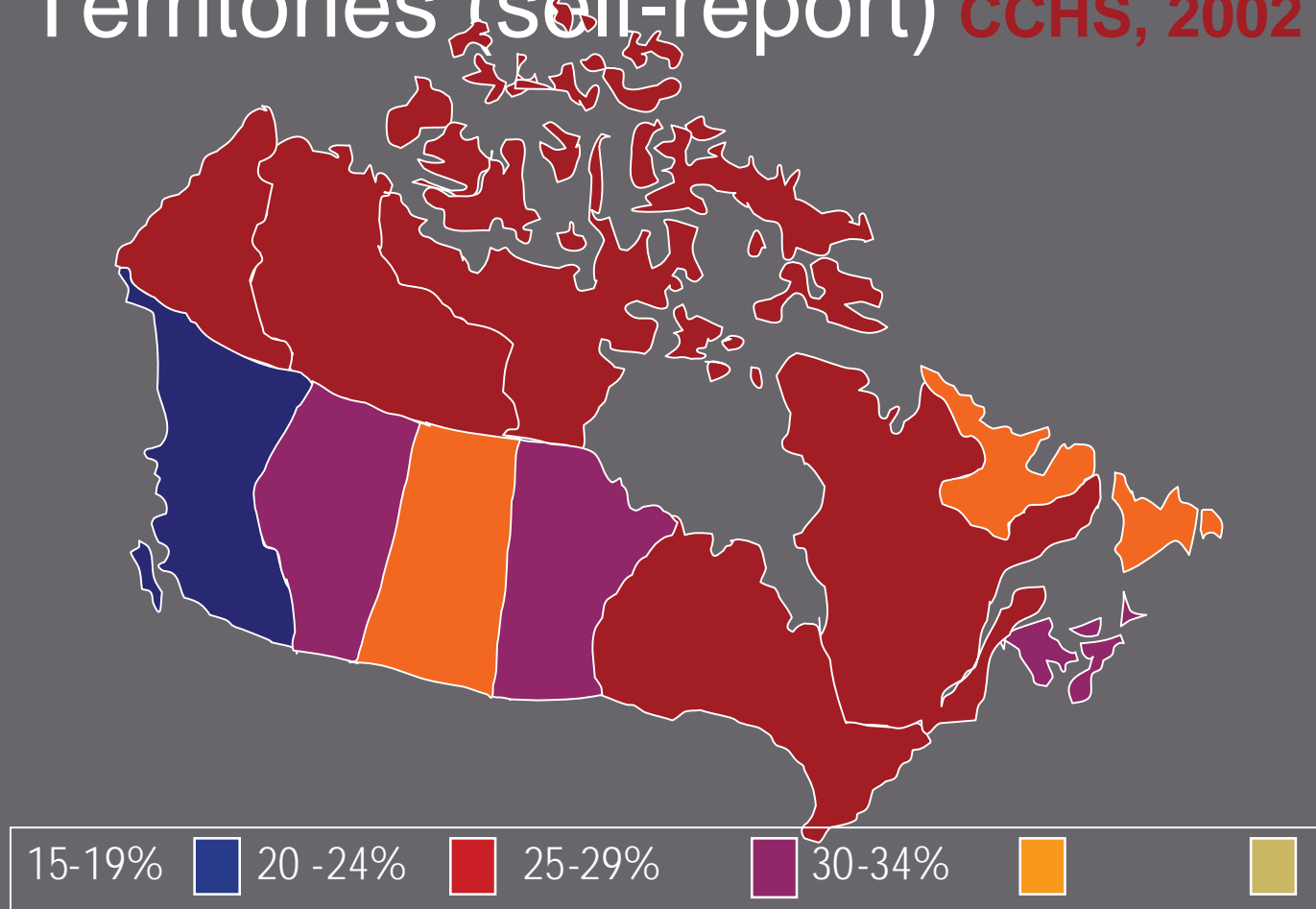
No Data  <10%  10%-14%  15-19%  ≥20% 

Source: P.T. Katzmarzyk, Unpublished Results.

Data from: Statistics Canada. *Health Indicators*, May, 2002.

Obesity Trends Among Canadian Adults

Provinces (measured) **CCHS, 2004**
Territories (self-report) **CCHS, 2002**



Data from: Statistics Canada.

Estimated Annual Costs Attributable to Obesity in the U.S.

Overweight and Obesity

→ Direct health care costs: \$93 billion

9% of all health care costs

Obesity- \$732 more per person

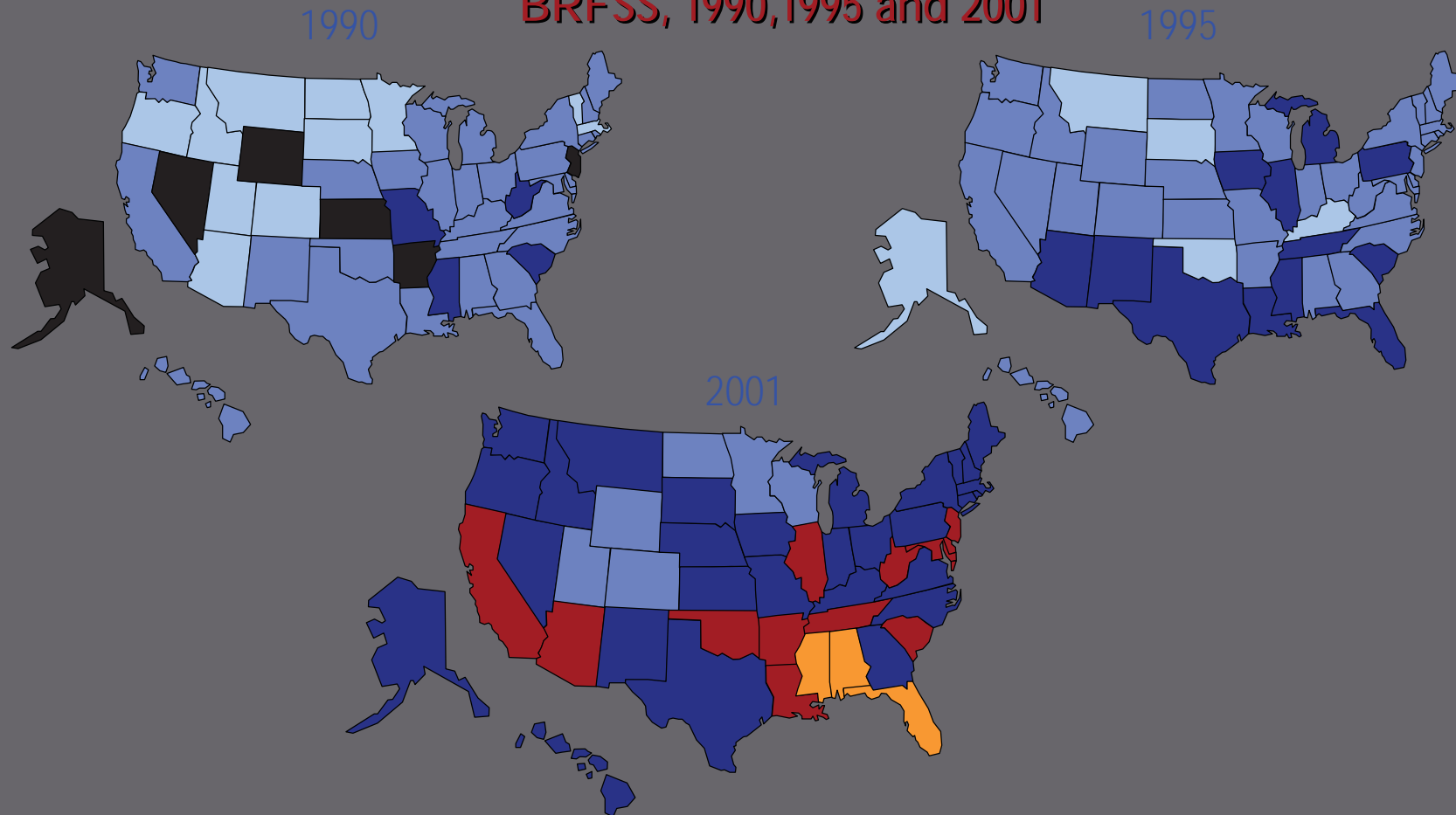
\$1,486 Medicare

\$ 864 Medicaid

Source : Finkelstein, Fiebelkorn and Wang. Health Affairs, May, 2003.

Diabetes Trends* Among Adults in the U.S., (Includes Gestational Diabetes)

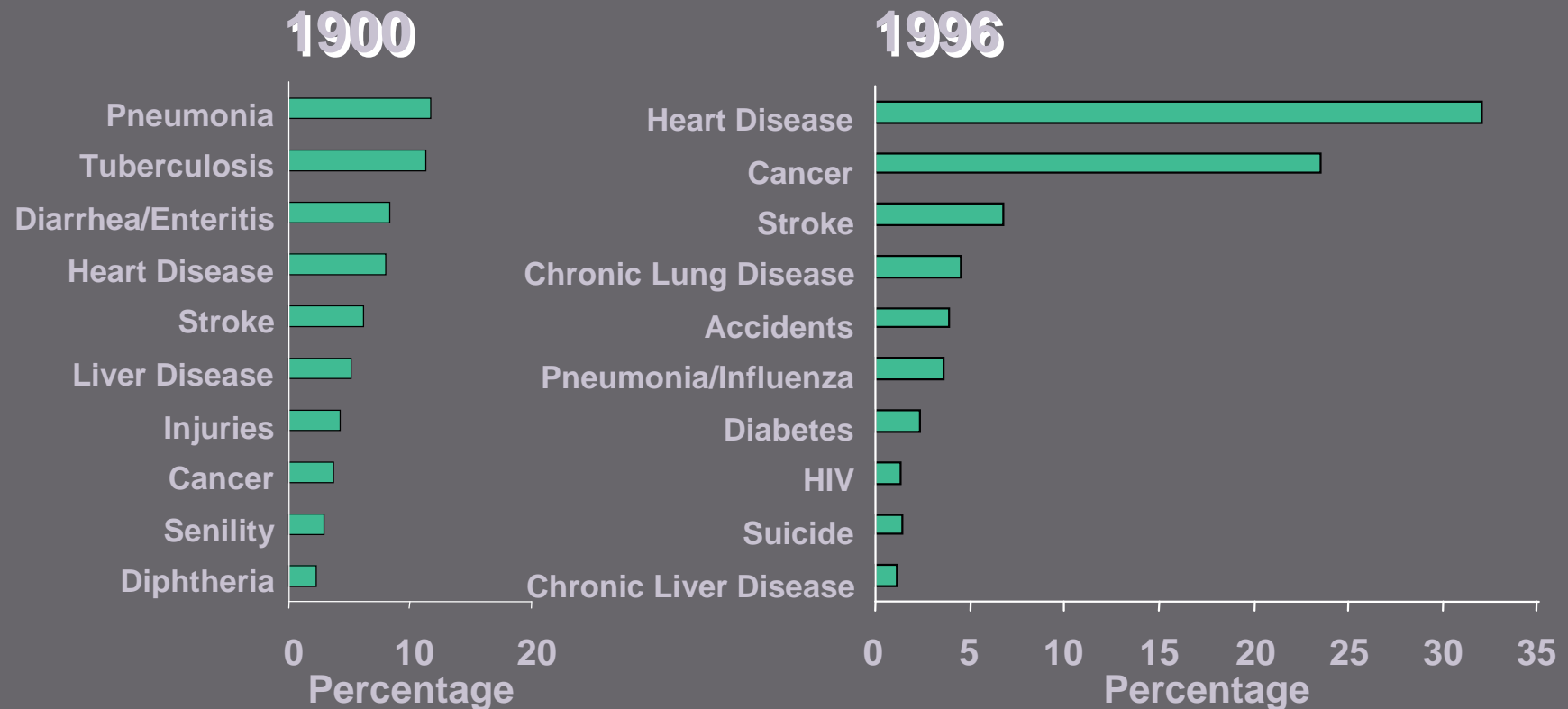
BRFSS, 1990, 1995 and 2001



Source: Mokdad et al., *Diabetes Care* 2000;23:1278-83; *J Am Med Assoc* 2001;286:10.

The 10 Leading Causes of Death as a Percentage of All Deaths

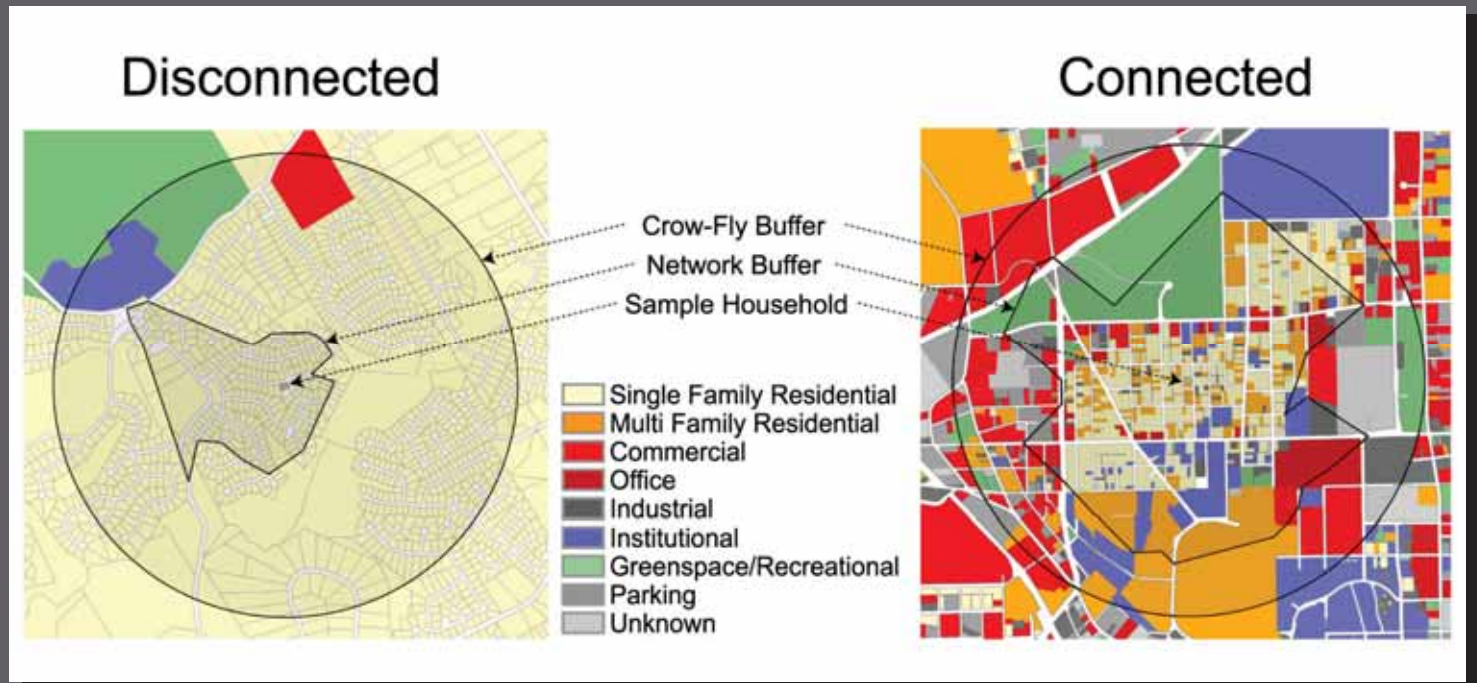
United States, 1900 and 1996



The average life expectancy in 1900 was 47.3 years of age. In 1993, it was 75.7 years of age.

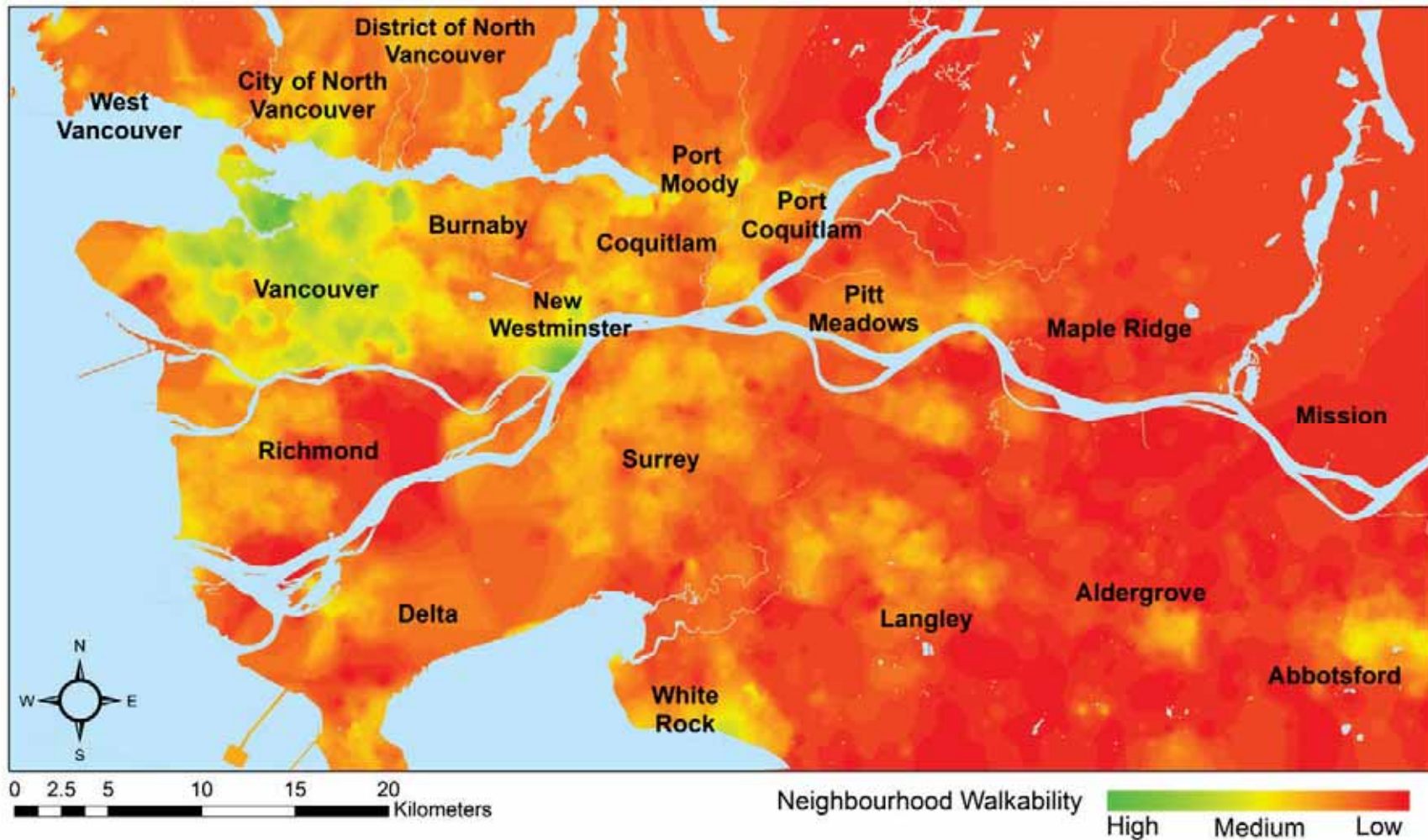
SOURCE: CDC, National Center for Health Statistics

Proximity



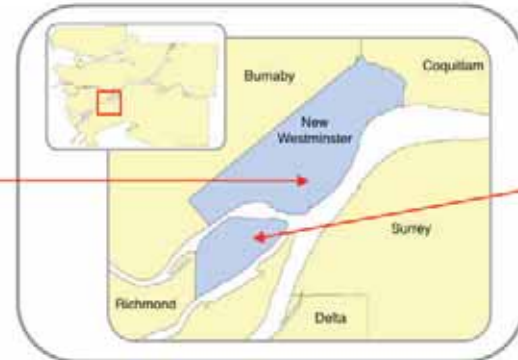
Connectivity

Vancouver Region Walkability & Transit Supportiveness Map



UBC Active Transport Lab

Comparing Two Communities



**Uptown
Moody Park**

Queensborough

Net Residential Density
(dwelling units/acre)

40.29

7.73

Mixed Use Index
(range 0 - 1)

0.58

0.09

Intersection Density
(per square km)

70.12

27.91

Retail Floor
Area Ratio

0.64

0.30

Overall Walkability

4.26

-3.74



Adult Findings – Walking

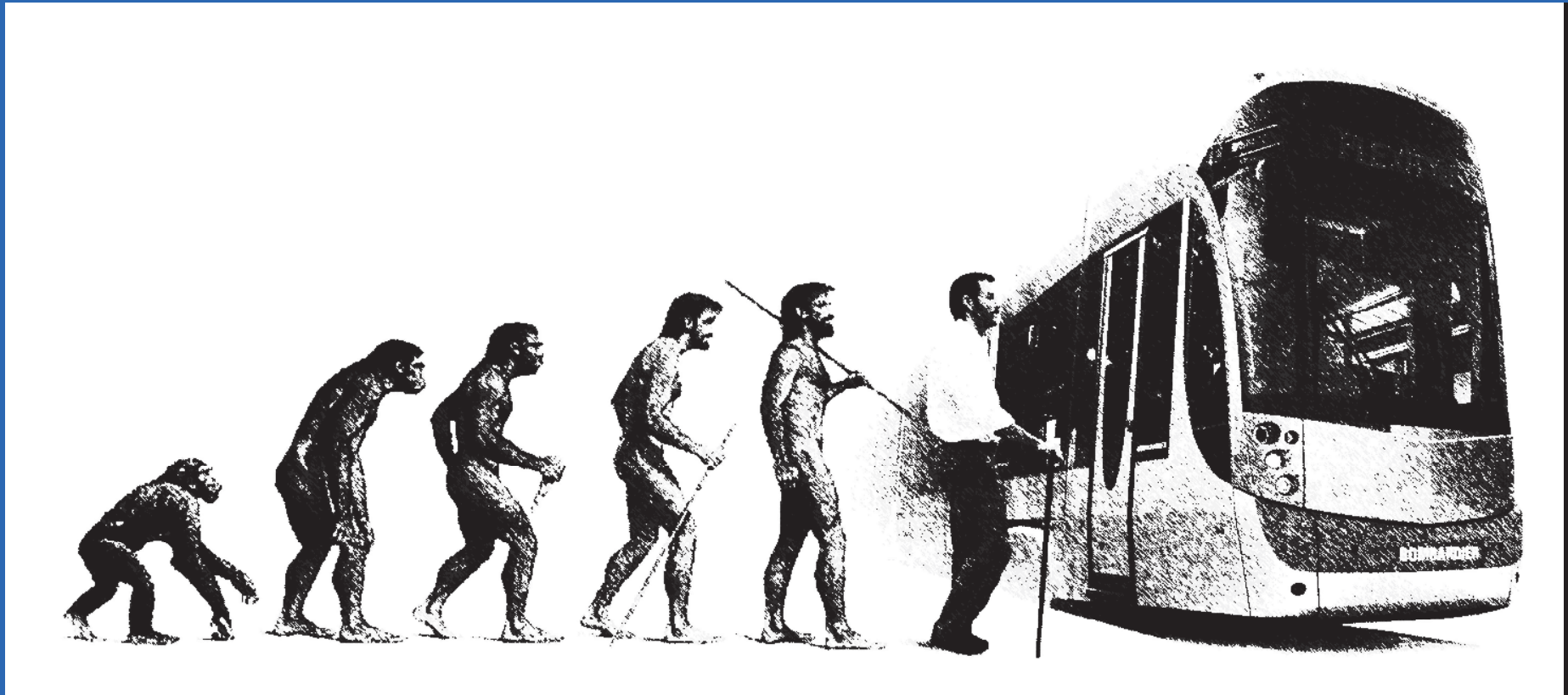
Built environment characteristics explaining walking in adults

	Any walk trip	Work/school walk trip	Non-work/school walk trip
Higher residential density	+++	+++	+++
Higher street connectivity	+++	+++	+++
Higher commercial density	+++	+++	+++
Higher mix of land uses	++	+	++
More nearby parks and open spaces	+++	+	+++
Higher overall neighbourhood walkability	+++	++	+++

NS = not significant, '+' = 95% significant; '++' = 99% significant, '+++ = 99.9% significant

Devlin and Frank, 2009

Can Transit Investments Promote Public Health?












Transit Use and Physical Activity

- Transit users in Atlanta were 3.42 times more likely to meet physical activity recommendations
 - by walking for transportation

Source: Lachapelle and Frank, 2009

Predictors of Obesity

	Coefficient	t-Ratio	P-Value
 Age	0.012	6.00	0.000
 Education	-0.080	-4.71	0.000
 Income	-0.057	-4.75	0.000
 Walk Distance	-0.049	-2.04	0.034
 Car Time	0.001	2.875	0.003
 Land Use Mix	-2.035	- 5.65	0.000
 Black Male	0.311	3.930	0.000
 Black Female	0.372	5.09	0.000
 White Female	-0.871	-11.3	0.000
Constant	-0.497	-2.22	0.026

Frank, L., Andresen, M., and Schmid, T., Obesity Relationships With Community Design, Physical Activity, and Time Spent in Cars. American Journal of Preventive Medicine. June 2004.

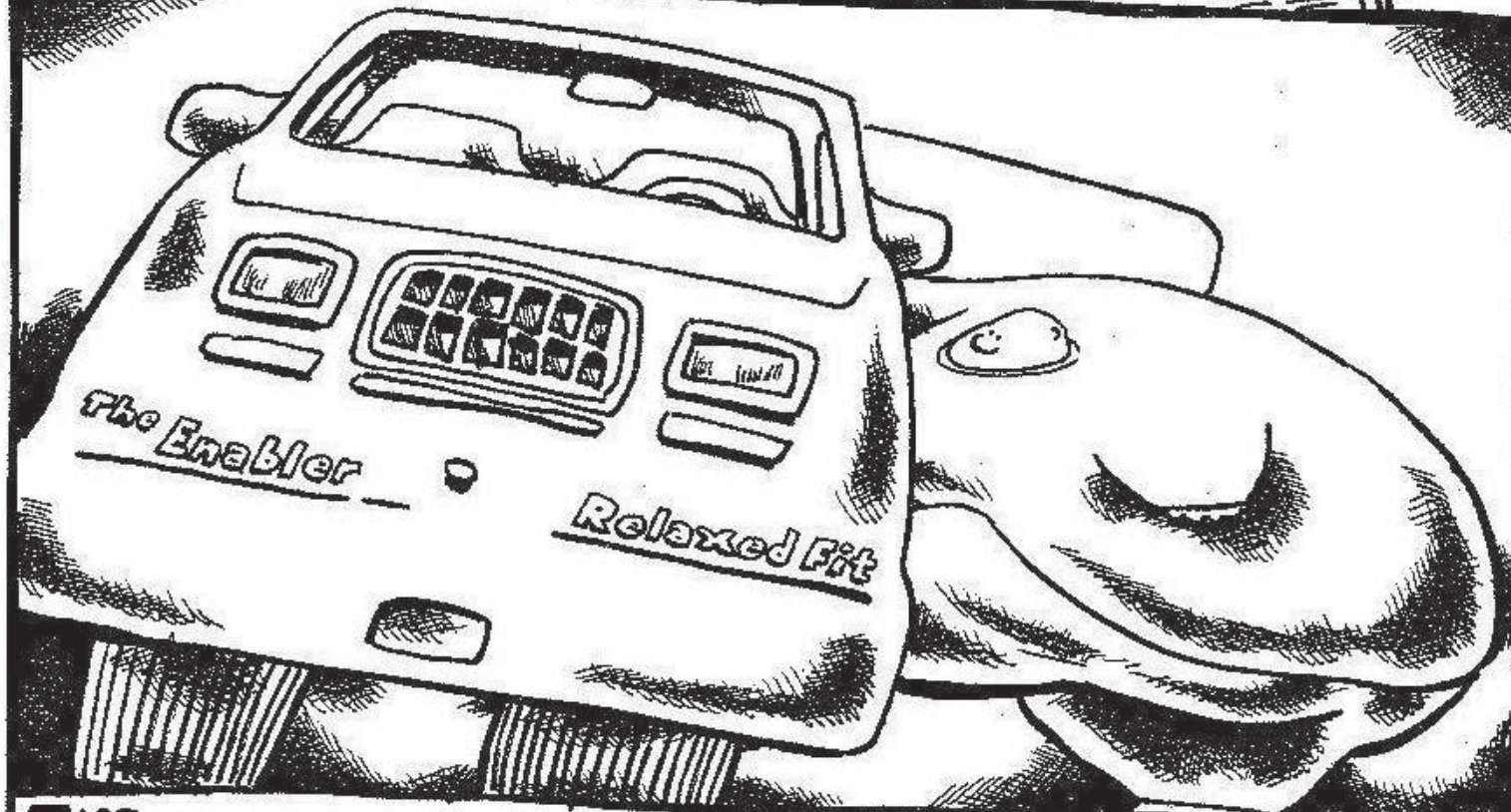
Obesity Results – Driving and Walking

- Every additional **hour** per day in a car translates into a **6** percent increase in the likelihood of obesity
 - Time spent driving increases as walkability decreases
- Every additional **Kilometer (.6 miles) walked** translates into **4.8** percent reduction in the likelihood of being obese
 - Distances walked increases with walkability

Frank, L., Andresen, M., and Schmid, T., Obesity Relationships With Community Design, Physical Activity, and Time Spent in Cars. [American Journal of Preventive Medicine](#). June 2004.

SUVs Explained!

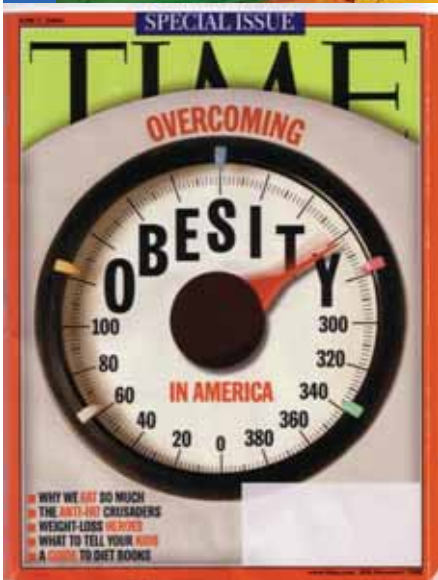
DRIVING CAUSES OBESITY
THE MORE YOU DRIVE,
THE BIGGER YOU GET.
-STUDY



TALS

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PERHAPS IT'S TIME TO REDEFINE
FOSSIL FUELS AS A CARB.



**“Nothing Great Was Ever Achieved Without
Enthusiasm”**

Ralph Waldo Emerson



LOGISTIC REGRESSION ANALYSES PREDICTING THE ODDS OF WALKING AT LEAST ONCE OVER 2-DAYS

YOUTH Age Range	5-8 years OR (95% CI)	9-11 years OR (95% CI)	12-15 years OR (95% CI)	16-20 years OR (95% CI)
	N=847	N=632	N=867	N=815
Intersection highest tertile (vs lowest)	1.7 (1.0-2.9)	1.3 (0.8-2.3)	1.7 (1.1-2.8)*	2.0 (1.1-3.6)*
Density highest tertile (vs lowest)	1.8 (1.0-3.1)	2.3 (1.2-4.3)**	3.7 (2.2-6.4)***	2.0 (1.0-4.1)
Mixed land use (vs no mix)	1.5 (0.9-2.4)	1.5 (0.9-2.5)	2.5 (1.6-3.8)***	1.9 (1.0-3.2)*
At least 1 commercial land use (vs 0)	1.5 (0.9-2.4)	1.6 (1.0-2.5)	2.6 (1.7-4.0)***	1.7 (1.0-3.1)
At least 1 recreation/open space land use (vs 0)	2.1 (1.3-3.4)***	1.8 (1.1-2.9)*	2.5 (1.7-3.6)***	1.8 (1.1-2.9)**

controlling for socio-demographics and stratified by age group
(Averaged over a two day period)

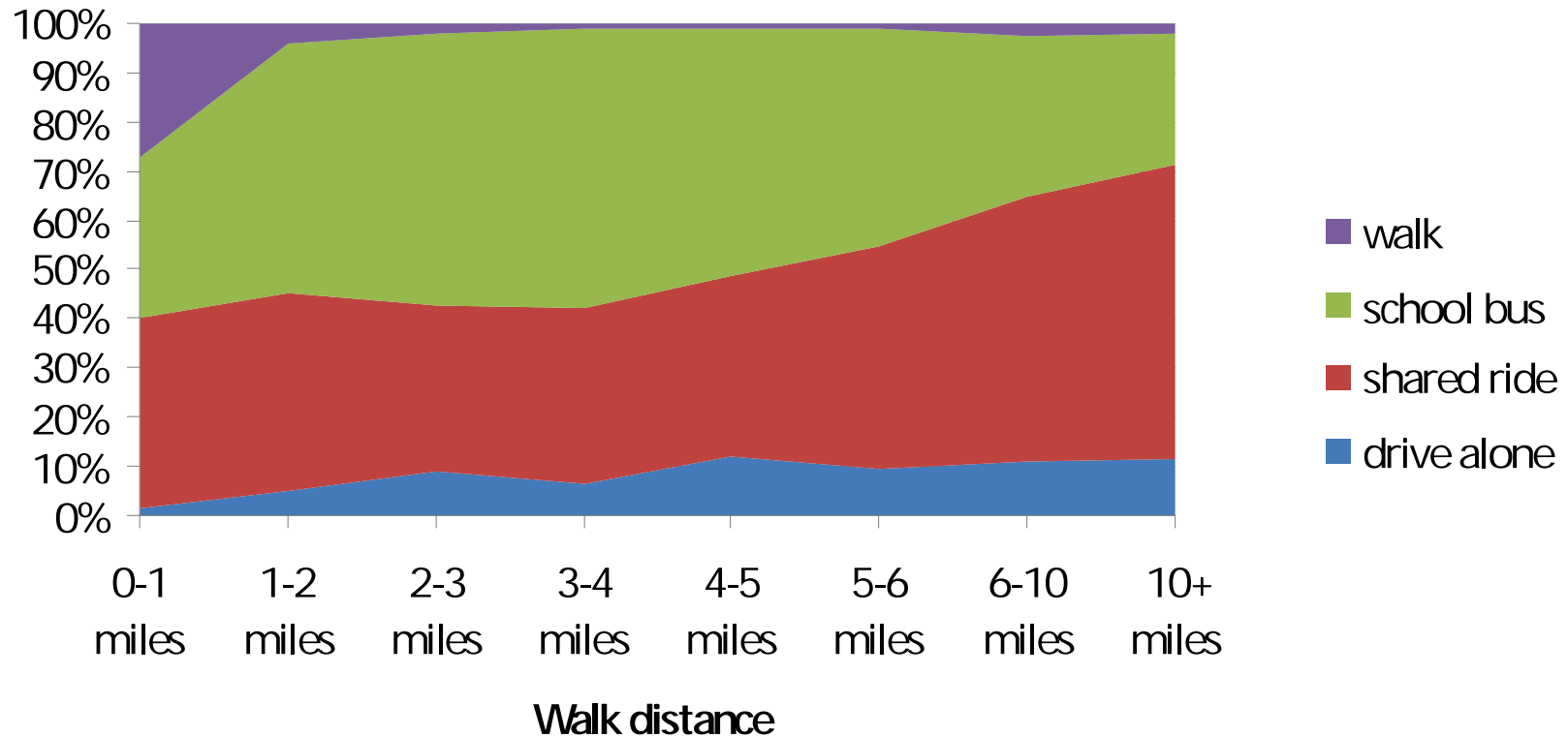
*p<.05, **p<.01, ***p<.001

(Youth) Walking and Vehicle Ownership

- ▣ Compared with youth from households with 3 or more cars (99.9% confidence level):
 - Youth from households with 2 cars were 1.4 times more likely to walk at least once over a two day period
 - Youth from households with 1 car were 2.6 times more likely to walk at least once over a two period and 2.2 times more likely to walk more than a ½ mile per day
 - Youth from households with no cars were 7.7 times more likely to walk at least once a two day period and 6.8 times more likely to walk more than a ½ mile per day.

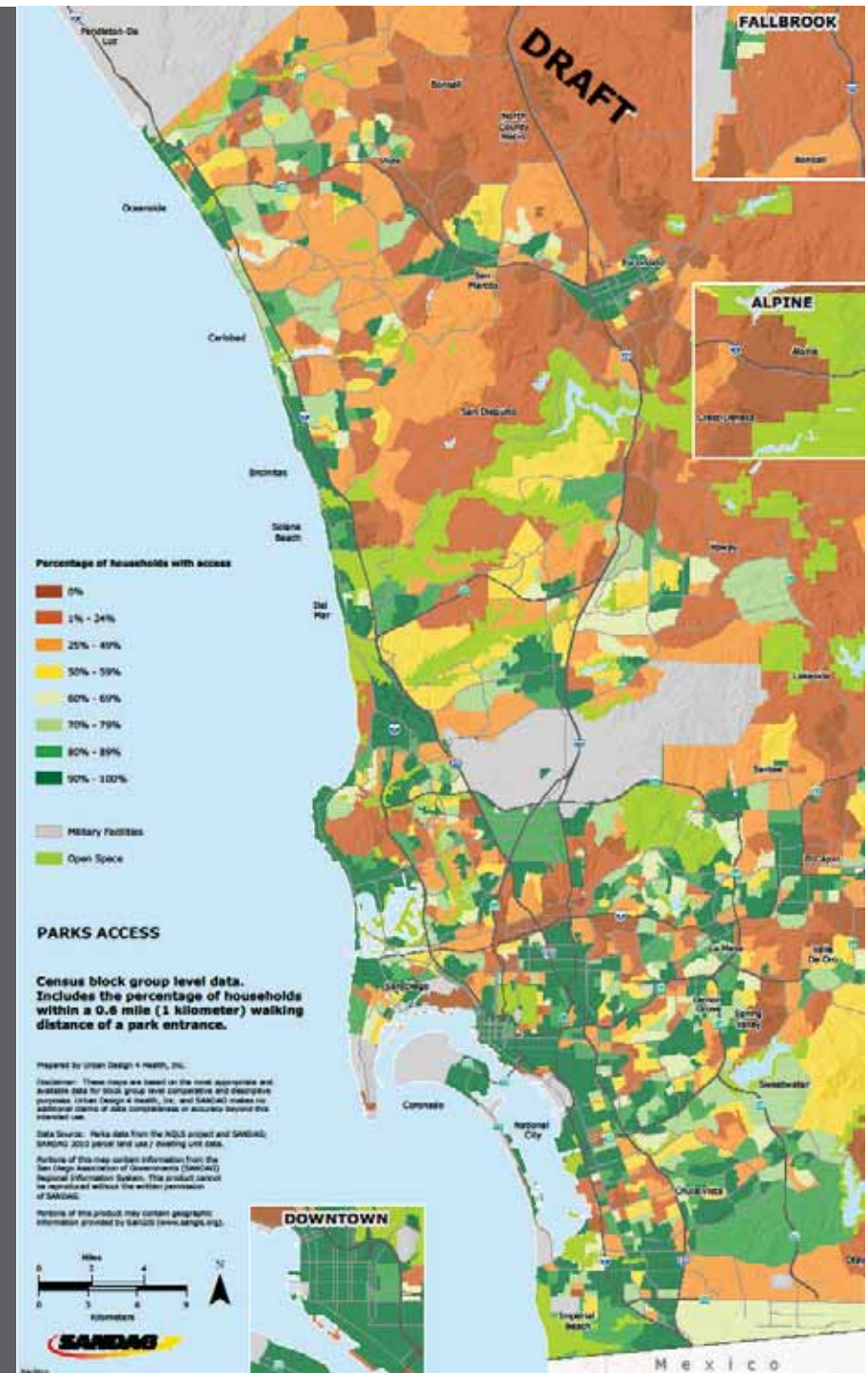
Short Distances are crucial to encouraging walking to school.

Mode to school by walk distance



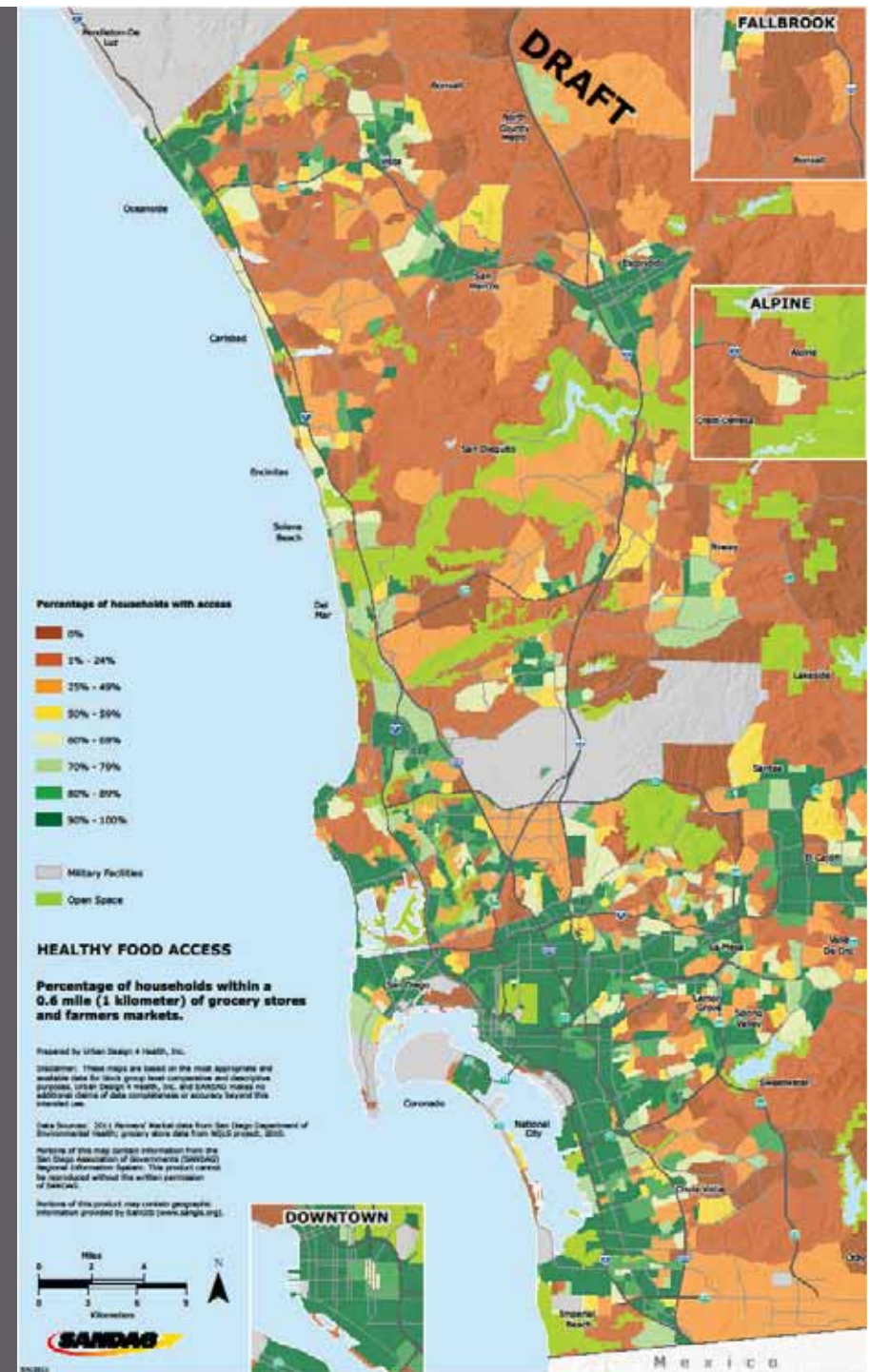
Park Access San Diego County

- Percentage of households within a 0.6 mile (1 km) walking distance of a park entrance
- Nearly 70 percent of all multi-family households (and 58 percent of all households) have park access within a 0.6 mile walk



Healthy Foods Access San Diego County

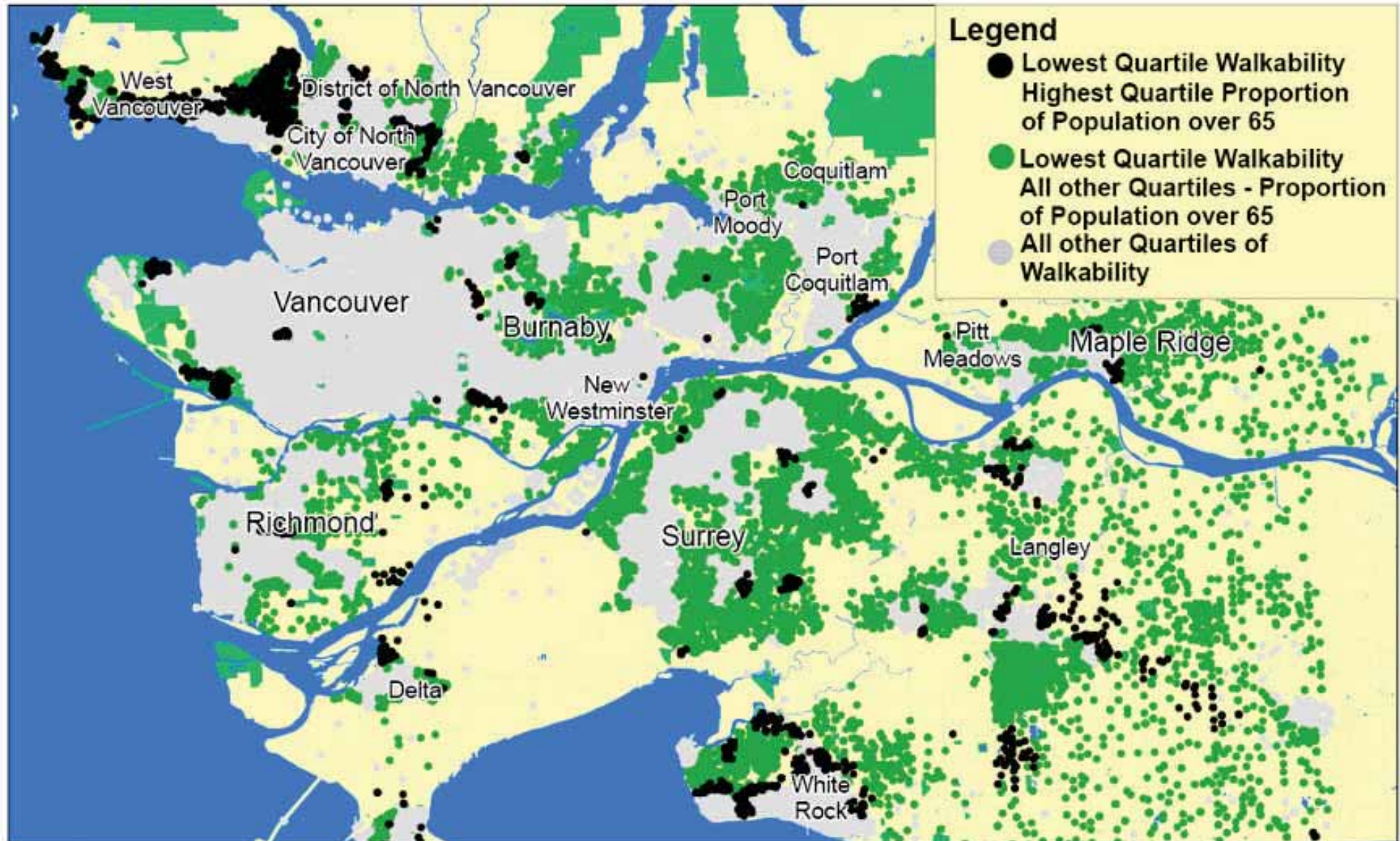
- Percentage of households within 0.6 miles (1 km) of a grocery store, produce market, specialty market or farmers' market
- Over 80 percent of multi-family households - and nearly 60 percent of all households - have access to a grocery store or farmers' market within walking distance.

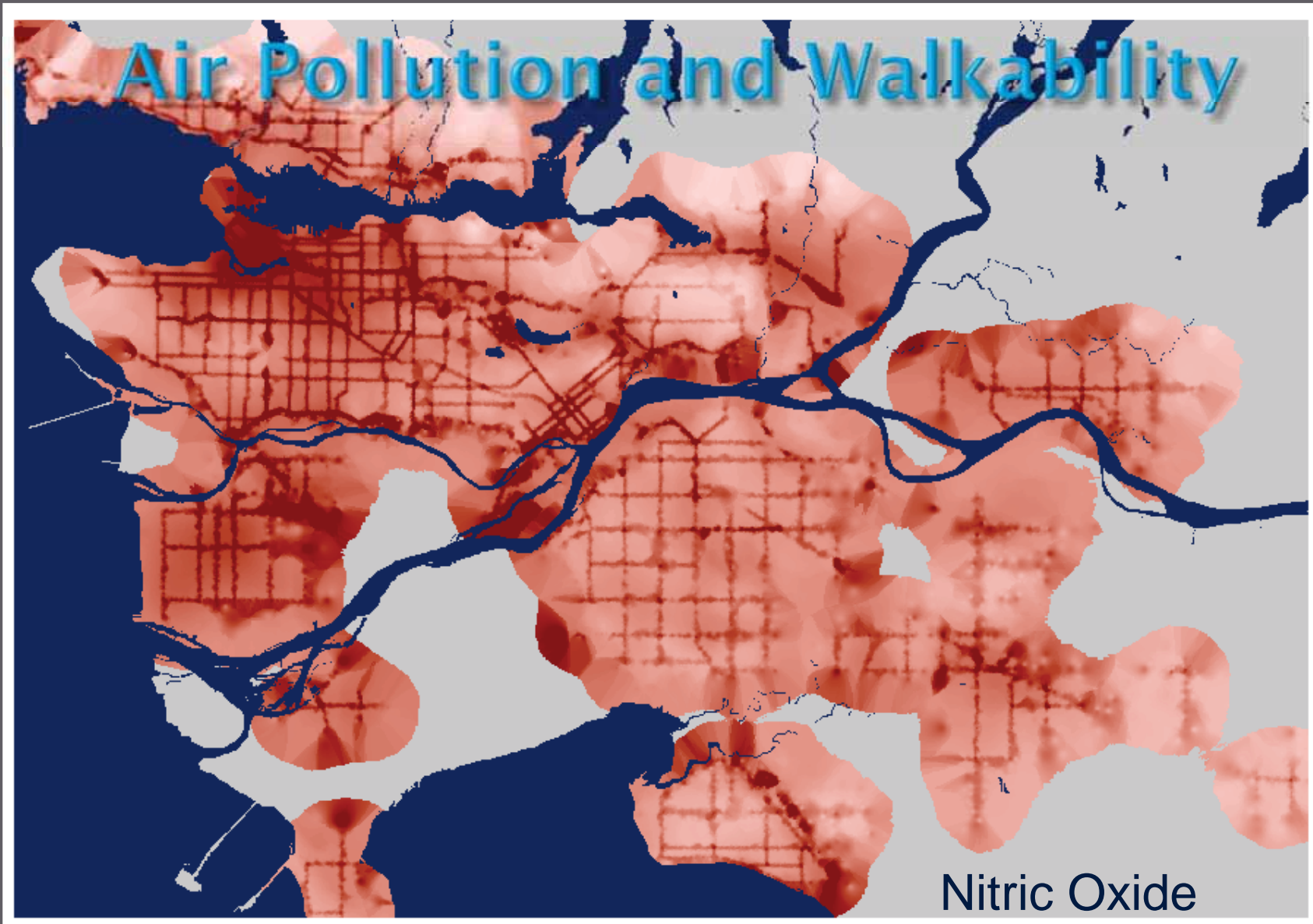


The Silver Tsunami

- ▣ “By 2032, 1/4 of B.C. residents will be over age 65.”
 - ▣ Vancouver Sun September 17, 2011
- ▣ California will see its 65-plus population more than double in the next 25 years, from 3.5 million in 2000 (10.6 percent of the state's population) to 8.2 million in 2030 (17.8 percent).
 - Where will the 65-plus population live?
 - Access to services, Less reliance on driving for safety reasons, Maintaining Independence
- ▣ Lack of Affordable Housing in Walkable Places
 - Cost of service delivery with Aging in central / walkable versus peripheral / unwalkable places

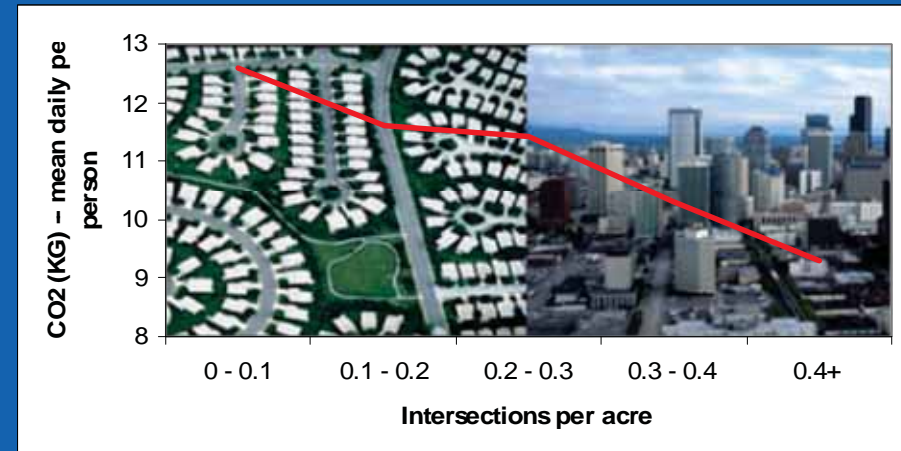
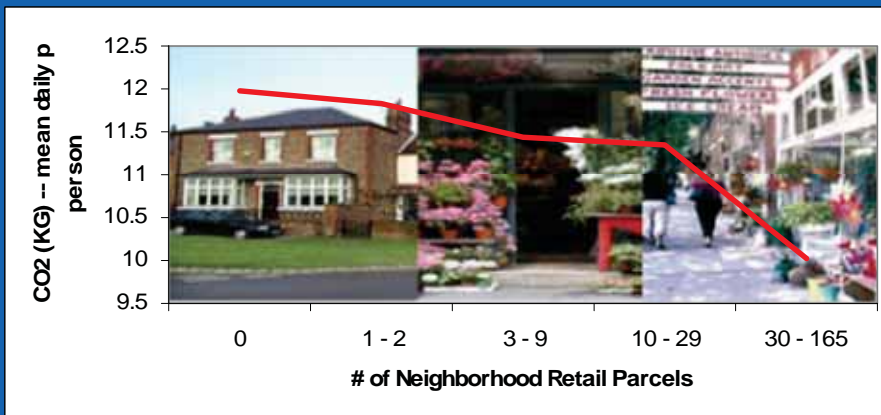
Walkability and Elderly





Marshall, Brauer, and Frank 2008

CO2 & Neighbourhood Design



Source: LUTAQH final report, King County ORTP, 2005

CO2 emissions from transportation

Includes:

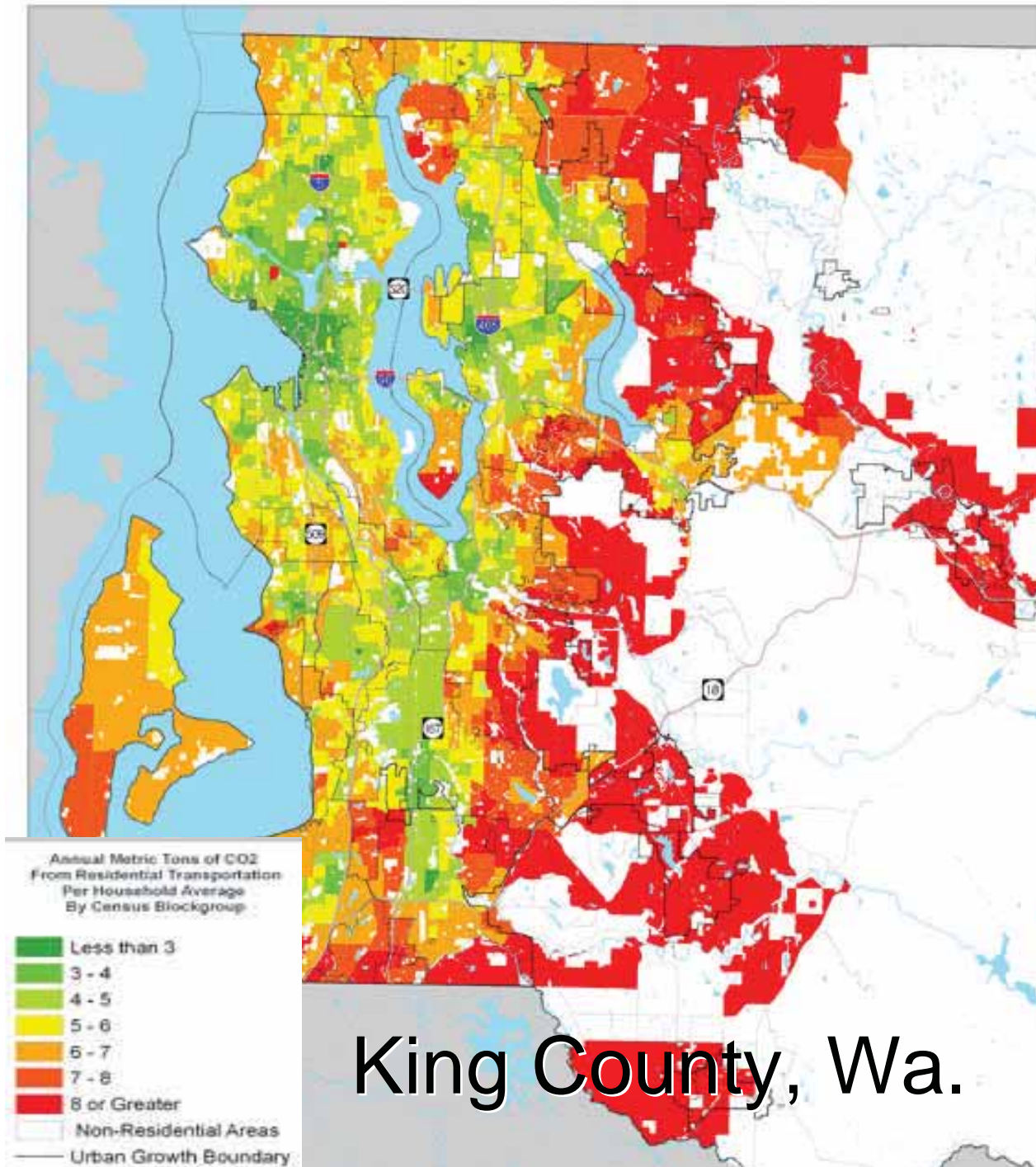
Local urban form (land use mix, intersection density, retail FAR)

Regional location (auto travel time)




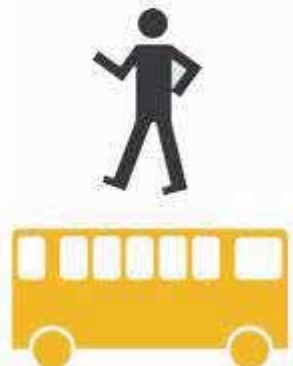
Transit accessibility & travel time

Demographics

Distance Based Impact Fee System



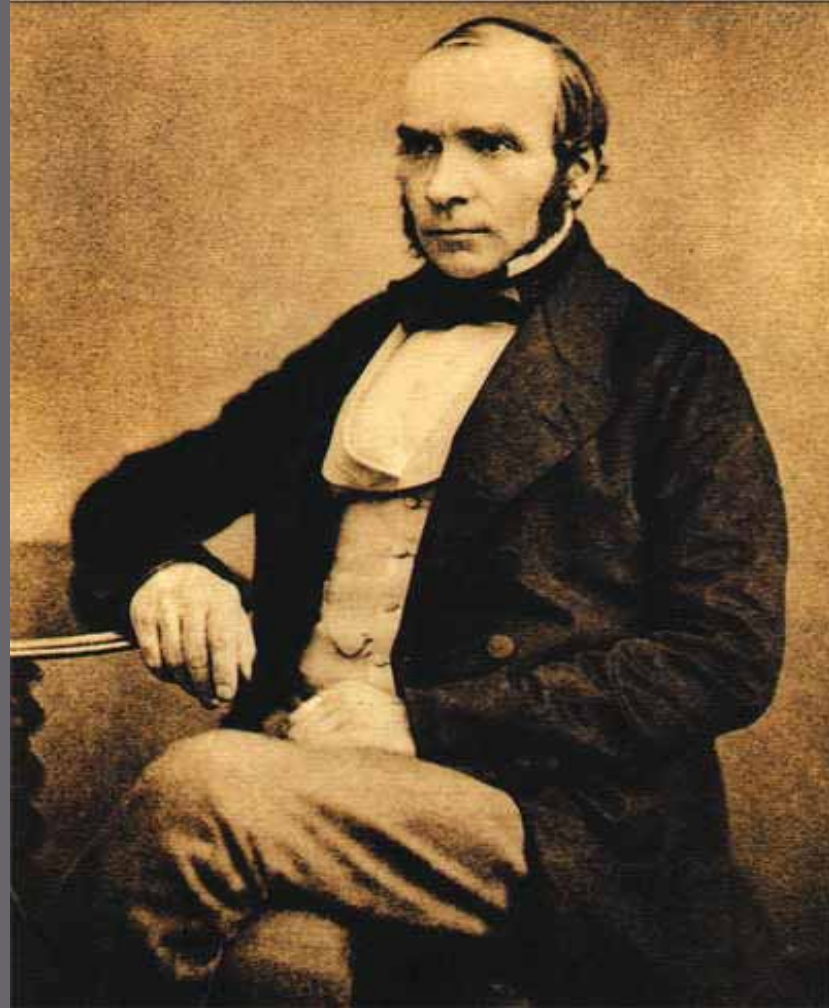
The Essential Role of Demand

 <p>2050 Payoff Scenarios</p>	<p>VEHICLE EFFICIENCY</p>  <p>MPG</p>	<p>FUEL MIX</p>  <p>GHGs/gal</p>	<p>DEMAND</p>  <p>daily VMT per capita</p>
<p>MAJOR PROGRESS</p>	<p>47</p>	<p>-35%</p>	<p>8.4</p>
<p>TECHNOLOGY BREAKTHROUGH</p>	<p>61</p>	<p>-65%</p>	<p>20.9</p>

The Precautionary Principle

wikipedia

- ▣ The precautionary principle states that if an action or policy has a suspected risk of causing harm to the public or to the environment, in the absence of scientific consensus that the action or policy is harmful, the burden of proof that it is not harmful falls on those taking the action.
- ▣ This principle allows policy makers to make discretionary decisions in situations where there is the possibility of harm from taking a particular course or making a certain decision when extensive scientific knowledge on the matter is lacking.
- ▣ The principle implies that there is a social responsibility to protect the public from exposure to harm, when scientific investigation has found a plausible risk.



John Snow 1857



The Broad Street Pump.

Has Zoning Become Health Adverse?

- ▣ The separation of residential, employment, and retail uses is associated with lower levels of active transportation and increased odds of being obese and being more at risk of developing a chronic disease
- ▣ It is now arguable that common modern applications of zoning are health adverse

Fiscal and Regulatory Approaches





Our Car Culture – me at 11

Summary

- ▣ Document (likely) health care **COST\$** (auto dominated) and **BENEFIT\$** of (transit & active) transportation investments
- ▣ Working across sectors
 - **Research** - Integration of health and urban planning research and data collection
 - **Practice** - Training planners to understand health and health practitioners to understand more about planning
- ▣ Zoning *for* Health
 - Health, safety, and welfare underpin development regulations and transportation investments
- ▣ Tying Transportation Funding to Measurable Performance



*Change is Inevitable. In a progressive
Country change is constant.
Benjamin Disraeli, 1867*