

INTEGRATING HEALTH INTO SCENARIO PLANNING



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Mission

To Support clients with innovative and objective information and tools to realize environmental, economic, and quality of life goals that are intrinsic in efforts to build new and to retrofit existing communities”.

“Pracademic” approach

Applied policy research, evidence based advice on relative impacts of alternative approaches to land use and transportation investment decisions.

Specialization

Interactions between land use, transportation, air quality, and public health.

Reputation

Demonstrated track record in conducting scholarly research and has been a leader in the assessment of how the design of communities impacts environmental and health related outcomes.

UrbanFootprint Health Module – background, theory

UrbanFootprint Health Module

- Growing body of evidence that the built environment influences travel, physical activity and health
- Health-related outcomes and costs need to be considered when making transportation & land use decisions
- Integrating health metrics into scenario planning results in a quantitative **Health Impact Assessment** tool



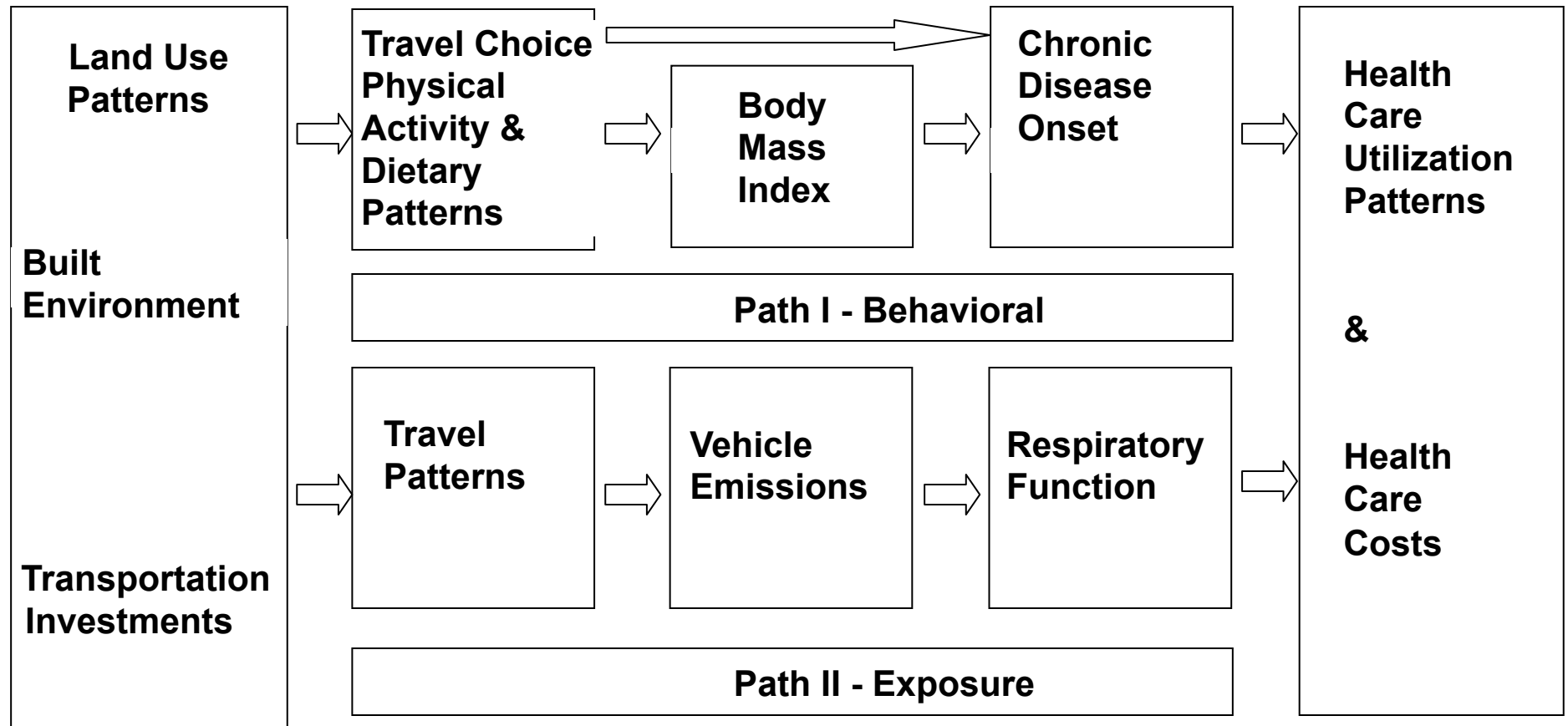
**Quality
of Life**

Environmental Quality
Air Quality and Greenspace

Human Behavior
Travel Patterns and Physical Activity

Built Environment
Transportation Investments and Land Use

CONCEPTUAL MODEL

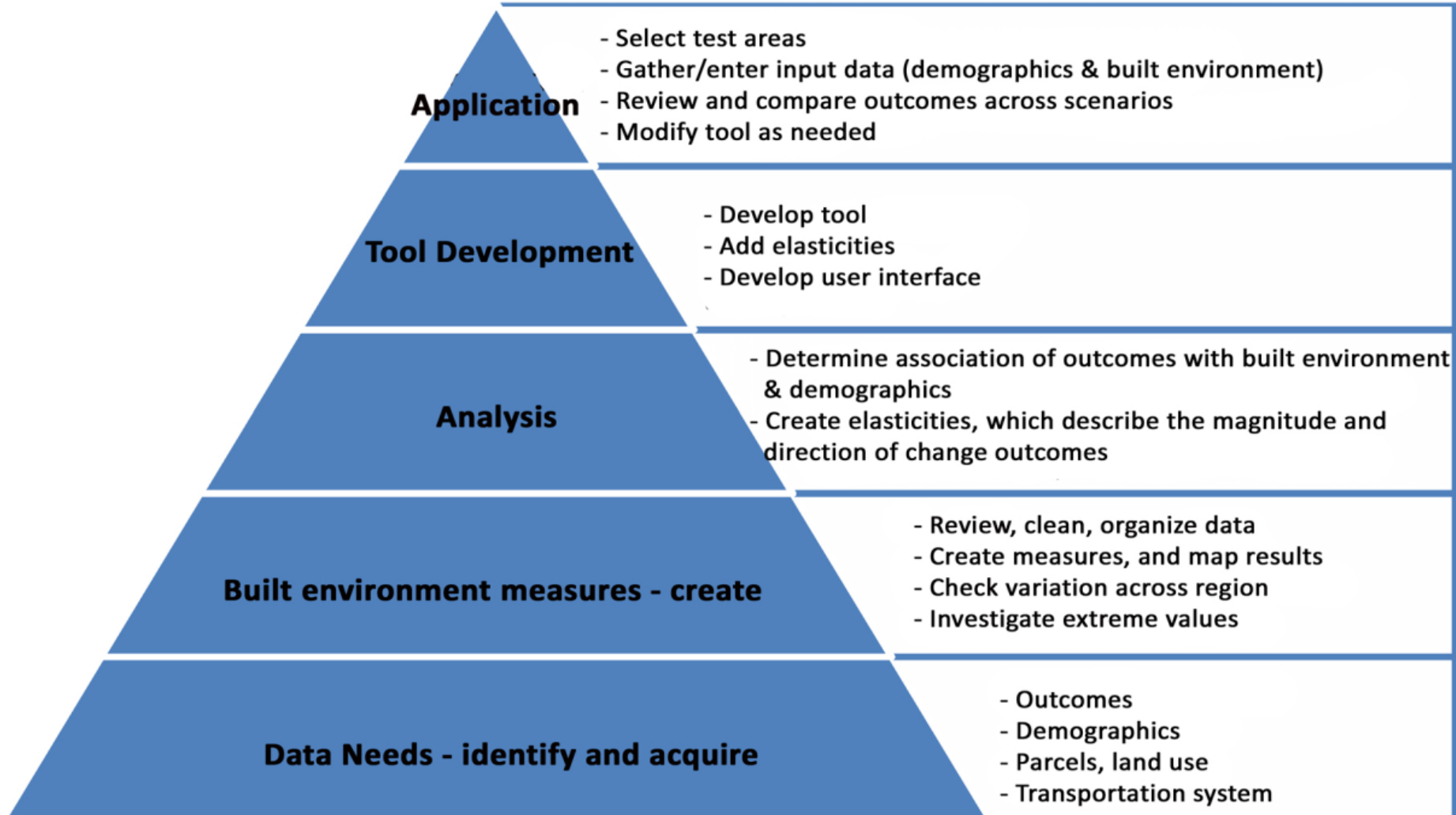


Note: **Diet and nutrition**, age, gender, income, genetics, and other factors also impact weight and chronic disease and to the extent possible are controlled in analyses. Vehicle age and climate impacts emissions and air quality, and respiratory function is also impacted by a variety of factors

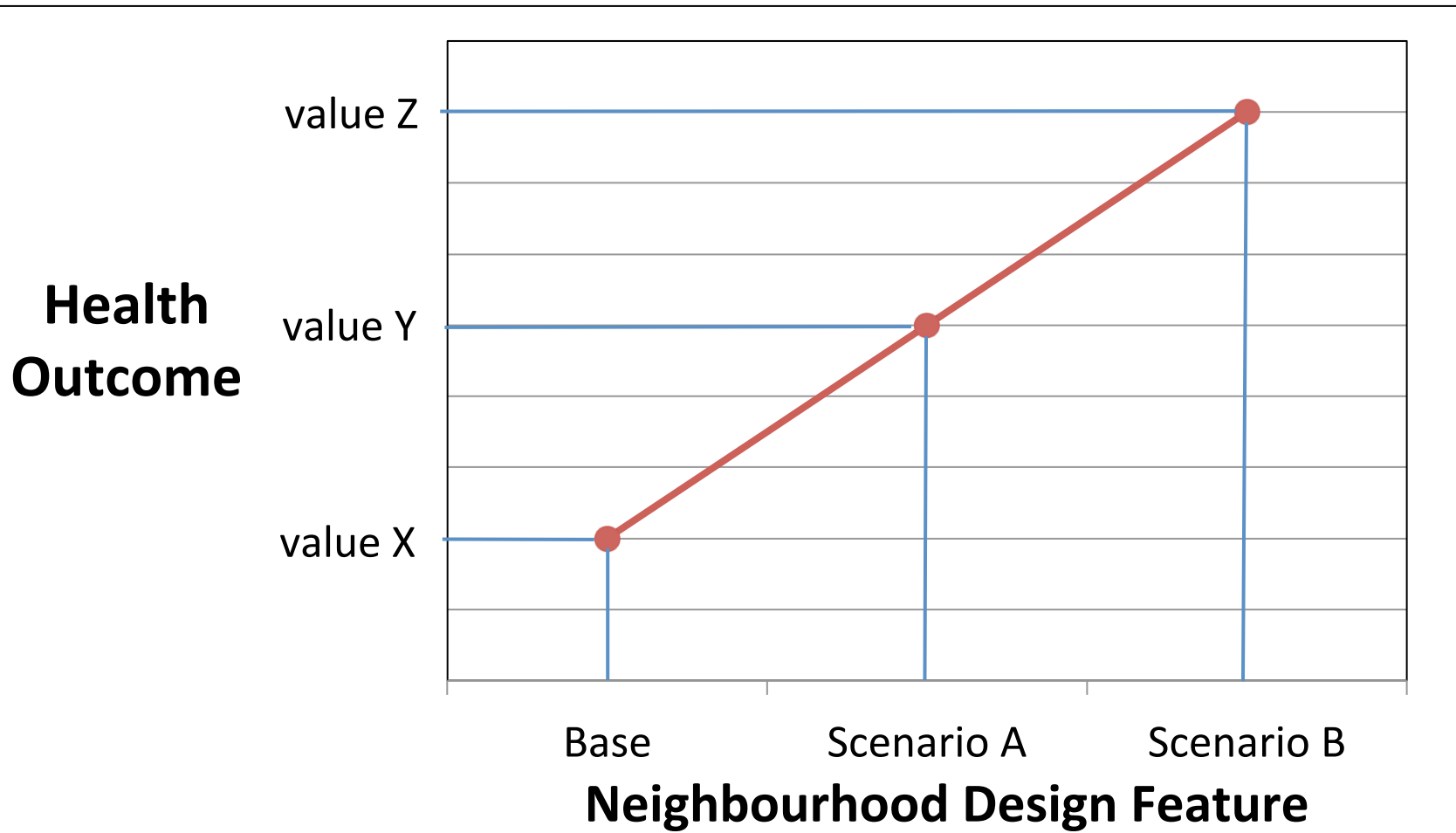
Builds on previous efforts:

- INDEX (Criterion Planners): Livable Community Initiative: Atlanta (SMARTRAQ)
- I-PLACE3S (California Energy Commission): King County, added health module
- Community Viz (Placeways): San Diego, Toronto, Ontario & Surrey, BC - added health module
- UrbanFootprint (Calthorpe Associates):
 - Vision California - added basic health module
 - Current update – refining models with better local data

Tool Development



Calculated Outcome Changes

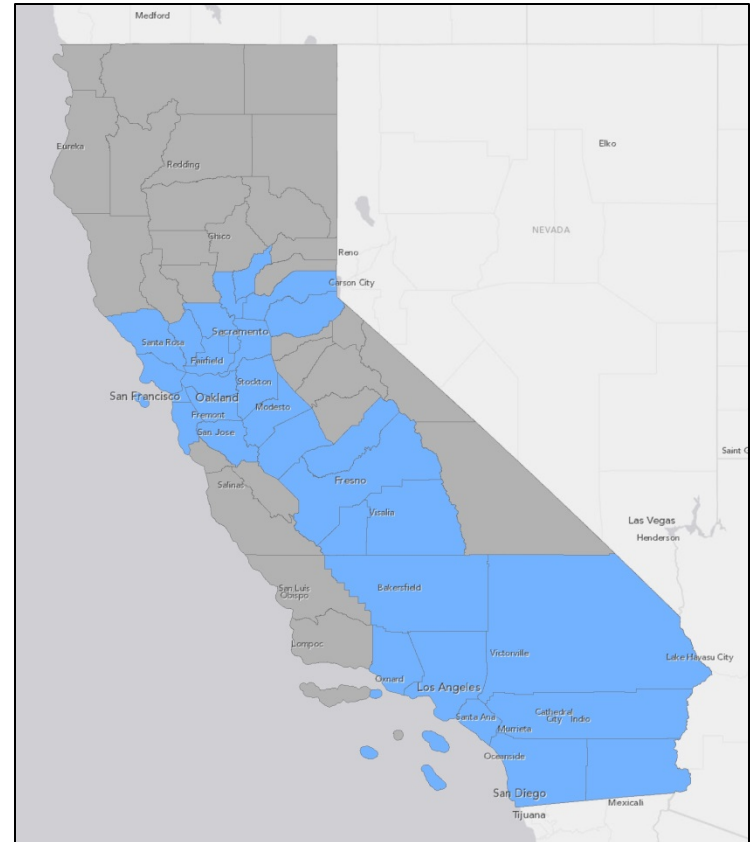


UrbanFootprint Health Module – overview

Study Region

30 counties across five
California regions:

- San Francisco Bay Area
- Sacramento
- San Diego County
- San Joaquin Valley
- Southern California
(including Los Angeles)



California Data sources

Provide Calif. demographics, socioeconomic status, behaviors, and health conditions:

- **UrbanFootprint** (UF) built environment, demographic, and socioeconomic data
- **Calif. Health Interview Survey** (CHIS)
- **Calif. Household Transport. Survey** (CHTS)



Strengths of approach

- **Large sample sizes**
 - 53,733 CHTS participants
 - 40,617 CHIS participants
- **Strata-specific model development**
 - 4 age groups (seniors, adults, teens, children)
 - For adults, three HH income groups (<\$50k, \$50-100k, >\$100k)
- **California-specific evidence base**
 - CHIS and CHTS data were collected from a representative cross-section of Californians
- **Variability in built environment characteristics**
 - 30-county study area covers a broad range of built environments and travel behaviors across California

Model overview

- **Model calibration**
 - California-specific data used to estimate associations between built environment characteristics & health behaviors/outcomes
- **User inputs**
 - Land use, transportation system, population characteristics
- **Calculated outputs**
 - Estimates of physical activity, obesity, and related health outcomes
- **Reporting of results**
 - Models applied at scale similar to a city block, then aggregated up to more statistically valid units (e.g. Census Tracts)
 - Results summarized in tables and displayed spatially

Models fitted

	Age cohort						
Data set	Adults, by income:			Senior	Teen	Child	Outcome
	Low	Med	High				
CHIS	x	x	x	x			Walking for transportation (min/wk)
	x	x	x	x			Walking for recreation (min/wk)
	x	x	x	x			Moderate physical activity (min/wk)
	x	x	x	x			Vigorous physical activity (min/wk)
					x	x	Days/week > 60 min physical activity
					x	x	Likelihood to walk/bike from school
	x	x	x	x	x	x	Body mass index
	x	x	x	x	x	x	Likelihood to be obese
	x	x	x	x			Likelihood to have high blood pressure
	x	x	x	x			Likelihood to have heart disease
	x	x	x	x			Likelihood to have type 2 diabetes
	x	x	x	x	x	x	Likelihood to have poor health
CHTS	x	x	x	x	x	x	Walking for transportation (min/day)
	x	x	x				Biking for transportation (min/day)
	x	x	x	x	x	x	Automobile travel (min/day)
	x	x	x	x	x	x	Recreational physical activity (min/day)

Sample sizes by cohort

- CHIS:

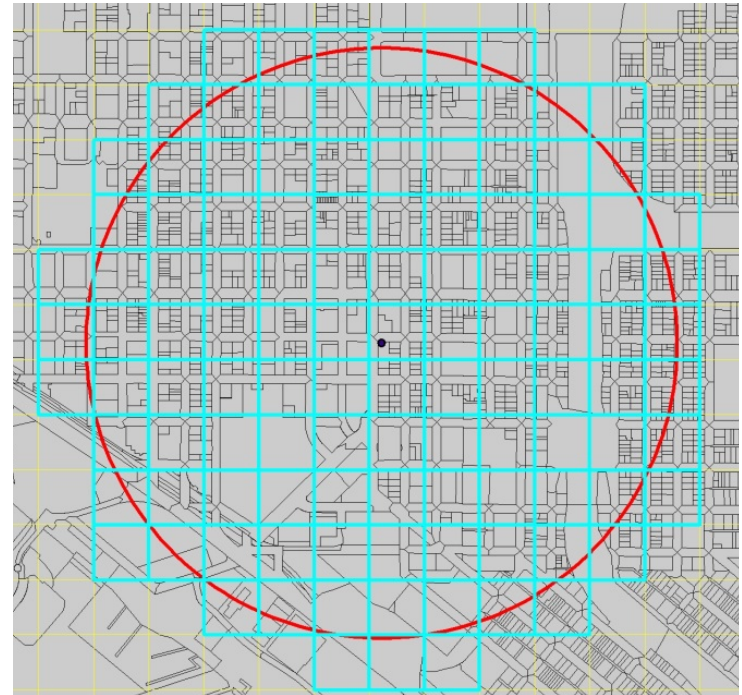
	Household income groups:			
Age groups:	All	Low (<\$35k)	Med (\$35-100k)	High (>\$100k)
Children (5-11)	3,117			
Teens (12-17)	2,367			
Adults (18-64)	23,515	9,188	6,537	7,790
Seniors (65+)	11,618			

- CHTS:

	Household income groups:			
Age groups:	All	Low (<\$50k)	Med (\$50-100k)	High (>\$100k)
Children (5-11)	4,829			
Teens (12-17)	4,734			
Adults (18-64)	35,695	10,593	11,283	13,819
Seniors (65+)	8,475			

Built environment data development

- Built environment variables were aggregated from grid cells to 1km airline buffers of each grid cell
- UF grid cells are 150m x 150m (about 5.5 acres)



Model Variables - Built Environment

- **Walkability index**

- dwelling unit count w/n 1km
- residential density w/n 1km
- retail floor area w/n 1km
- non-residential FAR w/n 1km
- distance to nearest retail
- distance to nearest restaurant
- land use mix w/n 1km
- intersection density w/n 1km
- local street length w/n 1km

- **Transit access index**

- transit stop count w/n 1km
- distance to nearest transit stop

- **Rail transit access within 2km**

- **Major road index**

- major street length w/n 1km
- any major road within 500m

- **Regional accessibility index**

- regional residential accessibility
- regional employment accessibility

- **Distance to nearest school**

- **Park access**

- Park acres w/n 1km
- Distance to nearest park

Model fitting procedure

- Applied variety of regression types:
 - Linear regression
 - Binary logistic regression
 - Poisson regression
 - Two-part regression for zero-inflated outcomes
 - Binary logistic regression for likelihood of any activity
 - Linear regression for amount of activity for those with any
- Backward stepwise variable selection process
- Validation process to check for:
 - Multicollinearity problems
 - Consistency of associations and predicted results with published evidence

CHIS Adult Models

Comparing 1) observed outcomes, 2) base year forecasted outcomes, 3) forecasted outcomes after built environment improvements

Outcome	mean sample observed outcome	mean base predicted outcome	mean change predicted outcome	absolute change (base predicted – change predicted)	% change
minutes of transportation walking (daily)	5.0	5.0	6.0	1.0	19.1%
minutes of transportation biking (daily)	1.2	1.1	1.3	0.2	17.8%
minutes of automobile transportation (daily)	74.9	75.2	74.3	-0.9	-1.2%
minutes of recreational PA (daily)	17.9	17.9	18.4	0.5	2.7%
body mass index	26.9	26.8	26.7	-0.2	-0.7%
likelihood of being overweight or obese	56.4%	56.4%	54.7%	-1.7%	-3.0%
likelihood of being obese	23.4%	23.3%	22.3%	-1.0%	-4.3%
likelihood of having high blood pressure	25.8%	25.7%	24.9%	-0.8%	-3.0%
likelihood of having heart disease	4.8%	4.7%	4.6%	-0.1%	-2.1%
likelihood of having type 2 diabetes	6.1%	5.9%	5.6%	-0.3%	-5.0%
likelihood of having poor self-reported health	17.8%	17.6%	17.5%	-0.2%	-0.9%

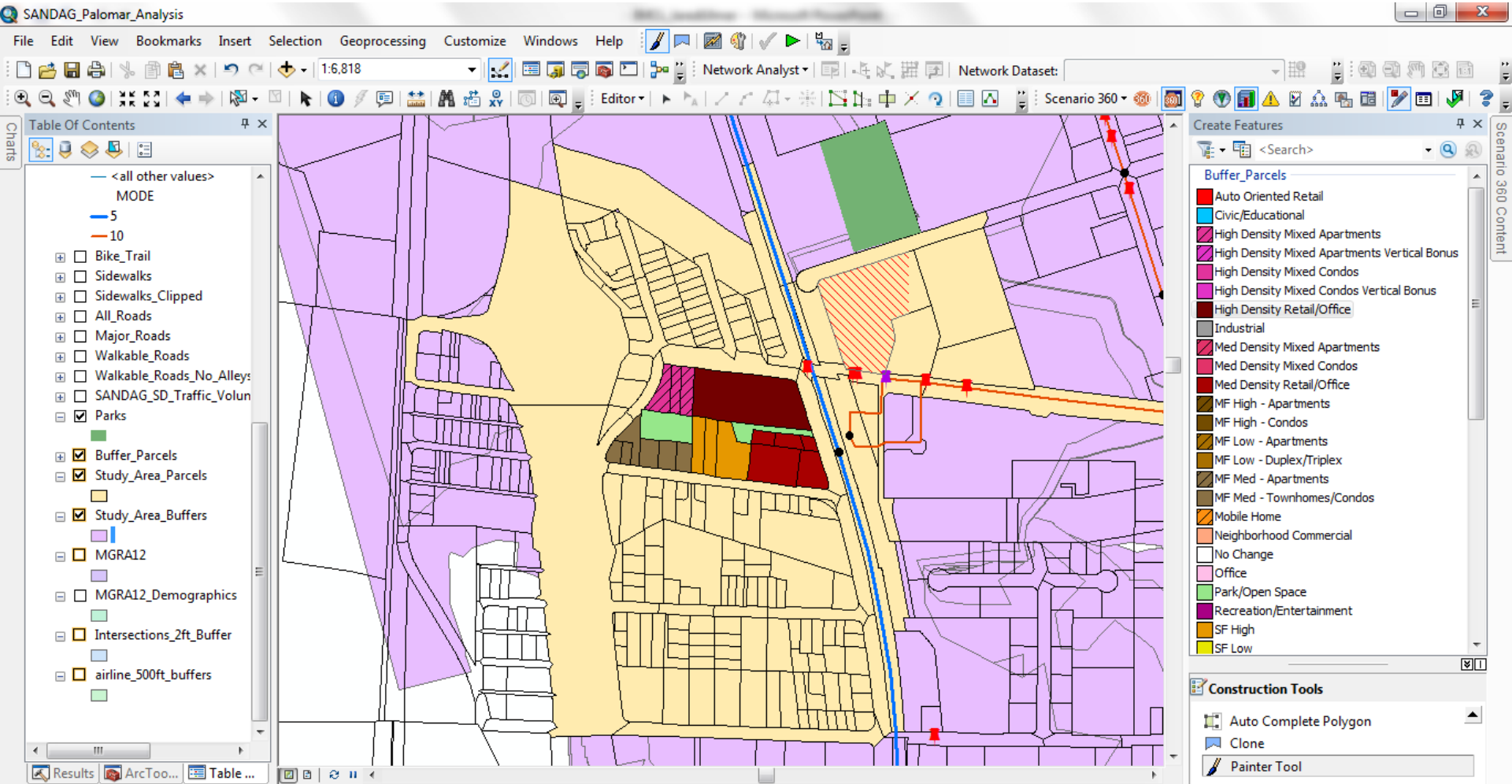
Results are preliminary and for illustrative purposes only

Potential applications

- Better inform decisions related to:
 - Development proposals
 - Land use and transportation plans/policies
 - Capital investments
- Conducting Health Impact Assessments
- Monetizing health-related impacts
- Identifying and mitigating health disparities at a high spatial resolution

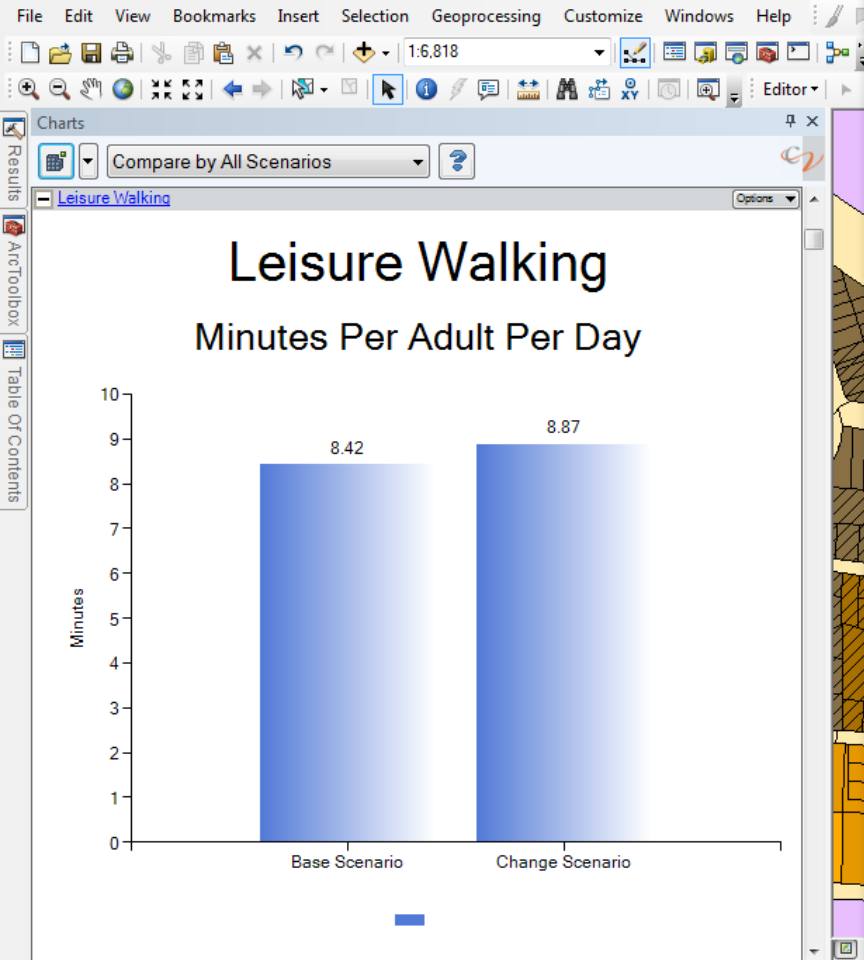
Examples of health model applications

CommunityViz - “painting” new land uses



CommunityViz - charts & indicators







SANDAG_Palomar_Analysis



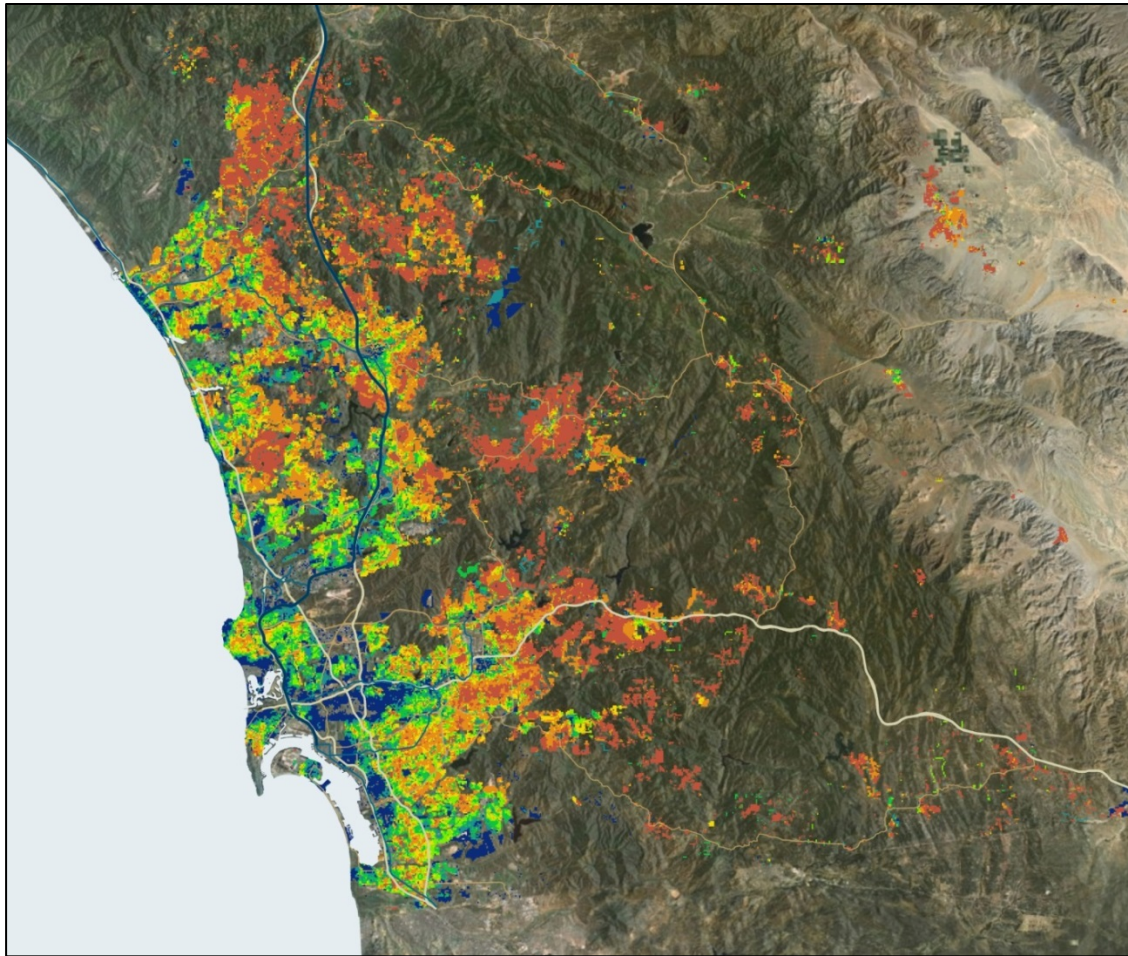
Indicators

Indicator	Units	Base Scenario	Change Scenario
Single Family DU		192.00	80.28
Multi-Family DU		155.00	1,625.81
Residential Area		44.32	68.51
Retail Area	acres	15.72	7.26
Park Area	acres	1.20	1.20
Retail Floorspace		370,073.00	395,221.22
Office Floorspace		0.00	41,237.62
Civic and Education Flo...		0.00	20,034.98
Recreation and Entertai...		0.00	68,393.44
Number of Schools		0.00	0.00
Number of Transit Stops		3.00	3.00
Number of Farmers Mark...		0.00	1.00
Number of Fast Food		7.00	10.00
Number of Grocery Stores		1.00	2.00
Number of Intersections ...		24.00	24.00
Number of Intersections ...		0.00	0.00
Total Intersections		24.00	24.00
Walkable Road Feet - B...	feet	22,007.56	22,007.56
Sidewalk Feet - Base St...	feet	23,501.52	23,501.66
Sidewalk Feet - Base St...	feet	0.00	0.00
Walkable Road Feet - N...	feet	0.00	0.00
Sidewalk Feet - New	feet	0.00	5,445.22
Total Walkable Road Mil...	miles	4.17	4.17
Total Sidewalk Miles	miles	4.45	5.48
Bike Feet - Base	feet	2,719.32	2,719.32
Bike Feet - New	feet	0.00	3,831.76
Total Bike Miles	miles	0.52	1.24
Net Residential Density	acres	7.83	24.90
Retail FAR		0.54	1.25
Intersection Density	sq miles	104.62	104.62
Office FAR		0.00	0.78
Office Area	acres	0.00	1.21
Sidewalk Coverage	miles	0.53	0.66
Total Population		883.90	3,840.76

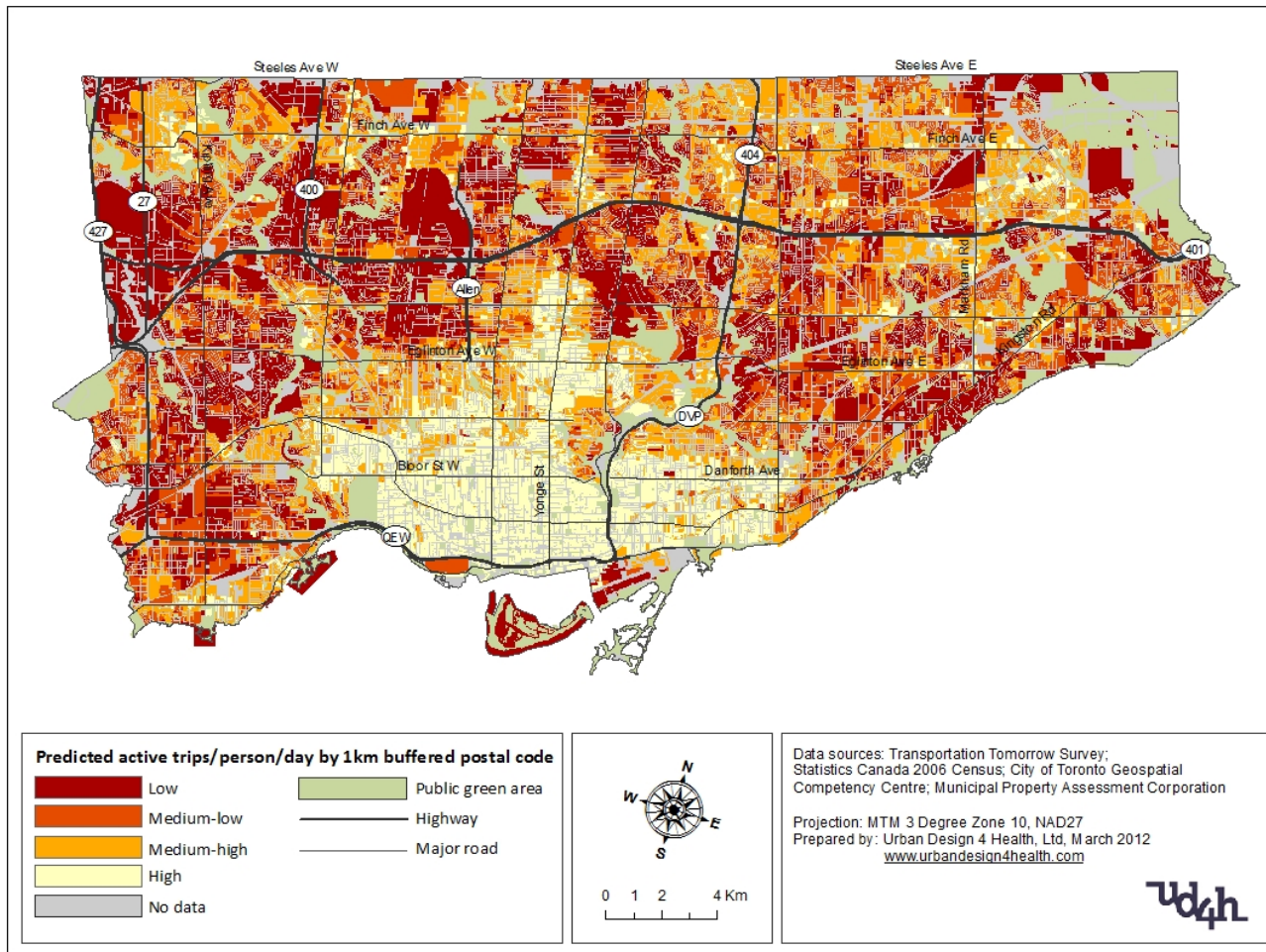
Health metrics: Palomar Gateway case study (San Diego)

Color Key				
	1-10% change - positive health impact		1-10% change - negative health impact	
	10-25% change - positive health impact		10-25% change - negative health impact	
	over 25% change - positive health impact		over 25% change - negative health impact	
HEALTH INDICATOR	Regional base	Base Scenario	Change Scenario	Percent Change
Daily minutes in car – adults (age 16 and up)	55.81	49.04	44.89	-8.46%
Daily minutes transportation walking – adults (age 16 and up)	6.61	6.1	10.24	67.87%
Daily minutes leisure walking - adults (18 and up)	12.27	8.42	8.87	5.34%
Daily minutes leisure moderate activity (adults 18+; not incl. walking)	34.21	17.33	18.38	6.06%
Percent visiting park in last 30 days (adults 18 and up)	70.3	56.95	59.23	4.00%
Body Mass Index - Adults 18 and up	26.73	28	27.65	-1.25%
Percent of adults obese	21.7	32.73	31.66	-3.27%
Percent of adults overweight or obese	59	68.91	66.98	-2.80%
Percent of adults with high blood pressure	28.2	30.92	26.16	-15.39%
Percent of adults with Type 2 Diabetes	4.4	8.63	7.8	-9.62%
Percent of adults 18 and up with current asthma	10.8	5.69	5.43	-4.57%

Predicted daily min. physical activity (blue = high, red = low) – San Diego



Predicted active trips/person/day - Toronto



- End Part 1 -

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