Urban Sprawl and Public Health

HEES
October 4, 2001

Richard Jackson, M.D., M.P.H.
National Center for Environmental Health

Howard Frumkin, M.D., Dr.P.H.
Rollin School of Public Health
1. Background: “Urban form” as a public health issue
2. Sprawl: a definition
3. Health implications of sprawl
4. A public health approach to sprawl
Background: Urban form as a determinant of public health
The Epidemiologic Transition of Cities
1. The Age of Pestilence and filth
“As a rule, the streets are extremely dirty and offensive, and the gutters obstructed with filth. The filth of the streets is composed of house-slops, refuse vegetables, decayed fruit, store and shop sweepings, ashes, dead animals, and even human excrements....The reeking stench of the gutters, the street filth, and domestic garbage of this quarter of the city, constantly imperil the health of its inhabitants.”

Eleventh Ward Inspector, New York City, 1864
CHOLERA.

THE DUDLEY BOARD OF HEALTH, hereby give notice, that in consequence of the Church-yards at Dudley

Being so full, no one who has died of the CHOLERA will be permitted to be buried after SUNDAY next, (To-morrow) in either of the Burial Grounds of St. Thomas’s, or St. Edmund’s, in this Town.

All Persons who die from CHOLERA, must for the future be buried in the Church-yard at Netherton.

BOARD OF HEALTH, DUDLEY.
September 1st, 1832.

W. MAURICE, PRINTER, HIGH STREET, DUDLEY.
2. The Age of Industrial pollution
Pittsburgh, 1890
3. The Age of Social Pathology
The summer of 1967: 130 urban riots across the United States
All persist today
Manila
But we can also identify...

4. The Age of Urban Sprawl
What is sprawl?

A pattern of urban regional development that features:

- Land-extensive, low density, leapfrog development
- Segregation of land uses
- Extensive road construction
- Architectural homogeneity
- Economic and racial homogeneity
- Shift of development and capital investment from inner city to periphery
- Absence of regional planning
Sprawl: A Schematic

Suburban Development

Traditional Neighborhood
Land consumption: Changes in population and land area, selected metro areas, 1970-90.

### Population Density: Selected Cities, 1997

<table>
<thead>
<tr>
<th>City</th>
<th>Area (square miles)</th>
<th>Pop’n (in 000s)</th>
<th>Density (people/sq. mile)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Washington</td>
<td>1,000</td>
<td>3,465</td>
<td>3,465</td>
</tr>
<tr>
<td>Boston</td>
<td>1,155</td>
<td>3,015</td>
<td>2,610</td>
</tr>
<tr>
<td>San Diego</td>
<td>755</td>
<td>2,610</td>
<td>3,455</td>
</tr>
<tr>
<td>Atlanta</td>
<td>1,790</td>
<td>2,580</td>
<td>1,440</td>
</tr>
<tr>
<td>Phoenix</td>
<td>1,090</td>
<td>2,400</td>
<td>2,200</td>
</tr>
<tr>
<td>Dallas</td>
<td>1,610</td>
<td>2,320</td>
<td>1,440</td>
</tr>
</tbody>
</table>
Population shifts:
Suburbanization of the U.S., 1990-98
Travel patterns

The Atlanta Region:
Household Vehicle Hours of Travel
by Employment Density

Adapted from: Lawrence D. Frank, "Land Use Impacts on Household Travel Choice and Vehicle Emissions in the Atlanta Region," January, 1999.
Driving in Atlanta, 1997

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Per Capita</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicle Miles Traveled (VMTs)/day</td>
<td>95,110,000</td>
<td>36.9</td>
</tr>
<tr>
<td>Hours of delay/year</td>
<td>136,590,000</td>
<td>52.9</td>
</tr>
<tr>
<td>Excess fuel consumed/year</td>
<td>214,000,000</td>
<td>82.6</td>
</tr>
</tbody>
</table>

Source: Texas Transportation Institute, 1999
How might sprawl affect health?

- ↑ air pollution
- greenhouse gas emissions
- ↑ heat island effect
- ↓ physical activity
- ↑ car crashes
- ↑ pedestrian injuries
- water quantity and quality
- mental health consequences
- ↓ social capital
Air pollution

Major pollutants of concern:

- ozone
- NOx
- CO
- particulates
- hydrocarbons
- lead
- SOx
- air toxics
- allergens
Air pollution

Major pollutants of concern:

- Ozone
- NOx
- CO
- Particulates
- Hydrocarbons
- Lead
- SOx
- Air toxics
- Allergens

Produced by cars and trucks.
Ozone

8hrO3 at TUCKER on 08/17/00

8hrO3 (ppm, 8 hr avg)

0.150

0.100

0.050

0.000

Unhealthy

Time (EDT)
Atlanta skyline: Siege of smog

The buildings of Midtown rise up out of the smog and haze that blanketed the city Thursday afternoon. Atlanta has been under a smog alert for three weeks.

20th straight day of health alert

Smog alert is a 38-year-old law designed to control pollution from motor vehicles.

It is a result of the city's efforts to reduce pollution by encouraging people to carpool or drive less.

SMOG ALERT
TODAY AND TOMORROW
CARPOOL—DRIVE LESS
Ozone health effects

• Respiratory effects:
  ▪ Airway inflammation
  ▪ Decreased air flow
  ▪ Increased symptoms, ER visits, medication use, hospitalizations

• Cardiovascular effects:
  ▪ Increased mortality

• Immune effects:
  ▪ Increased susceptibility to infection
## Greenhouse gas emissions

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Per Capita</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicle Miles Traveled (VMTs)/day</td>
<td>95,110,000</td>
<td>36.9</td>
</tr>
<tr>
<td>Hours of delay/year</td>
<td>136,590,000</td>
<td>52.9</td>
</tr>
<tr>
<td>Excess fuel consumed/year</td>
<td>214,000,000</td>
<td>82.6</td>
</tr>
<tr>
<td>Excess CO₂ produced/year</td>
<td>2.09 million tons</td>
<td></td>
</tr>
</tbody>
</table>

Source: Texas Transportation Institute, 1999
The Heat Island

Sketch of an Urban Heat-Island Profile

Late Afternoon Temperatures (°F)

- Rural
- Suburban Residential
- Commercial
- Downtown
- Urban Residential
- Park
- Suburban Residential
- Rural Farmland
Atlanta’s Heat Island: May 11, 1997

Source: NASA Marshall Space Flight Center
Health Consequences of Heat

- Heat syncope
- Heat edema
- Heat tetany
- Heat cramps
- Heat exhaustion
- Heat stroke

Increasing severity
Physical Activity

sprawl

- ↑ trip distances
- ↑ vehicle trips
- ↓ walking

↑ overweight
↑ obesity
Want to take a walk?
Fat for Life?
Six Million Kids Are Seriously Overweight. What Families Can Do.
By Geoffrey Cowley & Sharon Begley
Sedentary Lifestyle

- ↑ overall mortality (2 to 3-fold)
- ↑ cardiovascular disease (3 to 5-fold)

The effect of low physical fitness is comparable to that of hypertension, high cholesterol, diabetes, and even smoking

Sources: Wei et al., *JAMA* 1999; Blair et al., *JAMA* 1996

Overweight / Obesity

- ↑ risk of overall mortality (up to 2.5-fold in the 30-44 age group, less at older ages)
- ↑ risk of cardiovascular mortality (up to 4-fold in the 30-44 age group, less at older ages)
- ↑ risk of diabetes (up to 5-fold)
- ↑ risk of hypertension
- ↑ risk of some cancers
- ↑ risk of gall bladder disease

Prevalence of Obesity* Among U.S. Adults
BRFSS, 1992

(*Approximately 30 pounds overweight)
Prevalence of Obesity* Among U.S. Adults
BRFSS, 1998
(*Approximately 30 pounds overweight)
Diabetes Prevalence, 1991-92
Diabetes prevalence, 2000
Car Crashes
Car crashes

• Leading cause of deaths among persons 1-24 years old

• Each year in the United States, motor vehicle crashes account for:
  ▪ 42,000 deaths
  ▪ 3.4 million nonfatal injuries
  ▪ 24 million vehicles
  ▪ estimated $200 billion in costs

Source: NHTSA
Automobile fatality rates by city, 1998
(excluding pedestrian fatalities; deaths/100,000/year)

<table>
<thead>
<tr>
<th>City</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>New York</td>
<td>2.51</td>
</tr>
<tr>
<td>San Francisco</td>
<td>3.76</td>
</tr>
<tr>
<td>Philadelphia</td>
<td>5.36</td>
</tr>
<tr>
<td>Portland</td>
<td>6.55</td>
</tr>
<tr>
<td>Houston</td>
<td>9.80</td>
</tr>
<tr>
<td>Phoenix</td>
<td>10.52</td>
</tr>
<tr>
<td>Dallas</td>
<td>11.33</td>
</tr>
<tr>
<td>Atlanta</td>
<td>13.12</td>
</tr>
</tbody>
</table>

Source: NHTSA
Pedestrian fatalities
### Pedestrian fatality rates by city, 1998
(deaths/100,000/year)

<table>
<thead>
<tr>
<th>City</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>New York</td>
<td>2.33</td>
</tr>
<tr>
<td>San Francisco</td>
<td>4.55</td>
</tr>
<tr>
<td>Philadelphia</td>
<td>1.88</td>
</tr>
<tr>
<td>Portland</td>
<td>2.58</td>
</tr>
<tr>
<td>Houston</td>
<td>3.41</td>
</tr>
<tr>
<td>Phoenix</td>
<td>4.09</td>
</tr>
<tr>
<td>Dallas</td>
<td>4.28</td>
</tr>
<tr>
<td>Atlanta</td>
<td>6.44</td>
</tr>
</tbody>
</table>

Source: NHTSA
Pedestrian fatalities in Cobb, DeKalb, Fulton, and Gwinnett counties, Georgia, 1994-98, by race/ethnicity

<table>
<thead>
<tr>
<th>Race/Ethnicity</th>
<th>Number</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black</td>
<td>140</td>
<td>3.85</td>
</tr>
<tr>
<td>White</td>
<td>117</td>
<td>1.64</td>
</tr>
<tr>
<td>Hispanic</td>
<td>40</td>
<td>9.74</td>
</tr>
</tbody>
</table>

Source: MMWR, 1999
Water quantity and quality

• Quantity:
  - ↑ runoff, ↓ groundwater recharge

• Quality:
  - ↑ non-point source pollution
  - ↑ siltation
Mental Health

Road rage: Needless deaths

By Bill Montgomery
bmontgomery@ajc.com

Pat Duron admits that her husband, Chris, resembled “a big, rough bear” who could display a bearish temper.

He had mellowed with marriage, but Chris Duron’s widow and Clayton County police suspect he died Jan. 28 because he was angry enough to confront someone on I-75 who had an even hotter temper — and a gun.

The volatile combination of traffic-induced stress and anger that has become known as road rage has claimed at least five victims — killed or critically wounded — in metro Atlanta in a little more than three years.

Not all were active participants in a confrontation. Two-year-old Anthony Grimes, asleep in the cab of his father’s tractor-trailer, was critically injured by a gunshot April 21 from a car jockeying for the same lane on I-20 near Villa Rica. The shooting of the child, like Duron’s slaying, remains unsolved.

In the other fatal incidents:

- Truck driver William Henry Sluder, 49, was killed on I-20 in downtown Atlanta in March 1999 by gunfire from an Oldsmobile Delta 88. The case has not been solved.

- Sarkis Hazzouri, 38, a Cobb County businessman, was shot in...
Road Rage

• “driver behavior most people wouldn’t dream of doing if they were face to face with another person” (Wisconsin DHFS)

• 1990-96: 51% ↑ rate of “events in which an angry or impatient driver tries to kill or injure another driver after a traffic dispute.” 10,000 reported incidents, 12,610 injuries, 218 deaths (AAA Foundation for Traffic Safety, 1997)
## Self-reported aggressive driving behaviors (% respondents in each category)

<table>
<thead>
<tr>
<th>Behavior</th>
<th>Never</th>
<th>Rarely</th>
<th>Sometimes</th>
<th>Often</th>
</tr>
</thead>
<tbody>
<tr>
<td>Say bad things to yourself about other drivers</td>
<td>15.3</td>
<td>22.9</td>
<td>39.5</td>
<td>22.1</td>
</tr>
<tr>
<td>Complain or yell about other drivers to a passenger in your vehicle</td>
<td>25.5</td>
<td>22.2</td>
<td>39.0</td>
<td>13.1</td>
</tr>
<tr>
<td>Give another driver a dirty look</td>
<td>41.8</td>
<td>17.6</td>
<td>32.7</td>
<td>7.7</td>
</tr>
<tr>
<td>Honk or yell at someone</td>
<td>61.1</td>
<td>17.9</td>
<td>17.9</td>
<td>2.9</td>
</tr>
<tr>
<td>Keep someone from entering your lane because you are angry</td>
<td>80.2</td>
<td>12.9</td>
<td>5.9</td>
<td>0.8</td>
</tr>
<tr>
<td>Make obscene gestures to another driver</td>
<td>83.7</td>
<td>9.2</td>
<td>6.1</td>
<td>0.8</td>
</tr>
<tr>
<td>Think about physically hurting another driver</td>
<td>89.0</td>
<td>5.4</td>
<td>4.4</td>
<td>1.1</td>
</tr>
<tr>
<td>Make sudden or threatening moves to intimidate another driver</td>
<td>94.6</td>
<td>4.0</td>
<td>1.1</td>
<td>0.1</td>
</tr>
<tr>
<td>Follow or chase another driver in anger</td>
<td>96.5</td>
<td>3.2</td>
<td>0.3</td>
<td>0.0</td>
</tr>
</tbody>
</table>

Social capital defined as:

- Social networking and engagement
- Trust and reciprocity
Sprawl and social capital

• More driving time means less time with family, friends, and civic organizations.
  • Putnam: every 10 minutes of commute time means a 10% decline in social capital
• Suburban voters tend to favor more individualized, less collective solutions.
• Residential stability across the lifespan: The need for elders to change neighborhoods.
• Aggravated income inequality?
Sprawl and income inequality

[Diagram showing signs directing to different types of homes: ELEGANT HOMES FOR REALLY RICH PEOPLE, HANDSOME UPPER MIDDLE CLASS HOMES, PERFECTLY ADEQUATE WORKING CLASS HOMES]
Sprawl and income inequality
Health implications of sprawl: Summary

- ↑ air pollution
- greenhouse gas emissions
- ↑ heat island effect
- ↓ physical activity
- ↑ car crashes
- ↑ pedestrian injuries
- water quantity and quality
- mental health consequences
- ↓ social capital
Denser suburban growth urged

By D.L. Bennett
dbennett@ajc.com

The Atlanta Regional Commission wants local counties to adjust their land use plans to support a regional transportation plan within 18 months or risk the loss of future road-building money. The region's $33 billion transportation blueprint must pass federal muster before any new road money will be sent from Washington.

In most suburban counties, land use policies and zoning laws separate commercial and residential neighborhoods from the noise and pollution created by shopping centers. But the region's short- and long-term transportation plans rely on local governments to limit sprawl by clustering homes and offices in major corridors. The density of such developments would crisscross the region with federal clean-air rules.

Federal regulators' symbolic warning won't meet air-quality standards. But the Regional Commission has yet to submit a plan showing how it will rewrite ordinances to comply, and 10 more months to implement the changes. Krautter's proposal will be considered with the Georgia Regional Transportation Agency, which can withhold road-building money.

Candiates push 'slow-growth' agenda

Concerns over traffic, density and green space in forefront, but there are no simple answers.

By Janet Frankston
jfrankston@ajc.com

Candidates in several key metro Atlanta races are hoping to ride a "slow-growth" platform into office next week, but many might find that getting elected is the easy part.

From Gwinnett to Cobb to Cherokee, county commission candidates seek to tap into voters' concerns about traffic, density, green space and other growth-related issues. That same growth, though, has powered Atlanta's strong economy.

But Hunter said he couldn't always count on support from other commissioners, an experience shared by others as well.

"I was on the opposite side of a 3-2 vote for years," said Cherokee Commissioner Ilona Sanders, a slow-growth proponent who won re-election in the July primary.

Slow-growth commissioners now are the majority on the Cherokee board, but some proposals to manage growth will face opposition. Last year's countywide referendum was defeated, in part because registered voters opposed the plan.

Gwinnett slaps reins on growth

By Stacy Shelton
sshelton@ajc.com

Gwinnett, the county that rarely says no to a bulldozer, is finally taking a break.

County commissioners Tuesday unanimously approved a seven-month ban on requests for rezonings and special use permits—the only developers need to build apartments on land zoned for single-family homes.

Residential developers have been a popular target of rezonings in recent years since no projects were in the pipeline. It was largely symbolic, something observers say this latest moratorium could wind up being.

A seven-month backlog on rezoning requests had created a de facto moratorium. Even without Tuesday's official action, a new application could not have been submitted until March 1.
Smart Growth: A definition

A pattern of regional development that:
- protects and improves the quality of life for all citizens
- permits and promotes healthy behaviors
- minimizes or eliminates hazards to people
- protects, preserves, and restores the natural environment
Smart growth is likely to feature:

- Higher density, more contiguous development with walkable neighborhoods
- Preserved green spaces and other environmental amenities
- Mixed land uses
- Limited road construction, balanced by transportation alternatives (pedestrian, bicycles, mass transit)
- Architectural heterogeneity
- Economic and racial heterogeneity
- Development and capital investment balanced between central city and periphery
- Effective, coordinated regional planning
A Public Health Approach to Sprawl

Issues to consider:
• Enormous and growing interest among policymakers and the public.
• Possibility of “collateral benefits” of interventions
• The action is at the state and local level
The Intersection of Public Health and Sprawl

Potential loci of public health involvement:

• Zoning decisions
• Greenspace preservation efforts
• Mass transit decisions
• Design issues e.g. sidewalks
• Watershed protection programs
• Public education
Public health officials do not just work in the Health Department. They also include:

- Urban planners
- Transportation engineers
- Landscape architects
- Developers
- Lenders
- Neighborhood activists

...and many others.