The Spatial Context of Health Disparities:

University of Connecticut

Findings from the UConn-DPH Geocoding Collaborative

Wednesday, December 10, 2008
1:00 to 4:00 PM
The Lyceum
Hartford, Connecticut

DPH
Connecticut Department of Public Health

The Spatial Context of Health Disparities in Connecticut: The Role of Local Poverty Levels

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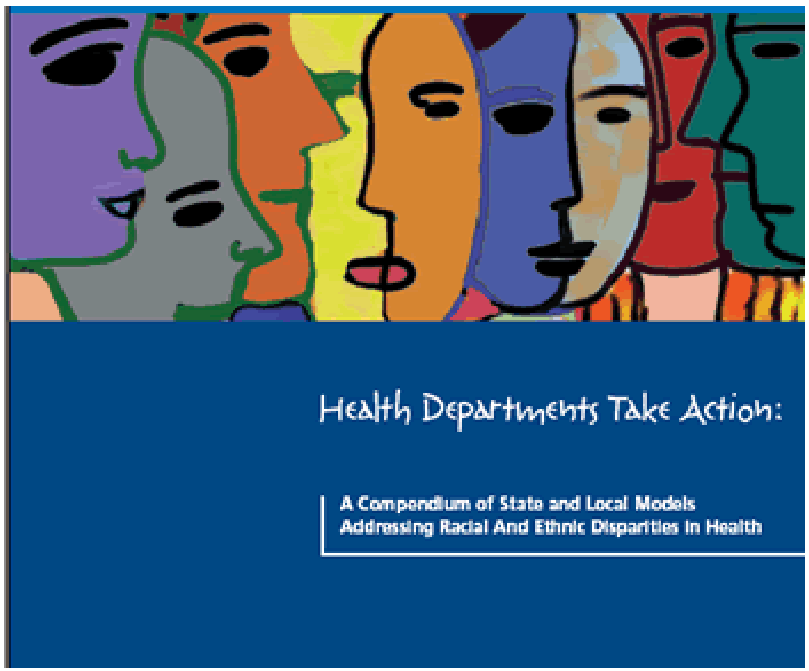
What are Health Disparities?

- "…differences in health status among distinct segments of the population including differences that occur by gender, race or ethnicity, education or income, disability, geographic location, and sexual orientation," (Division of Public Health, NC, 2008).

Healthy People 2010 Initiative

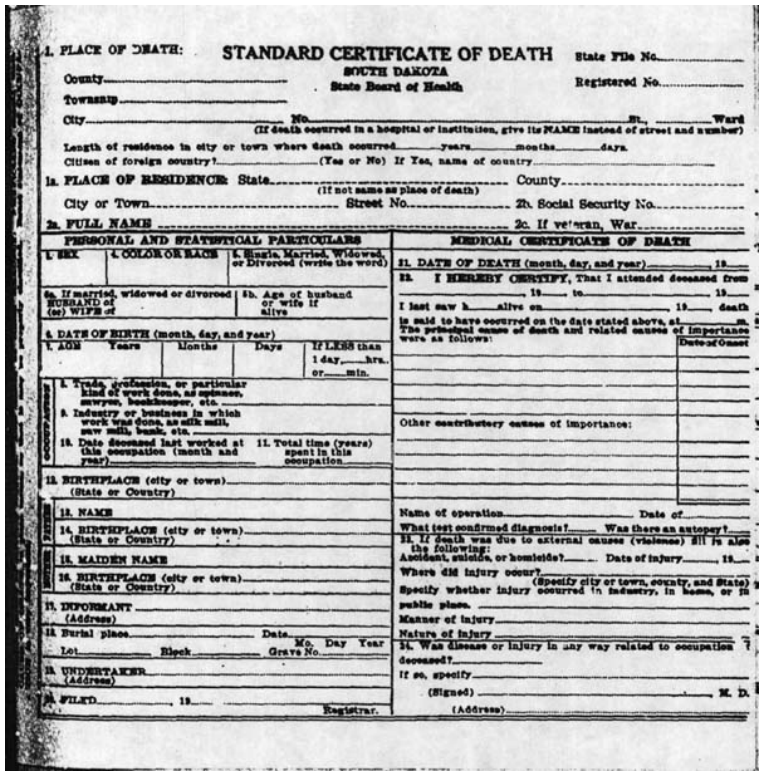


- Major federal and local funding to investigate and eliminate health disparities between various social, economic and demographic groups
- In CT: "Connecticut Center for Eliminating Health Disparities Among Latinos," at UConn (NIH), and "Connecticut Health Disparities Project," at DPH (Connecticut Health Foundation.)

The Spatial Context of Health Disparities

- Significance of spatial *context:* socioeconomic and environmental characteristics of places where people live their lives
- In contrast, much of the research has focused on *composition* factors, or the characteristics of an individual (income, race, ethnicity, age, education, etc.)
- Long-term "civil" debate in academia on roles of composition versus context in the creation and persistence of health disparities in mortality and morbidity

Analyzing the Role of Spatial Context in Health Disparities



STANDARD CERTIFICATE OF DEATH

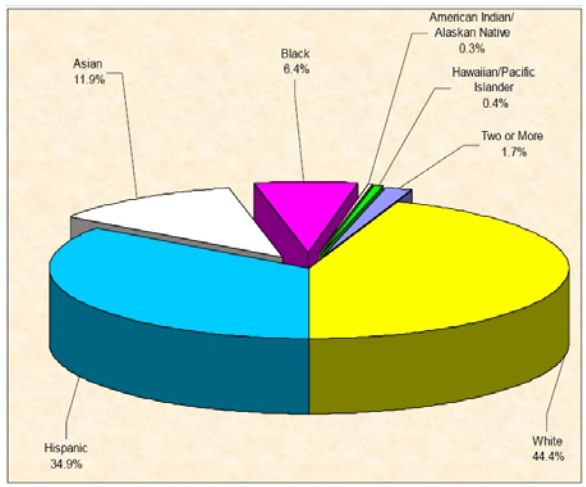
SOUTH DAKOTA

State Board of Health

- Need accurate data collected on a regular basis at a small scale
- Vital records information collected by CT DPH on mortality and morbidity

Problems with Current Data

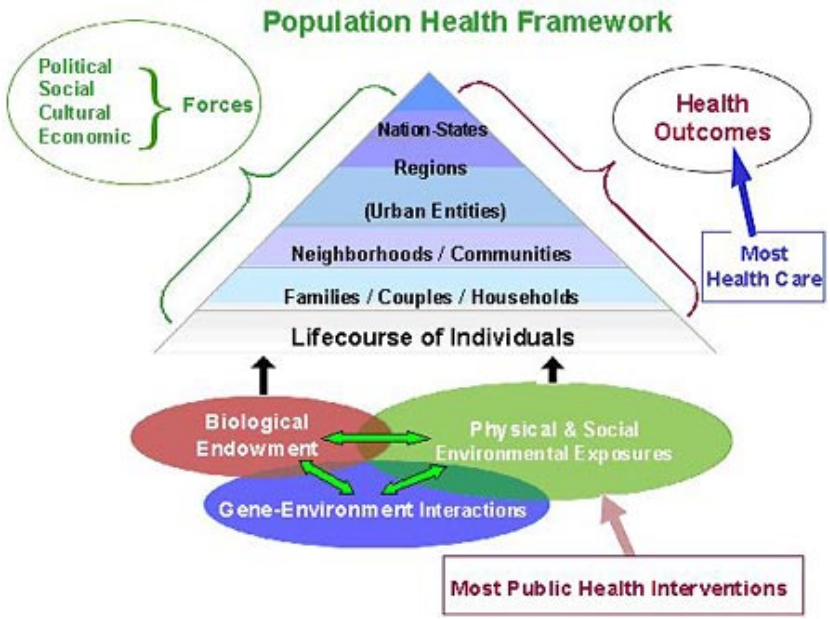
- Published data aggregated at town level
- Obscures considerable socioeconomic and demographic heterogeneity within towns/cities, which may affect population health at the neighborhood level
- Many databases do not have much information on individuals (e.g., death certificates).
- Timely surveillance programs that monitor health in CT, especially changing health disparities, are problematic without useable information on the geographic component of population health
- Two ways to use spatial information: proxy for characteristics of individuals in an area (ecological fallacy problem); examine role of spatial context on population health



General Significance of the Research

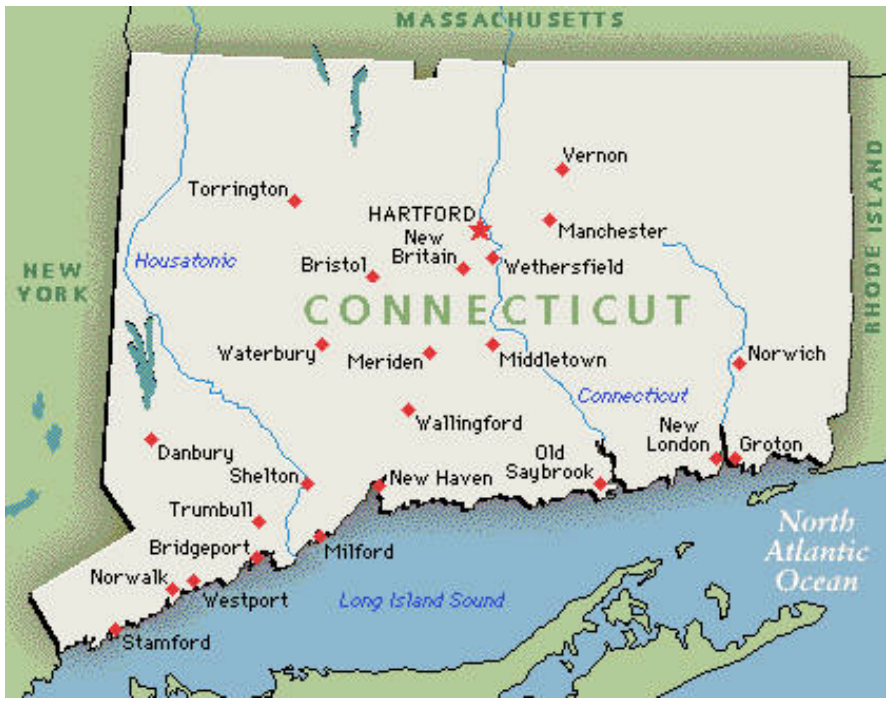
- At the present time, geocoded health data that can be linked with census data at multiple spatial scales do not exist in Connecticut. Hence, the nature and magnitude of health disparities in the state cannot be described, let alone analyzed (especially using sophisticated multilevel statistical models).

- Until this first step is completed, no other research on this important topic can be conducted in Connecticut, leaving policy-makers in the dark with respect to an important aspect of the health of the state's population.



Specific Significance of the Research

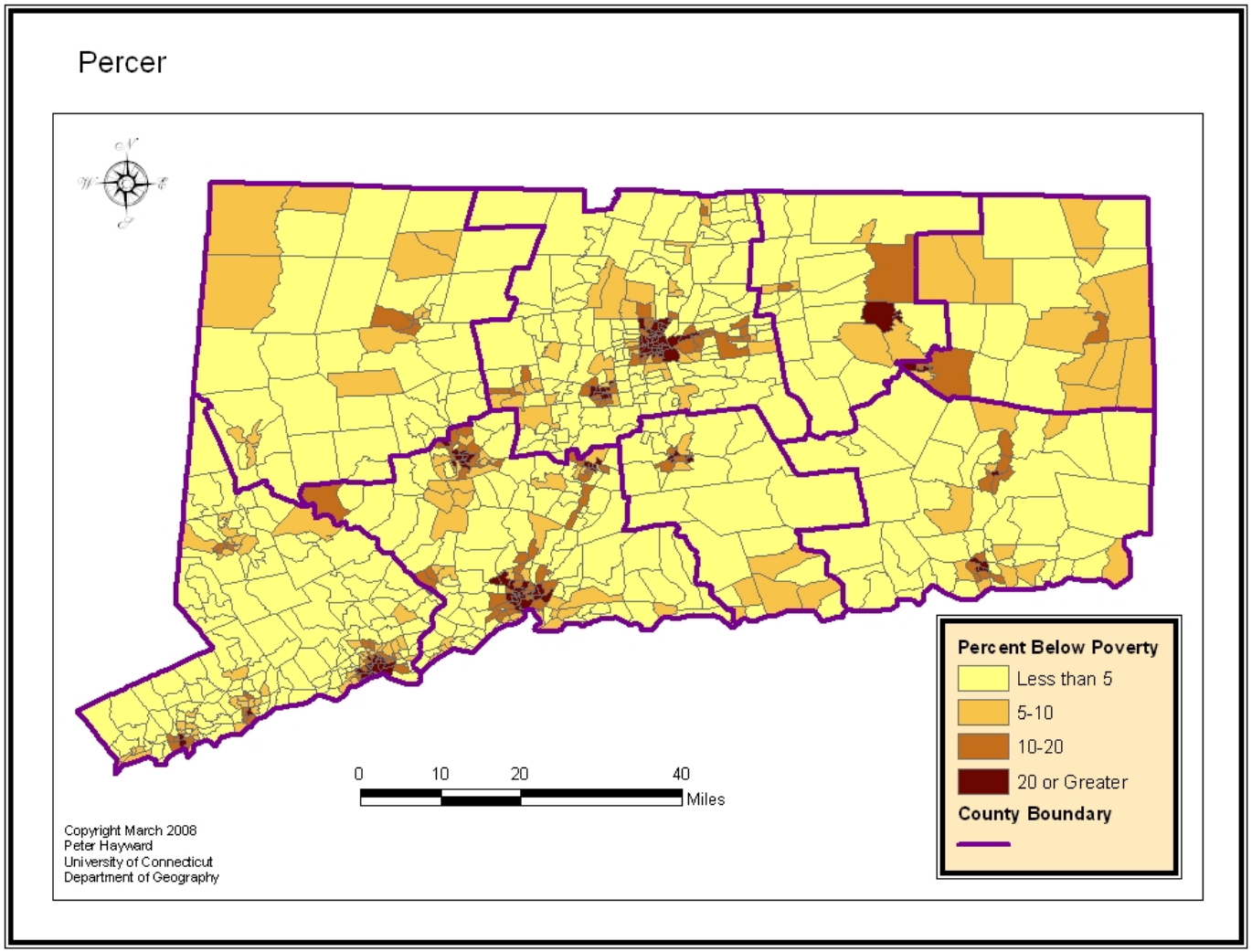
- No systematic analysis of mortality and the role poverty may play in differentiating rates from place to place in Connecticut, especially at the neighborhood scale



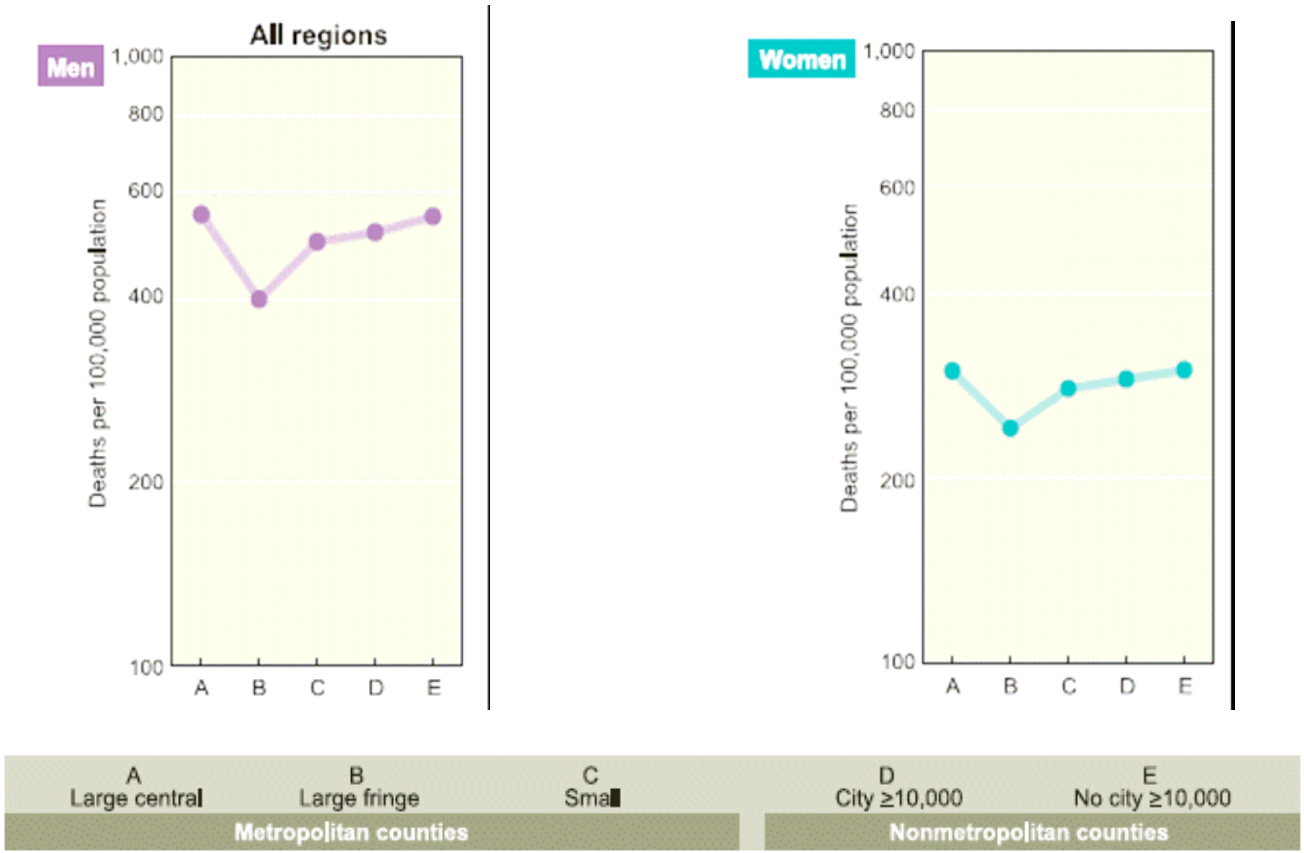
- Differences in income and poverty in CT are significant, and inequalities are increasing over time

Figure 1. Census 2000 % of People Below Poverty Level by Census Tract in Connecticut

(Sources: Census 2000)



Death rates for all causes, aged 25-64, by sex and urbanization level, 1996-1998



Source: Health, United States 2001 – Rural Urban Health Chartbook

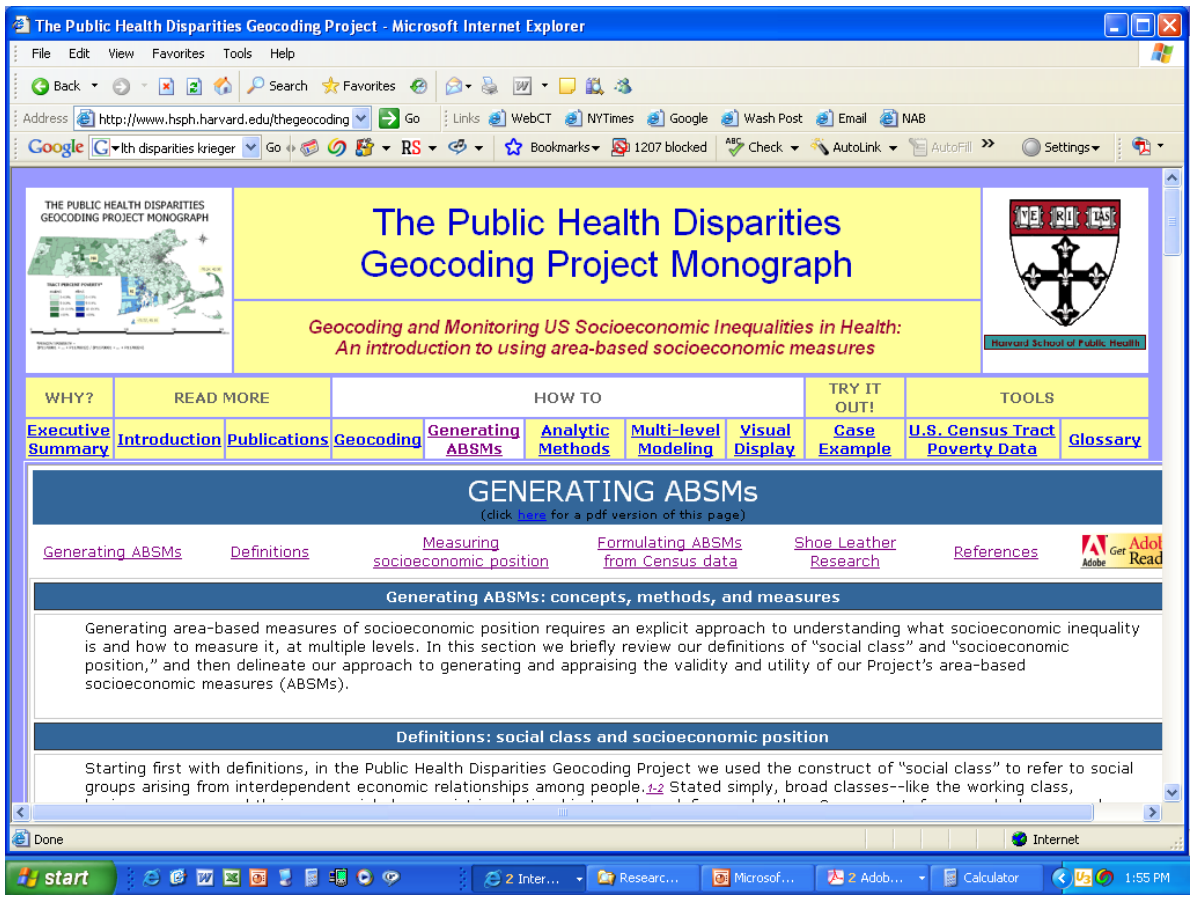
Current DPH – UConn (Geography Dept.) Research Project

- Link detailed census data with mortality database
- Analyze gradients in mortality rates associated with different poverty levels
- Do analysis at local scale representative of neighborhoods – census tracts

Methodology and Data:

Follow up on work of Nancy Krieger of the Harvard School of Public Health

Examines Spatial Health Disparities in MA and RI

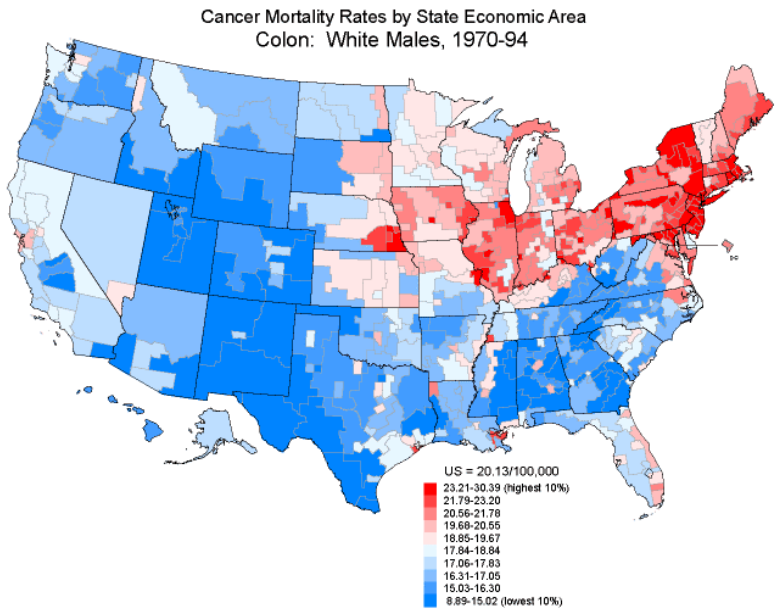


Steps in Generating Census Tract Mortality Rates for Poverty Groups

- Collect geocoded mortality data for 1999-2001 (~30,000 deaths a year)
- From mortality records: race/ethnicity, age, sex
- Collect Census 2000 data at tract level on % of population below poverty level and divide tracts into 4 groups (0-5%, 5-10%, 10-20% and 20+%)
- Also collect detailed age breakdowns for tracts in order to standardize data (0-14, 15-14, 25-44, 45-64, 65+)
- Aggregate mortality and demographic data for all tracts in each poverty group
- Calculate Age Adjusted Mortality Rates (AAMR) for each poverty level

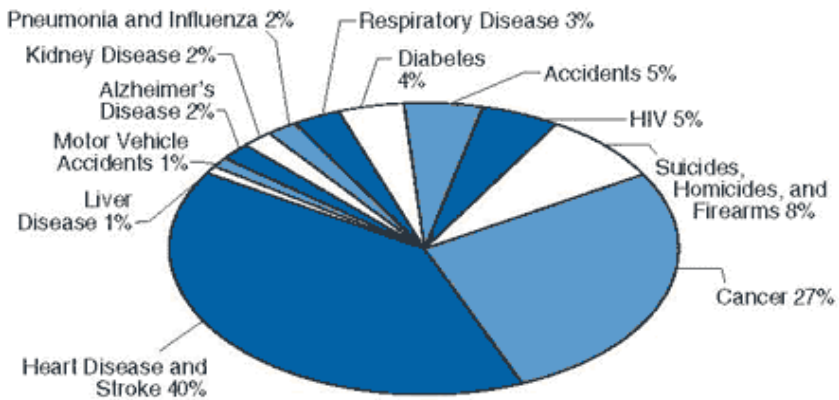
Problem with New Methodology

- Lose Relative Geography
- That is, spatial distribution of high/low mortality levels lost
- Result >> No maps

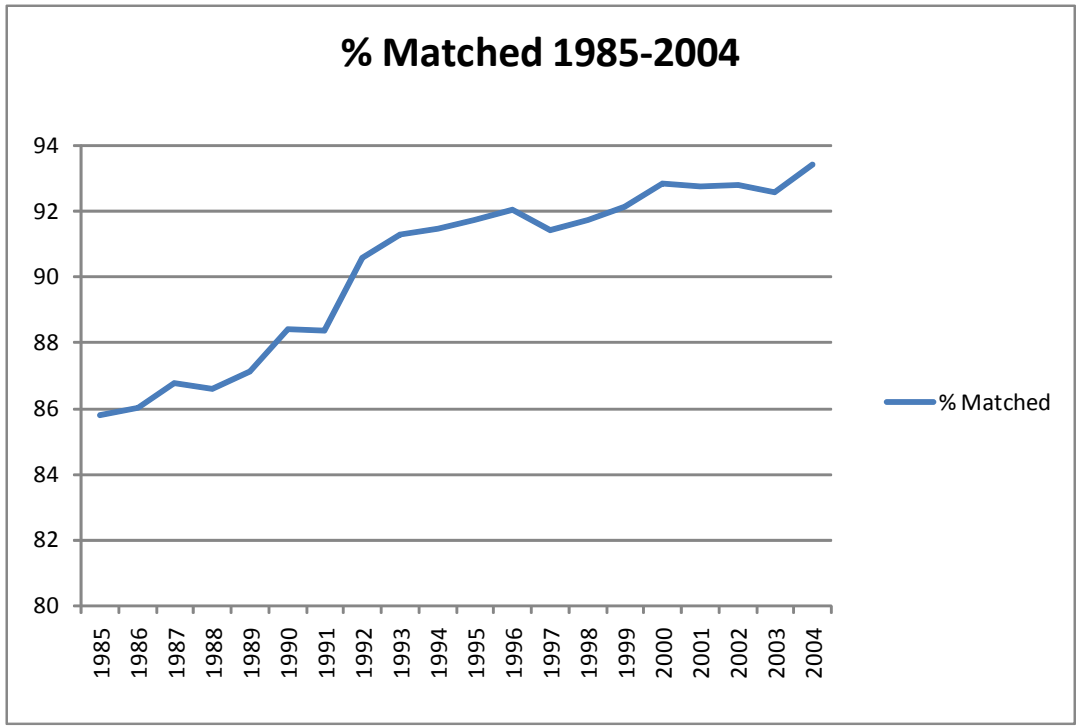


Mortality and Causes of Death

- Detailed AAMR calculated for 15 causes of death
- Use International Classification of Diseases and Health Related Problems, Tenth Revision (ICD-10).
- Heart disease (I00-I09, I11, I13, I20-I25), malignant neoplasms (C00-C97), cerebrovascular disease (I60-I69), chronic lower respiratory disease (J40-J47), influenza/pneumonia (J10-J18), unintentional injuries (V01-X59, Y85-Y86) , diabetes mellitus (E10-E14), septicemia (A40-A41), nephrotic disease (N00-N07, N17-N19, N25-N27), chronic liver diseases (K70, K73-K74), suicide (X60-X-84, Y87), Alzheimer's disease (G30), HIV (B20-B24), atherosclerosis (I70) and homicide (X85-Y09, Y87).



Adapted from *The District of Columbia Healthy People 2010 Plan: A Strategy for Better Health* (September 2000)



Mortality Data: 1991-2001

-- 93% geocoding match rate
-- n = 82,762
-- after linking mortality and census data – 81, 218 (~98%)

Percent Successfully Matched Addresses: 1985-2004

Results 1 – Aggregate Analysis of All State Residents

Table 1. General Statistics of Population Distribution and AAMR for Demographic Groups

(Sources: Census 2000; CT Death file, 1999-2001; CDC Wonder Mortality Files)

Lower Than DPH Estimates

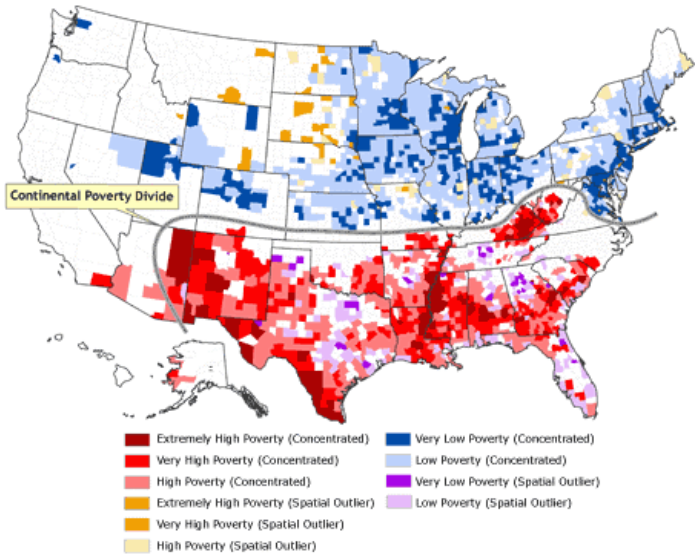
Pop Group	n	% of Total Pop	Poverty 1 - 4.9%	Poverty 5 - 9.9%	Poverty 10 - 19.9%	Poverty >= 20%	AAMR – CT[1]
Total Pop	3,385,983	100.0	55.4	20.1	12.3	12.2	752 (± 5)
Male	1,640,696	48.5	55.6	20.1	12.1	12.2	836 (± 8)
Female	1,749,325	51.7	55.1	20.1	12.4	12.4	676 (± 6)
All White	2,766,228	81.7	61.8	20.2	10.5	7.5	759 (± 5)
All Black	309,216	9.1	21.3	19.8	23.5	35.4	888 (± 23)
All Hispanic	320,223	9.5	23.6	19.7	19.2	37.6	496 (± 20)

Uneven Distribution of Population

AAMR is age adjusted mortality rate and number in parentheses represents 95% confidence interval

1. Calculated CT AAMR based on geocoded database aggregated from tract level w/ 93% match
2. CT AAMR estimated by CT Dept. of Public Health using aggregate data

General Descriptives of Data Set and Aggregate AAMRs — Major Points

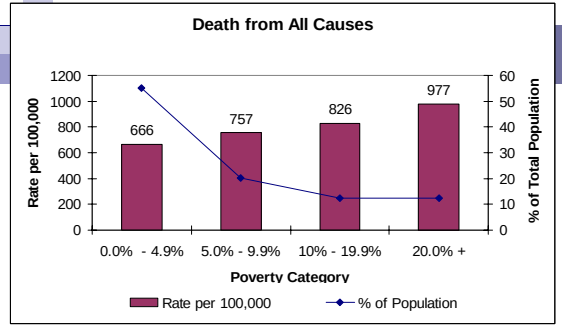


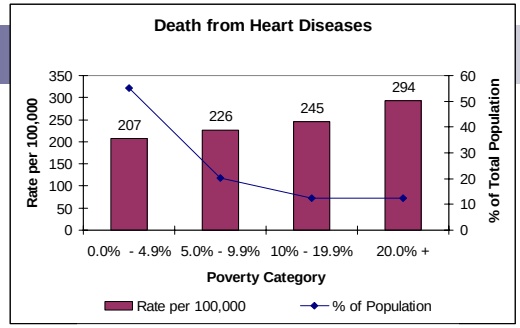
- Most of state's population is in lower poverty areas while majority of minority groups concentrated in poorer areas
- Population numbers very close to actual Census 2000 population
- Newly calculated AAMR lower than state estimates for males and Hispanics
- Potential sources of error are unmatched deaths
- Latino/Hispanic Paradox

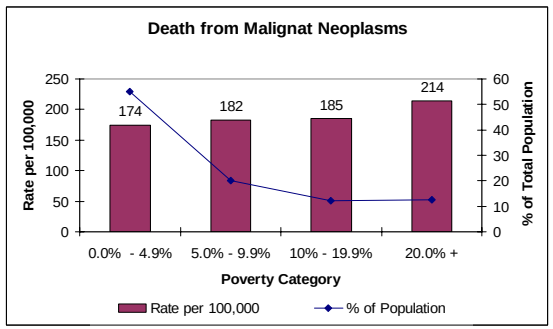
Latino/Hispanic Paradox

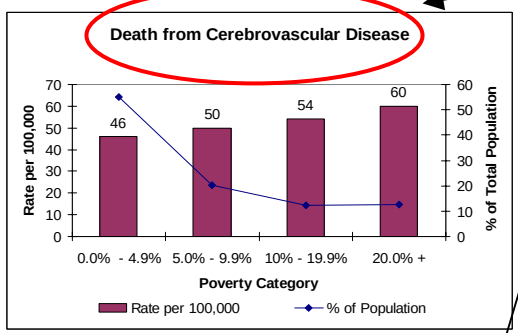
- Finding that although they are generally worse off economically than the white population, Hispanics consistently display lower mortality rates than whites
- Why? Some explanations:

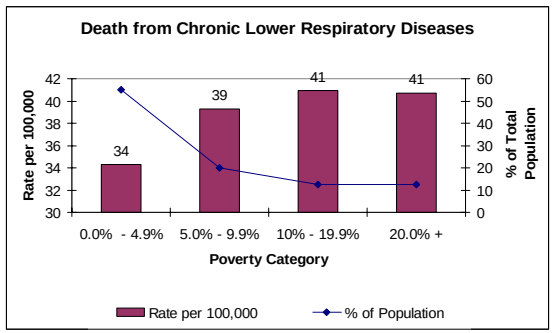
1. Differences in health behaviors (i.e. eating healthier foods) and tight social networks that make it easier to continue healthier life styles.
2. Hispanic migrants to the US are generally healthier than those in the country they left behind (selection bias)
3. "Salmon Hypothesis" - many Hispanics born outside the US return to their birthplace after retirement, leading to lower Hispanic mortality rates in the US
4. Misclassification problems complicate issue

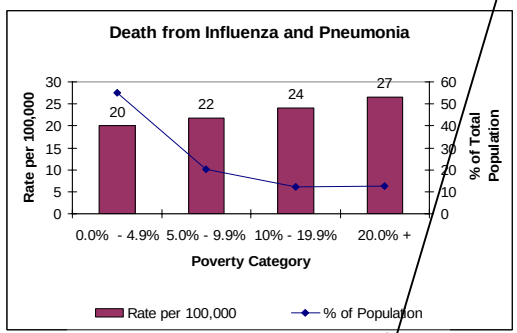


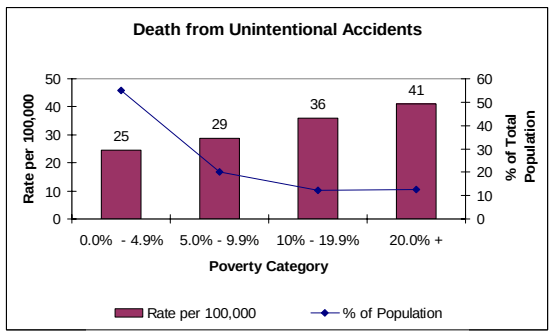


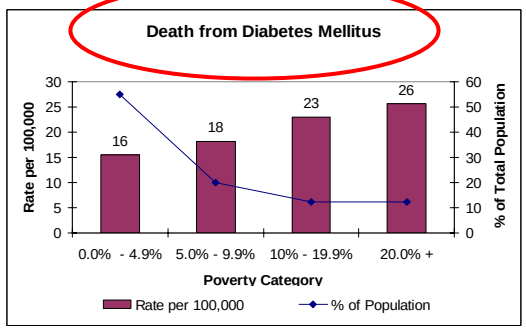






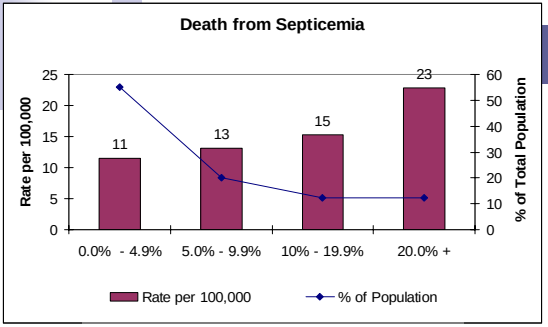


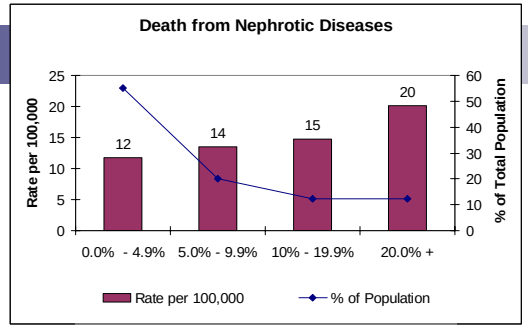


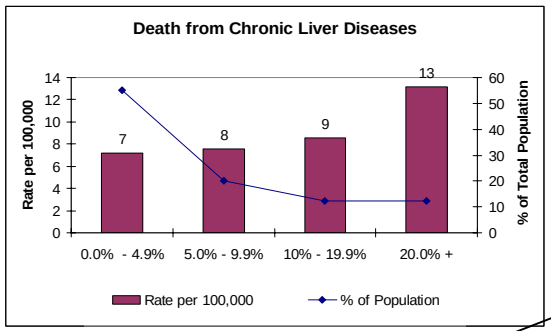


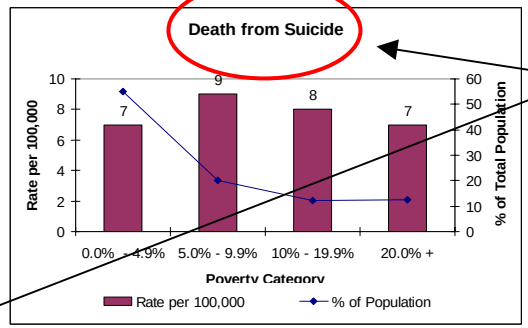
Strong Poverty Effect and Mortality Gradient Across Many Causes of Death

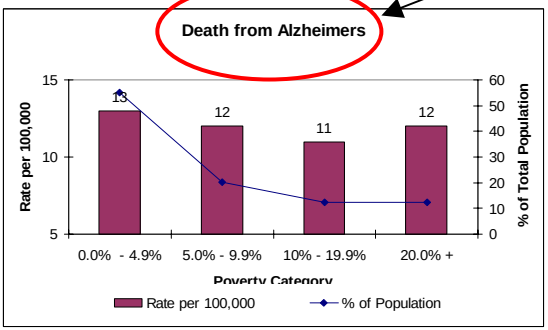
Figure 2. Connecticut AAMR for 15 Causes of Death by Poverty Level of Tract, 1999-2001 (Sources: Census 2000; CT Death file, 1999-2001)

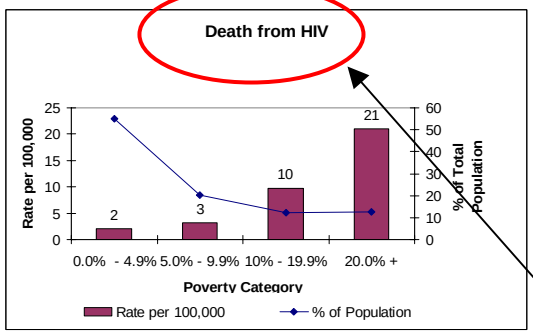


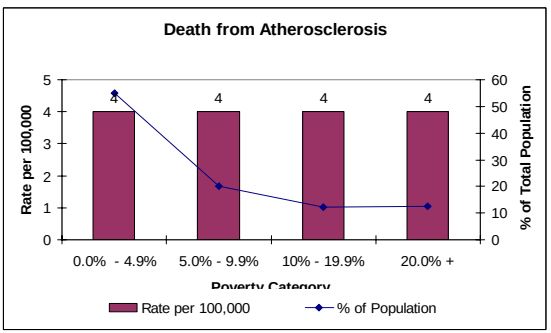


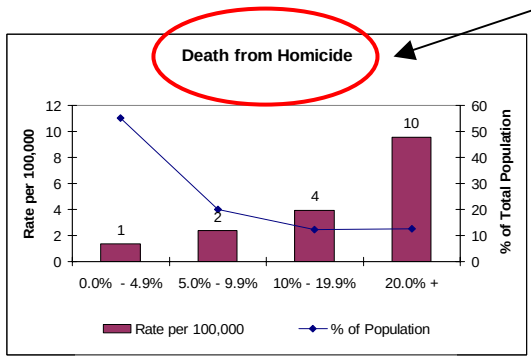












Inconsistent Poverty Effect

Very Strong Poverty Effect and Mortality Gradient

Figure 2. Connecticut AAMR for 15 Causes of Death by Poverty Level of Tract, 1999-2001
(Sources: Census 2000; CT Death file, 1999-2001)

Table 2. Rate Ratios for 15 Causes of Death for the Full CT Population, 1999-2001

(Sources: Census 2000; CT Death file, 1999-2001)

Cause of Death	Rate Ratio		Cause of Death	Rate Ratio
All-causes	1.5		Septicemia	2.0
Heart Disease	1.4		Nephrotic Diseases	1.7
Malignant Neoplasms	1.2		Chronic Liver Disease	1.8
Cerobrovascular Disease	1.3		Suicide	1.0
Chronic Lower Respiratory Disease	1.2		Alzheimer's Disease	0.9
Influenza and Pneumonia	1.3		HIV	10.5
Unintentional Injuries	1.7		Atherosclerosis	1.0
Diabetes Mellitus	1.7		Homicide	7.1

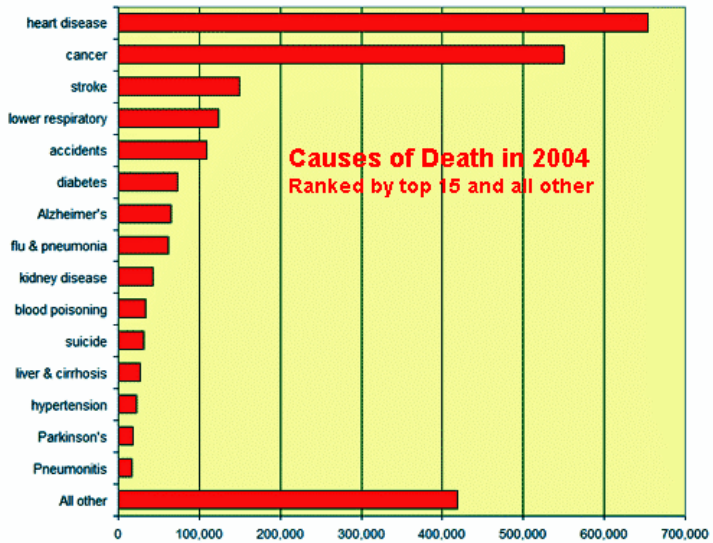
Strong Poverty Effect

Inconsistent Poverty Effect

Very Strong Poverty Effect (small numbers?)

Mortality Gradients and Causes of Death — Major Points

- Clear gradient and poverty effect (Poverty Syndrome)
- Exceptions: Suicide and Alzheimer's (small samples? Competing causes of death?)
- Rank Ratios relatively large for Unintentional Injuries, Septicemia, Nephrotic and Chronic Liver Disease, and Diabetes
- Very large rate ratios for HIV and Homicide



What is the Poverty Syndrome?

- High poverty areas create an environment that promotes negative behaviors (more smoking, poorer diets, alcoholism, stress, etc.) that often lead to higher death rates
- Poorer areas often do not have the social networks and social capital that help care for many of the sick, especially for groups as the elderly who are frequently isolated from the general society
- Poorer communities are more likely to have limited access to health care, and residents typically do not seek preventative care
- Substandard housing and local environmental hazards
- Important to note that health outcomes are a result of the interaction of numerous compositional and contextual variables, not a single factor like area-level poverty rates.

Results 2 – Poverty Levels and Mortality Rates for Different Demographic Groups in Connecticut

Table 3. AAMR Mortality Gradients for All CT, Males and Females & Rate Ratios, 1999-2001

(Sources: Census 2000; CT Death file, 1999-2001; CDC Wonder Mortality Files)

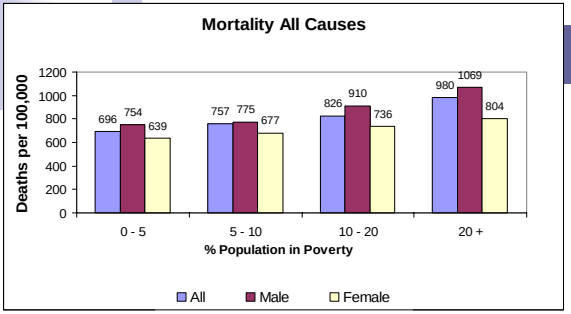
AAMRs Very Close

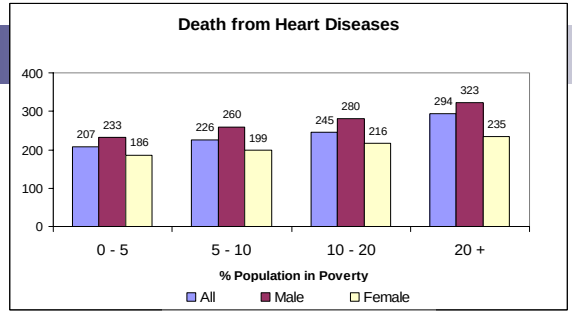
% of persons below poverty level	% of population	All-causes	Heart Disease	Malignant Neoplasms	Cerebro-vascular Disease	Chronic Lower Respiratory Diseases	Influenza and Pneumonia	Unintentional Injuries	Diabetes Mellitus
All									
0.0% - 5.0%	55.4	662	207	174	46	34	20	25	16
5.0% - 10.0%	20.1	654	226	182	50	39	22	29	18
10% - 10.0%	12.3	781	245	185	54	41	24	36	23
20.0% +	12.2	977	294	214	60	41	27	41	26
Connecticut AAMR		***752***	***223***	***180***	***49***	***37***	***22***	***29***	***18***
CT-DPH AAMR		***775***	***226***	***188***	***50***	***38***	***22***	***30***	***19***
Male									
0.0% - 5.0%	55.5	765	233	202	42	35	20	34	17
5.0% - 10.0%	20.1	863	260	218	46	43	23	41	21
10% - 10.0%	12.2	939	280	223	50	46	27	53	26
20.0% +	12.2	1061	323	233	51	42	27	59	24
Connecticut AAMR		***836***	***252***	***211***	***44***	***39***	***22***	***40***	***19***
Female									
0.0% - 5.0%	55.1	639	186	154	49	34	20	16	14
5.0% - 10.0%	20.1	677	199	158	53	37	21	17	16
10% - 10.0%	12.5	736	216	160	57	38	22	21	21
20.0% +	12.4	804	235	178	58	35	23	23	24
Connecticut AAMR		***676***	***197***	***158***	***52***	***35***	***21***	***18***	***17***
Rate Ratios									
All		1.5	1.4	1.2	1.3	1.2	1.3	1.7	1.7
Male		1.4	1.4	1.2	1.2	1.2	1.4	1.8	1.4
Female		1.6	1.3	1.2	1.2	1.0	1.1	1.4	1.7

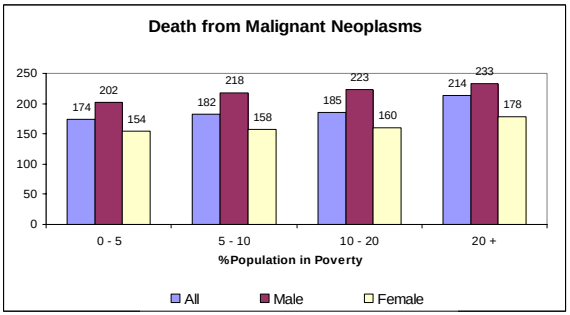
Connecticut AAMR (age adjusted mortality rates) -- deaths per 100,000 population, and are based on the newly geocoded dataset (except DPH AAMR)

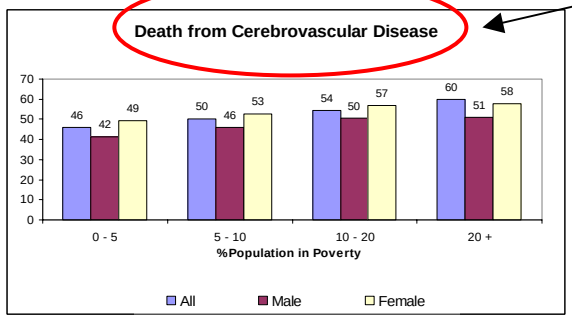
Consistent Relationship

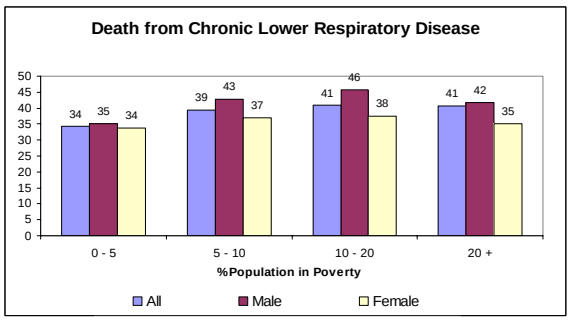
Exception

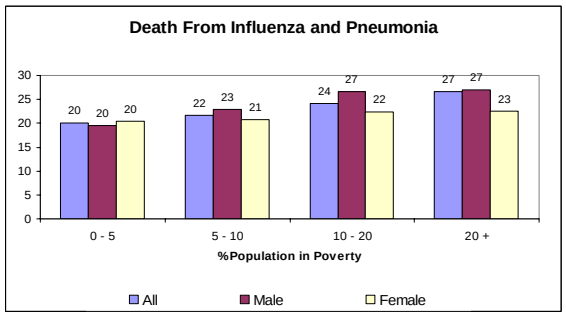


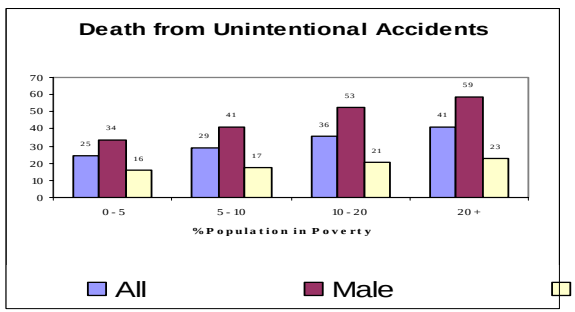


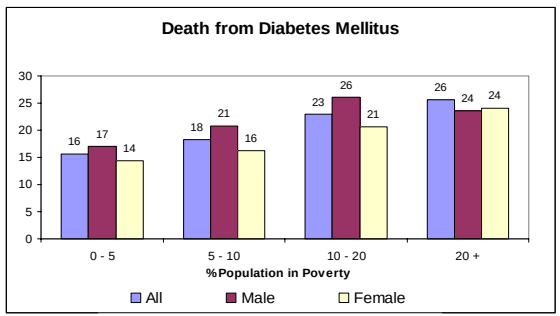












Exception to Male/Female AAMRs

Figure 3. AAMR Comparisons Between Demographic Groups (All, Male and Female), by Poverty Levels, 1999-2001 (Sources: Census 2000; CT Death file, 1999-2001)

Fairly Consistent Relationships Between Male/Female Groups Across Poverty Levels

Mortality Gradients and Causes of Death (Male/Female) — Major Points

- Females have lower AAMR than males across most causes of death
- Clear gradients associated with poverty levels
- Relationship between males and females is consistent through all poverty levels

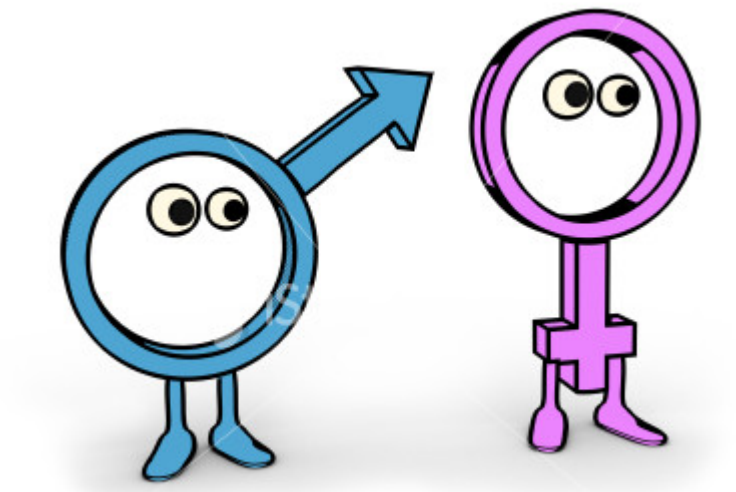


Table 4. AAMR Mortality Gradients for All CT, White, Black and Hispanic & Rate Ratios, 1999-2001

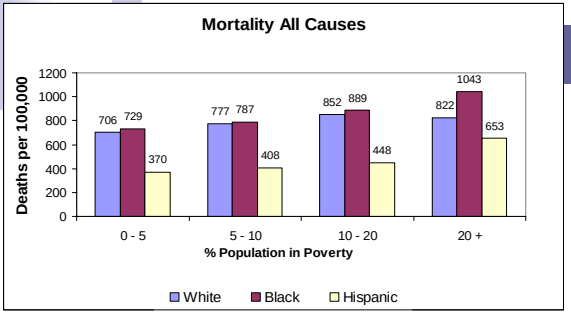
(Sources: Census 2000; CT Death file, 1999-2001; CDC Wonder Mortality Files)

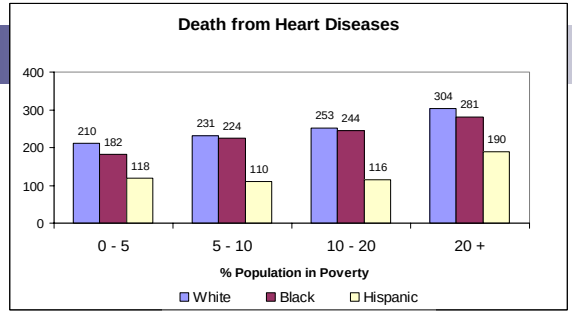
Consistent Relationships **Exceptions**

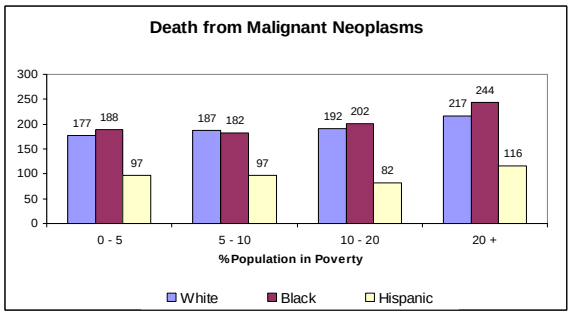
% of persons below poverty level	% of population	All-causes	Heart Disease	Malignant Neoplasms	Cerebro-vascular Disease	Chronic Lower Respiratory Diseases	Influenza and Pneumo-nia	Unintentional Injuries	Diabetes Mellitus
All									
Connecticut AAMR		***752***	***223***	***180***	***49***	***37***	***22***	***29***	***18***
CT-DPH AAMR		***775***	***226***	***188***	***50***	***38***	***22***	***30***	***19***
White									
0.0% - 5.0%	61.8	706	210	177	47	35	21	25	15
5.0% - 10.0%	20.2	777	231	187	51	41	23	31	18
10% - 10.0%	10.5	852	253	192	55	44	25	39	22
20.0% +	7.5	1022	304	217	62	45	29	54	22
Connecticut AAMR		***759***	***226***	***183***	***50***	***38***	***22***	***30***	***17***
Black									
0.0% - 5.0%	21.3	729	182	188	45	22	15	32	36
5.0% - 10.0%	19.8	787	224	182	51	21	14	33	34
10% - 10.0%	23.5	885	244	202	59	22	18	44	32
20.0% +	35.4	1043	281	244	54	29	18	39	42
Connecticut AAMR		***888***	***240***	***210***	***52***	***24***	***17***	***37***	***37***
Hispanic									
0.0% - 5.0%	23.6	370	118	97	26	14	10	21	29
5.0% - 10.0%	19.7	408	110	97	29	10	8	14	16
10% - 10.0%	19.2	448	116	82	20	21	7	23	22
20.0% +	37.6	653	190	116	31	24	11	38	19
Connecticut AAMR		***496***	***142***	***101***	***27***	***19***	***9***	***26***	***22***
Rate Ratios									
All		1.5	1.4	1.2	1.3	1.2	1.3	1.7	1.7
White		1.4	1.4	1.2	1.3	1.3	1.4	2.1	1.4
Black		1.4	1.5	1.3	1.2	1.3	1.2	1.2	1.2
Hispanic		1.8	1.6	1.2	1.2	1.7	1.1	1.8	0.7

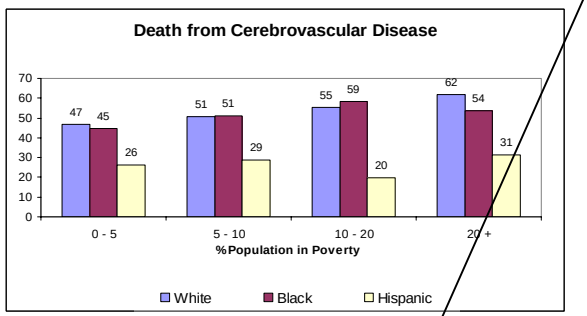
Connecticut AAMR (age adjusted mortality rates) -- deaths per 100,000 population, and are based on the newly geocoded dataset (except DPH AAMR)

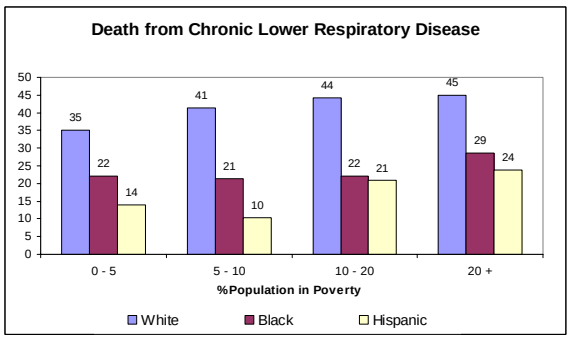
Consistent Low Hispanic AAMRs **Inconsistent Poverty Effect**

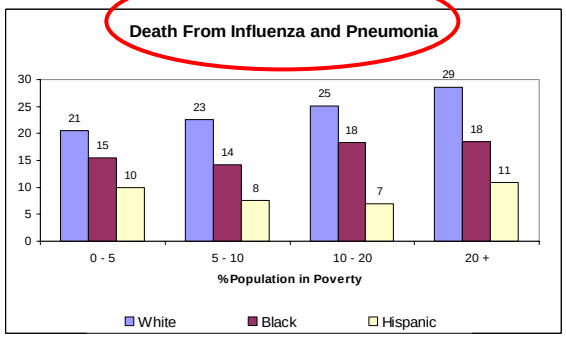


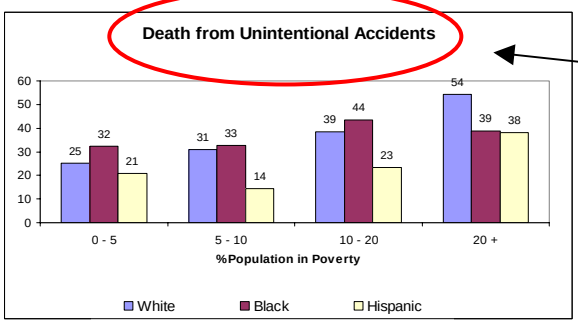


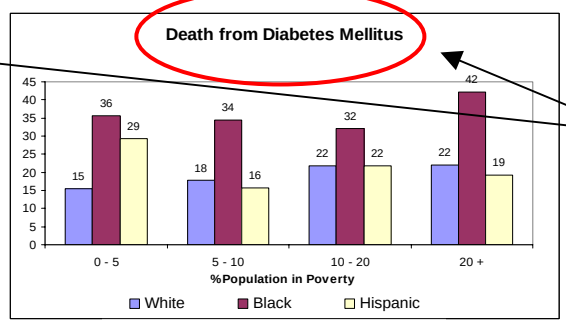












[Fairly Consistent Relationships Between Race/Ethnicity Groups Across Poverty Levels]

[Relationships Between Race/Ethnicity Groups Changes Across Poverty Levels]

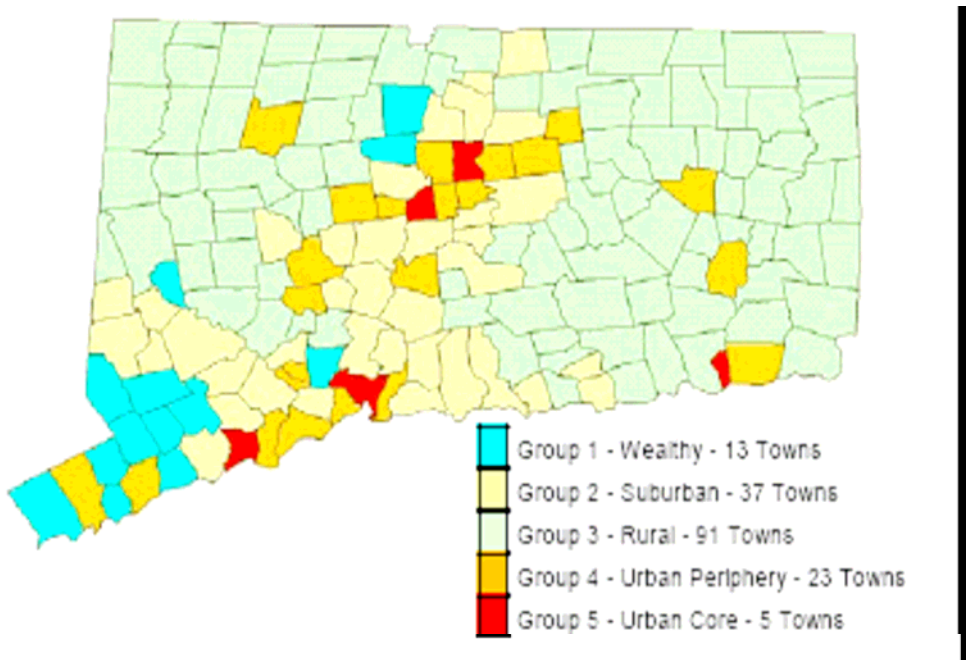
Figure 4. AAMR Comparisons Between Demographic Groups (White, Black and Hispanic), by Poverty Levels, 1999-2001 (Sources: Census 2000; CT Death file, 1999-2001)

Mortality Gradients and Causes of Death (Race/Ethnicity) — Major Points

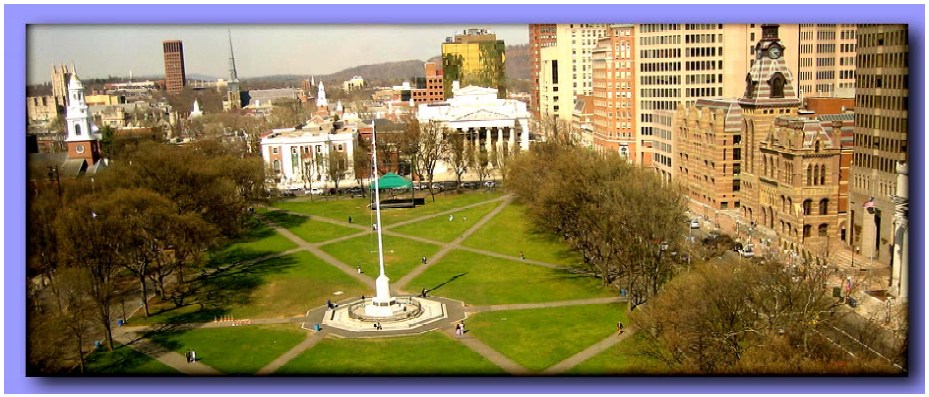
- Hispanics have consistently lower AAMRs most causes of death
- In general, highest AAMRs for black population
- Exceptions: lower respiratory disease, and influenza/pneumonia
- Mortality gradients associated with poverty levels not very strong, especially for Hispanics
- Some strong poverty effects are apparent

Future Research Issues I

- Examine differences in mortality rates between towns identified in a report developed by the UConn Center for Population Research
- *"The Changing Demographics of Connecticut - 1990 to 2000. Part 2: The Five Connecticuts"* (Levy et al, 2004).
- This report provides a readily accessible classification of Connecticut towns developed using spatial, social, economic and demographic variables.
- Relative geography important



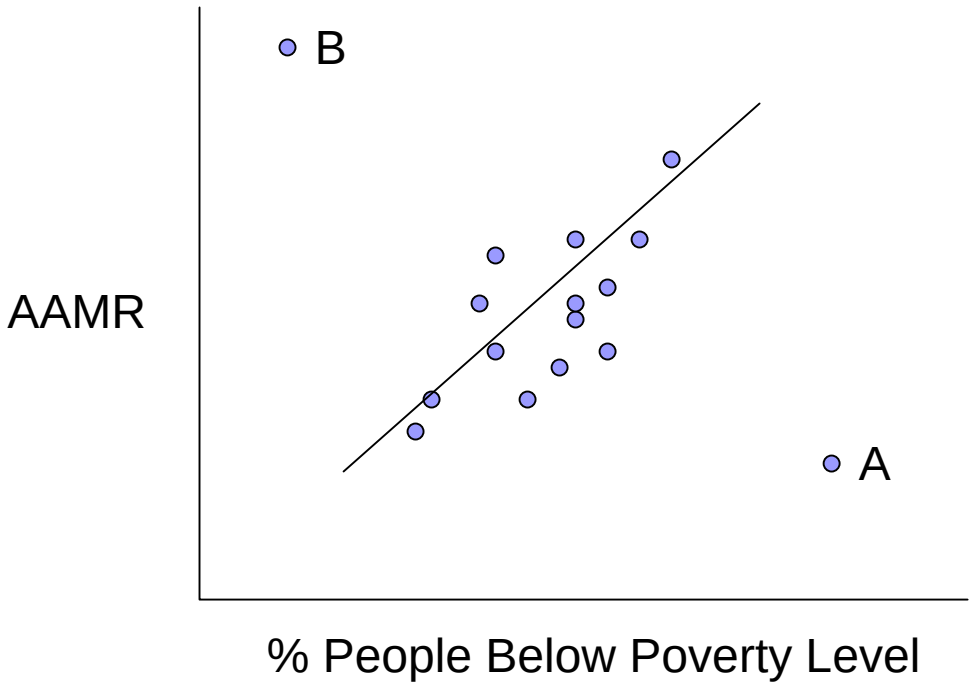
Future Research Issues II



- Population health and health disparities in Connecticut's major cities
- 1990 – 2000 changes in population health
- Factors associated with changes

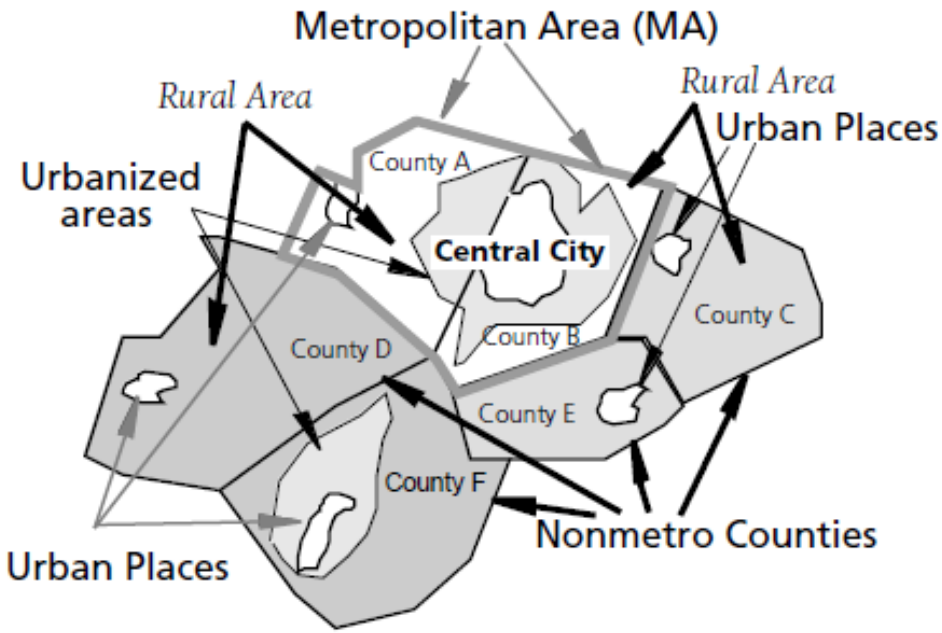
Future Research Issues III

- Exceptions to the Rule: Factors associated with AAMR outliers
- Using tract and town/city scale data:
  - A) why do some poor places have low mortality rates?
  - B) why do some rich places have high mortality rates?



Future Research Issues IV

- The role of area definitions/classifications in the analysis of rural/urban Health Disparities in Connecticut
- Multiple ways to define differences between urban type places/areas and rural ones



Future Research Issues V

- Changes in health disparities over time
- 1990 – 2000 changes in rate ratios
- Factors associated with changes