

SOME GEOGRAPHIC ASPECTS OF DISEASE MORTALITY IN TEXAS

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INTRODUCTION

This paper attempts a comparative look at disease in Texas. I hope to be able to map mortality of the top 5 of 10 death-causing diseases in Texas counties.

This originated on reflection of the general view that disease rates vary by location, among a host of other variables. I am interested in seeing whether there are groups of places in Texas that appear to have more or less disease mortality. Specifically, I hypothesize that Texas urban areas have higher disease mortality rates than rural areas. The list of the 10 leading causes of death for 2004 according to the CDC are:

Heart disease

Cancer

Stroke (cerebrovascular diseases)

Chronic lower respiratory diseases

Accidents (unintentional injuries)

Diabetes

Alzheimer's disease

Influenza/Pneumonia

Nephritis, nephrotic syndrome, and nephrosis

Septicemia

(<http://www.cdc.gov/nchs/fastats/lcod.htm>)

DATA

I acquired digital data from the Centers for Disease Control, at

<http://wonder.cdc.gov/cmfi-icd10.html>, (Wide-ranging OnLine Data for Epidemiologic

Research, which is an easy-to-use internet system that makes the information resources

of the Centers for Disease Control and Prevention (CDC) available to public health professionals and the general public.

The data was in query/table format, which I made of use by joining to Texas map data/tables I already had. I then converted the data from vector to raster, which is more flexible in terms of data manipulation. I have county as the smallest data unit. I used the WHO ICD-10 (International Classification of Diseases) disease codes to define the top 5 of the 10 leading causes of death diseases. The relevant codes are presented in the CDC table below, along with total deaths and percentage of total death figures, 2003, (see appendix 1 for the unexpanded ICD list).

Deaths and percentage of total deaths for the 10 leading US causes of death, 2003

Rank	Death Cause	ICD Category/Categories	% of Total Deaths 2003
1	Heart disease	I00-I09, I11, I13, I20-I51	28.0
2	Cancer (malignant neoplasms)	C00-C97	22.7
3	Stroke (cerebrovascular diseases)	I60-I69	6.4
4	Chronic lower respiratory diseases	J40-J47	5.2
5	Accidents (unintentional injuries)	V01-X59, Y85-Y86	4.5
6	Diabetes	E10-E14	3.0
7	Influenza/Pneumonia	J10-J18	2.7
8	Alzheimer's disease	G30	2.6
9	Nephritis, nephrotic syndrome, & nephrosis	N00-N07, N17-N19, N25-N27	1.7
10	Septicemia	A40-A41	1.4

Adapted from:

http://www.cdc.gov/nchs/data/hestat/leadingdeaths03_tables.pdf#1

I initially proposed to look at the top 5 diseases in the above list, but when getting the data for the fifth category, accidents, I noticed that all the data was unreliable, and so I went ahead to select # 6, Diabetes Mellitus.

METHODS

The data request page at

<http://wonder.cdc.gov/cmfi-icd10.html> ,

has 7 request categories, viz:

1. Organize table layout (grouping results by age group, gender, state, county, etc)
2. Select location (states or census regions)
3. Select years and demographics (age group, year, gender, race, urbanization)
4. Select cause of death (ICD-10 codes, ICD-10 113 groups)
5. Select injury intent and mechanism (injury intent and mechanisms)
6. Select rate options (death rates per amounts, age-adjusted rates)
7. Other options (export results, show zero values, precision)

I used age-adjusted (to 2000 U.S Standard Population) death rates in all queries, because according to the National Cancer Institute and the CDC, this is the better way to compare the mortality experiences of 2 or more populations. It allows communities with different age structures to be properly compared

(<http://www.health.state.ny.us/diseases/chronic/ageadj.htm>). These rates are computed using the direct method, which requires use of a standard age distribution.

More details of age-adjustment and the direct method are available at

<http://www.cdc.gov/nchs/datawh/nchsdefs/ageadjustment.htm#v47#3>.

The age-adjusted death rates were selected by ICD category for each county.

I combined ICDs to fit into the categories in Table 1, to produce 1 combined rate per county per disease category. For e.g., diseases of the heart is made up of I00-I09, I11, I113, I120-I151, each of which occur in separate tables that I would then have to combine. Next, I imported the tables into excel to look them over generally, then to remove any data that was classed as "Unreliable", (CDC WONDER states that:

"Death rates based on counts of twenty or less (death count ≤ 20) are flagged as "Unreliable". A death rate based on fewer than 20 deaths has a relative standard error (RSE(R)) of 23 percent or more. A RES(R) of 23 percent is considered statistically unreliable."

I then summed the disease totals by county, ending up with tables that had one number per county per disease category. Then I imported these datasets into ArcView as tables, and joined them to georeferenced Texas geodatabase files of county by county code. I had hoped to use spatial analysis tools, especially overlay (intersect and symmetrical difference), to get information about the spatial nature of disease in Texas. I now however decided that raster map algebra would be a better method to achieve my goals of seeing how death rates combine spatially in Texas. I therefore converted my data from vector to raster. To illustrate the data per disease I created maps (Figures 1-5) by classifying each disease into 4 categories (symbology, classified, 4 classes), using the quantile classification method. Then I used the Spatial Analyst/local/cell statistics tool to calculate per-cell statistics from the multiple rasters (one for each disease), and added datasets together to get sums, (using sum as the overlay statistic). The assumption was that the higher the sum the greater the coincidence of higher death rates in certain areas, and vice versa.

RESULTS

I hypothesized that urban areas would have higher combined mortality rates, (end product of adding raster datasets), and rural areas to have lower rates. This was based on the general notion that city dwellers tend to have more stress and pollution, and less of an opportunity to consume natural foods, among other things, than rural people. In other words, city dwellers being less healthy overall, than rural dwellers. Upon addition of all 5 raster datasets, I again classified the data into 4 with the quantile method (Figure 6). Then I overlaid a 1999 map of urban areas from the Texas General Land Office (GLO) onto the summed raster map to get a basic visual idea of how death rates and the urban/rural map look when combined (Figure 7). Surprisingly, the 2 maps appeared to coincide very well, with almost each urban area locating itself within either of the top 2 death rate categories.

I later found out that in reality, rural death rates are generally higher than urban death rates (McGehee et al, 2004; Ricketts, 2000; Crutcher, 2008). If this is actually the case then I would have to assume that, among other things:

1. Somewhere in the sequence of events, I must have made (a) mistake(s).
2. Classifications of urban/rural might be subjective.
3. This could have something to do with classification methods and # of classes.
4. Arcview's method of eliminating raster cells that have no data when adding datasets.
5. A host of other reasons unknown to me.

It would be interesting to pursue these ideas further.

Figure 1

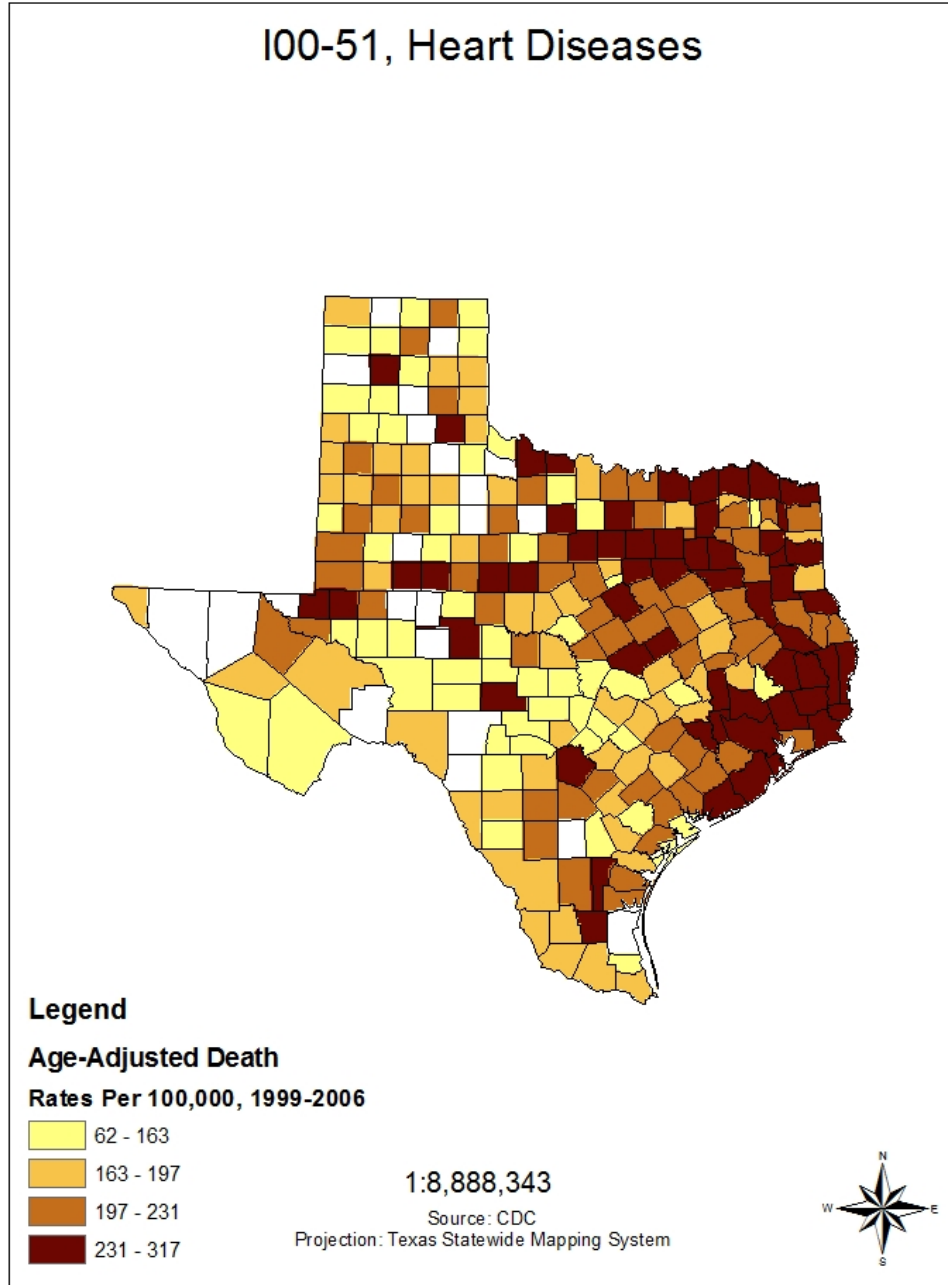


Figure 2

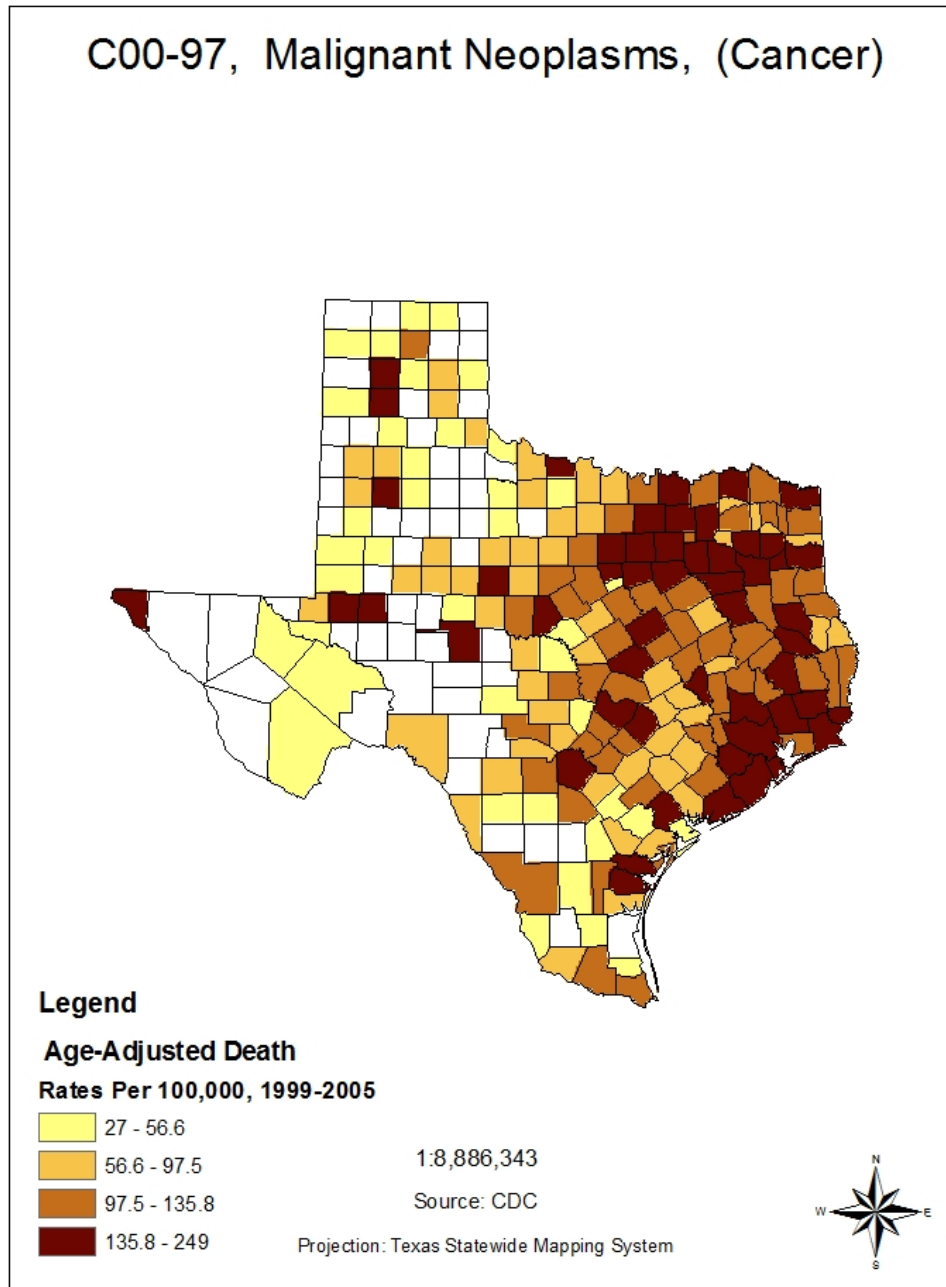


Figure 3

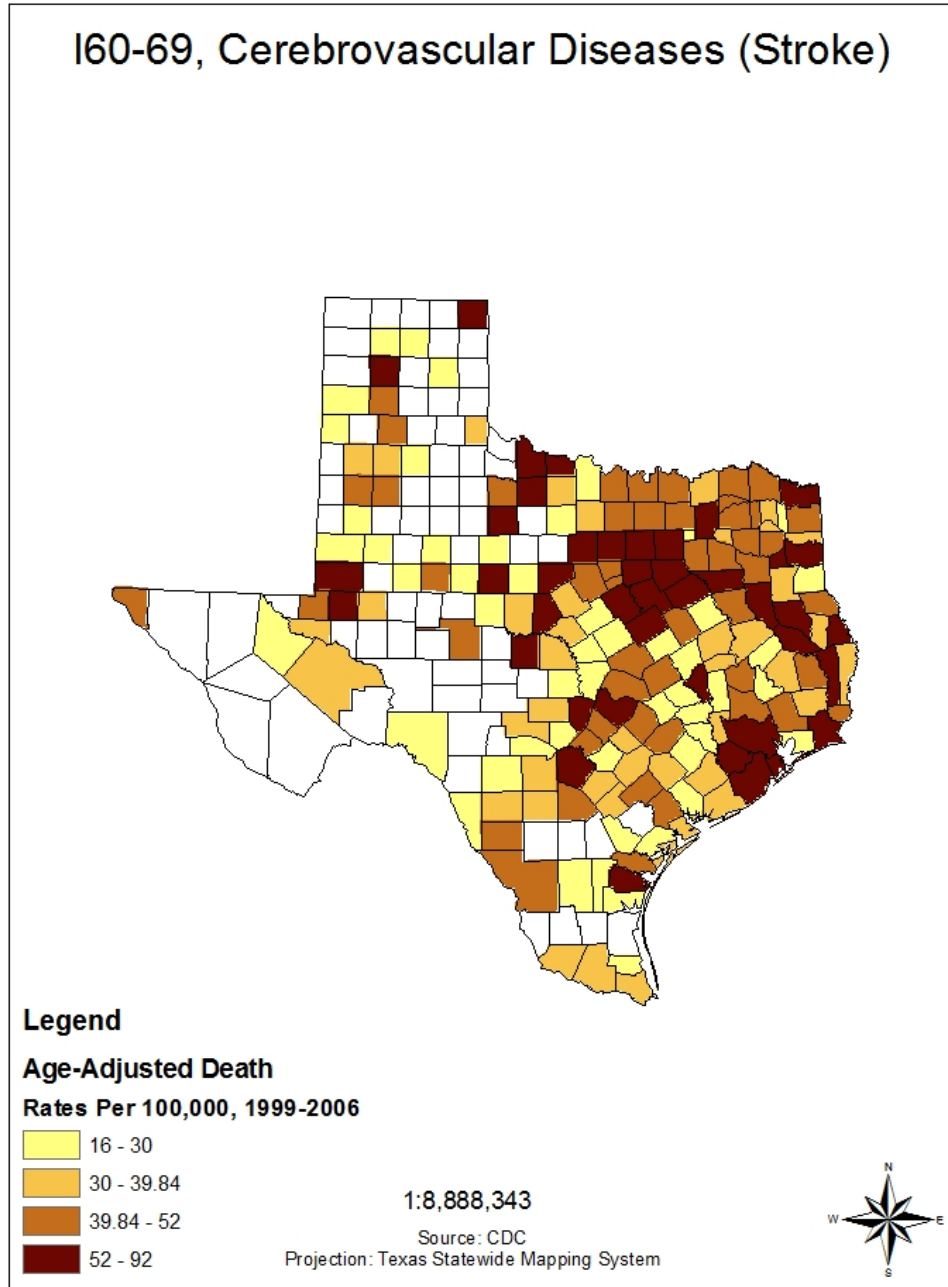


Figure 4

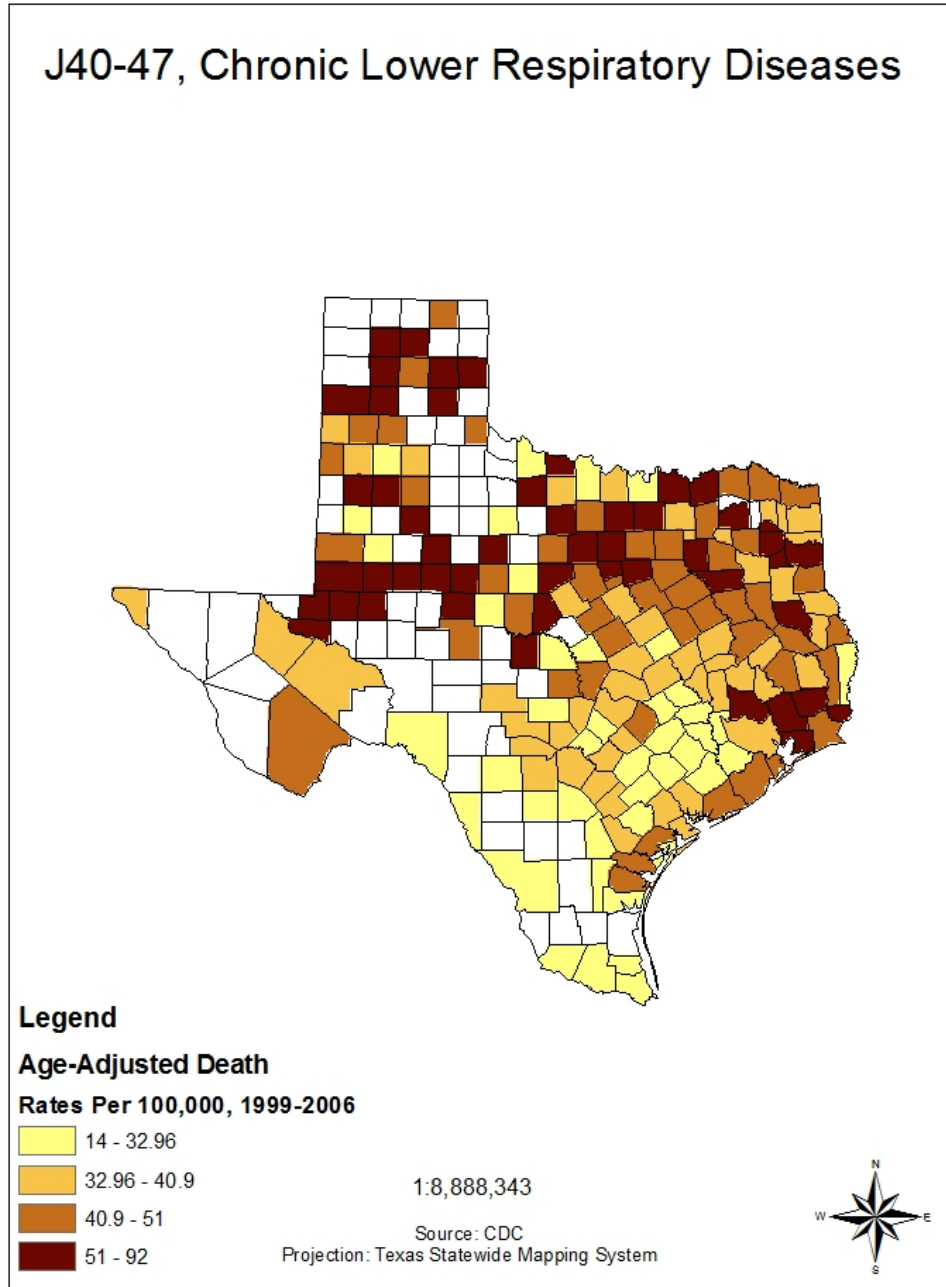


Figure 5

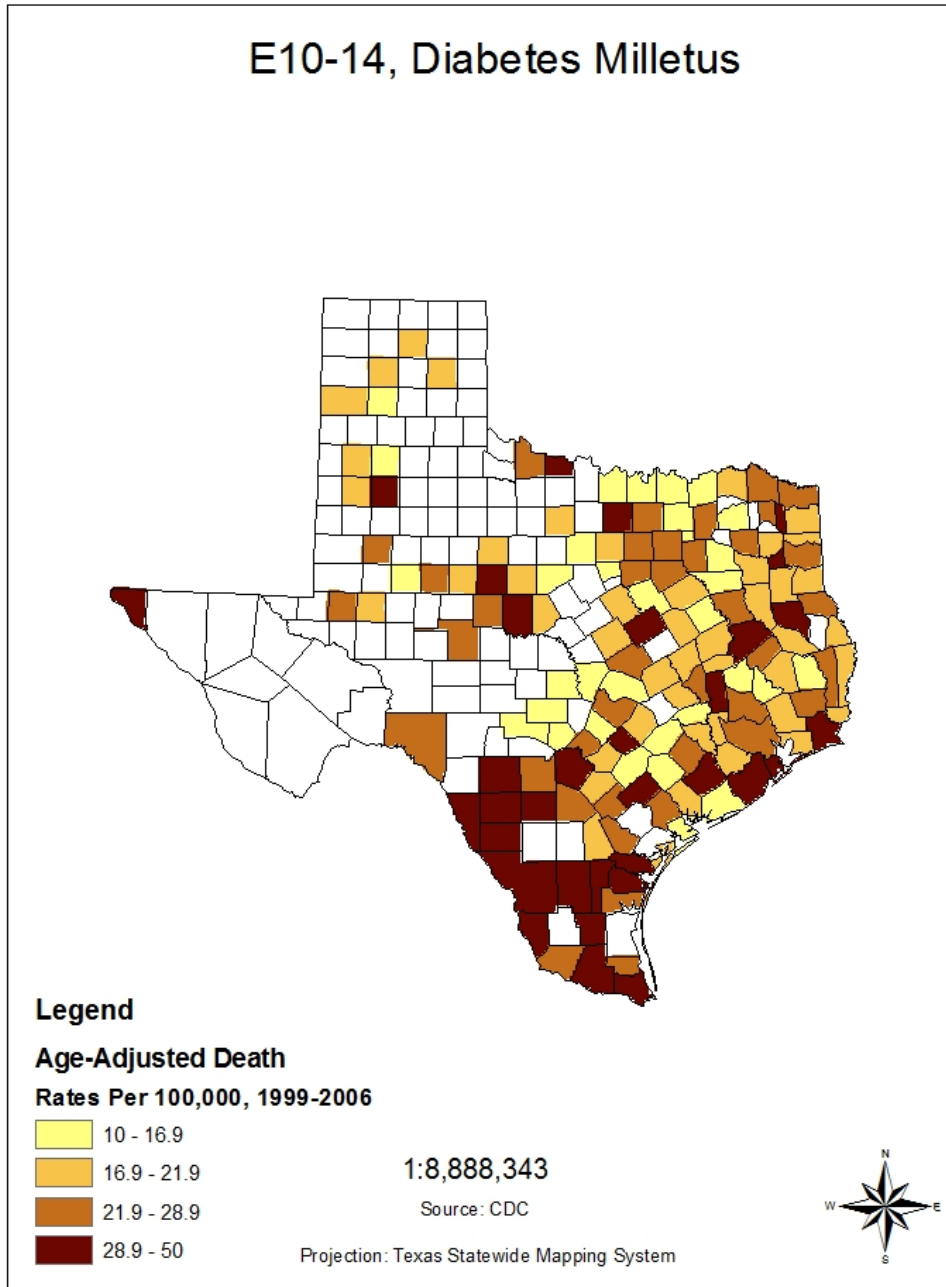


Figure 6

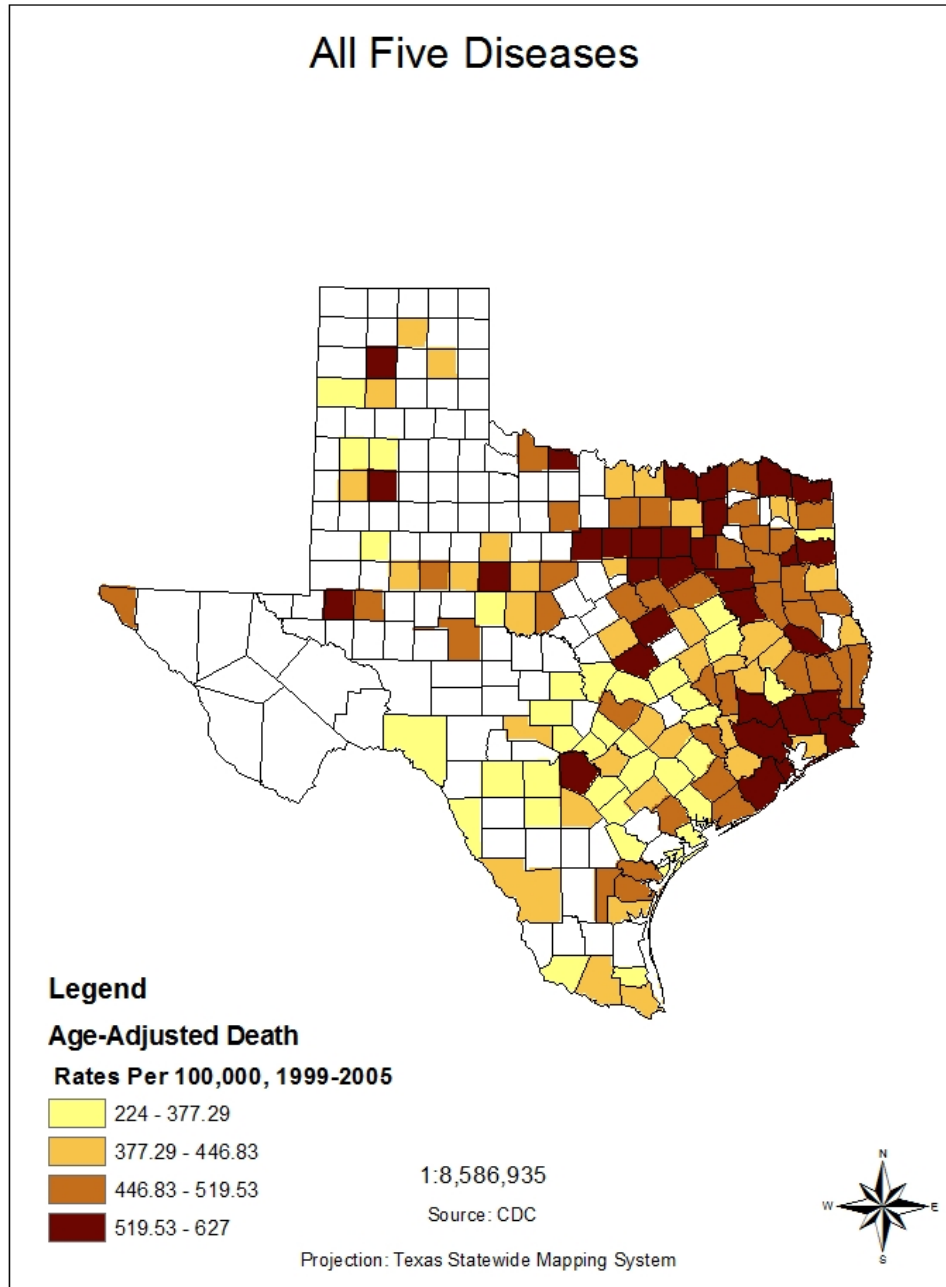
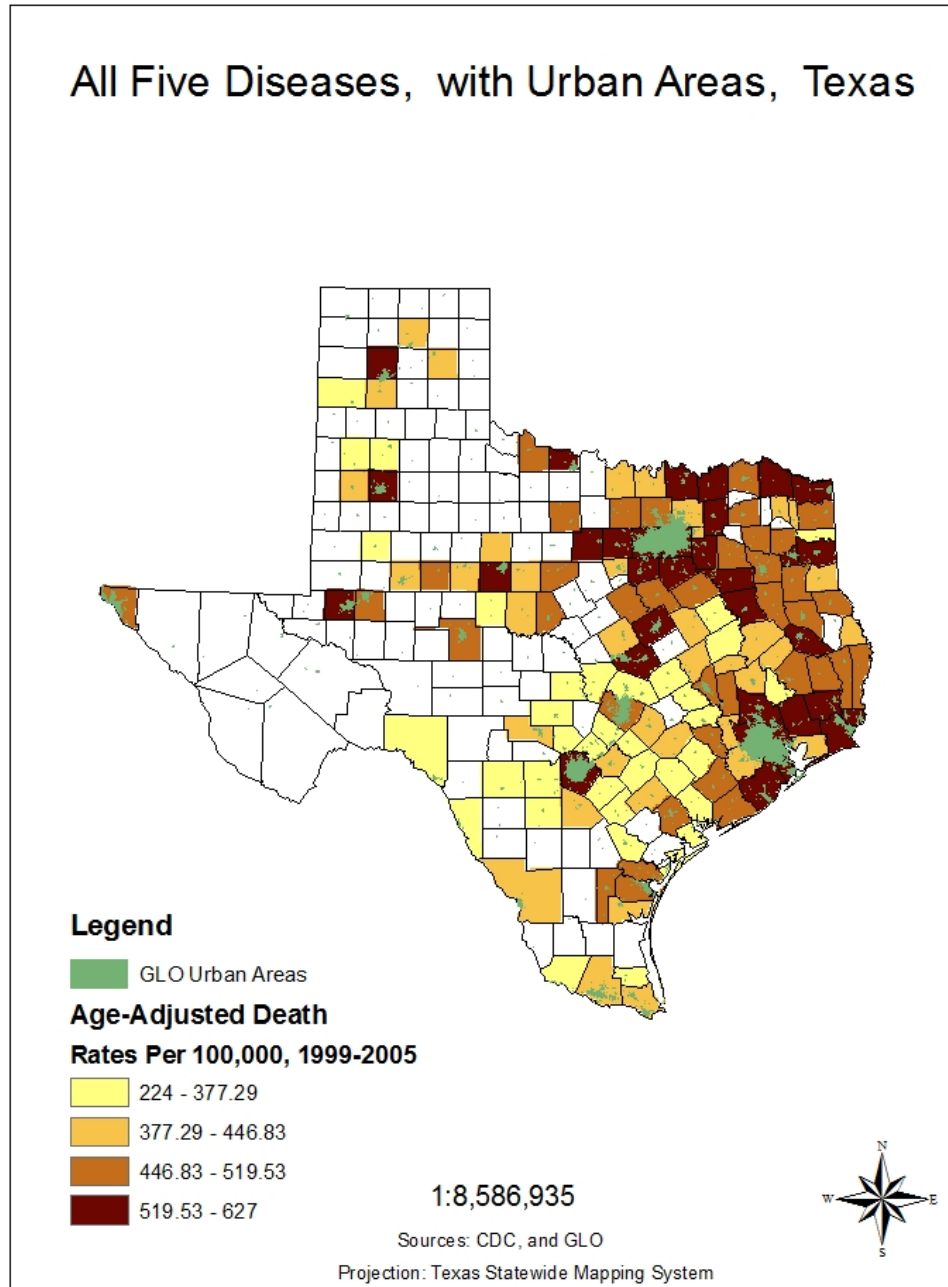


Figure 7



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M. Crutcher, 2008, State of the State's Health Oklahoma, 2008.

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McGehee, Mary A, Hall, Stanley D, Murdock, Steve H. Rural and Urban Death Rates by Race/Ethnicity and Gender, Texas: 1990 and 2000, Journal of Multicultural Nursing & Health, Summer 2004.

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Ricketts, T. (2000), The Changing Nature of Rural Health Care. Annual Review of Public Health, 21:639-57.

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APPENDIX 1

Tabular List of inclusions and four-character subcategories, 2007

Chapter List

Chapter	Blocks	Title
<u>I</u>	<u>A00-B99</u>	Certain infectious and parasitic diseases
<u>II</u>	<u>C00-D48</u>	Neoplasms
<u>III</u>	<u>D50-D89</u>	Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism
<u>IV</u>	<u>E00-E90</u>	Endocrine, nutritional and metabolic diseases
<u>V</u>	<u>F00-F99</u>	Mental and behavioural disorders
<u>VI</u>	<u>G00-G99</u>	Diseases of the nervous system
<u>VII</u>	<u>H00-H59</u>	Diseases of the eye and adnexa
<u>VIII</u>	<u>H60-H95</u>	Diseases of the ear and mastoid process
<u>IX</u>	<u>I00-I99</u>	Diseases of the circulatory system
<u>X</u>	<u>J00-J99</u>	Diseases of the respiratory system
<u>XI</u>	<u>K00-K93</u>	Diseases of the digestive system
<u>XII</u>	<u>L00-L99</u>	Diseases of the skin and subcutaneous tissue
<u>XIII</u>	<u>M00-M99</u>	Diseases of the musculoskeletal system and connective tissue
<u>XIV</u>	<u>N00-N99</u>	Diseases of the genitourinary system
<u>XV</u>	<u>O00-O99</u>	Pregnancy, childbirth and the puerperium
<u>XVI</u>	<u>P00-P96</u>	Certain conditions originating in the perinatal period
<u>XVII</u>	<u>Q00-Q99</u>	Congenital malformations, deformations and chromosomal abnormalities
<u>XVIII</u>	<u>R00-R99</u>	Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified
<u>XIX</u>	<u>S00-T98</u>	Injury, poisoning and certain other consequences of external causes
<u>XX</u>	<u>V01-Y98</u>	External causes of morbidity and mortality
<u>XXI</u>	<u>Z00-Z99</u>	Factors influencing health status and contact with health services
<u>XXII</u>	<u>U00-U99</u>	Codes for special purposes

From: <http://www.who.int/classifications/apps/icd/icd10online/>