

Improving the communication of geographic patterns of disease through computer-based tools

Linda Williams Pickle, Ph.D.



Email: PICKLEL@MAIL.NIH.GOV

ASA meeting
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Outline

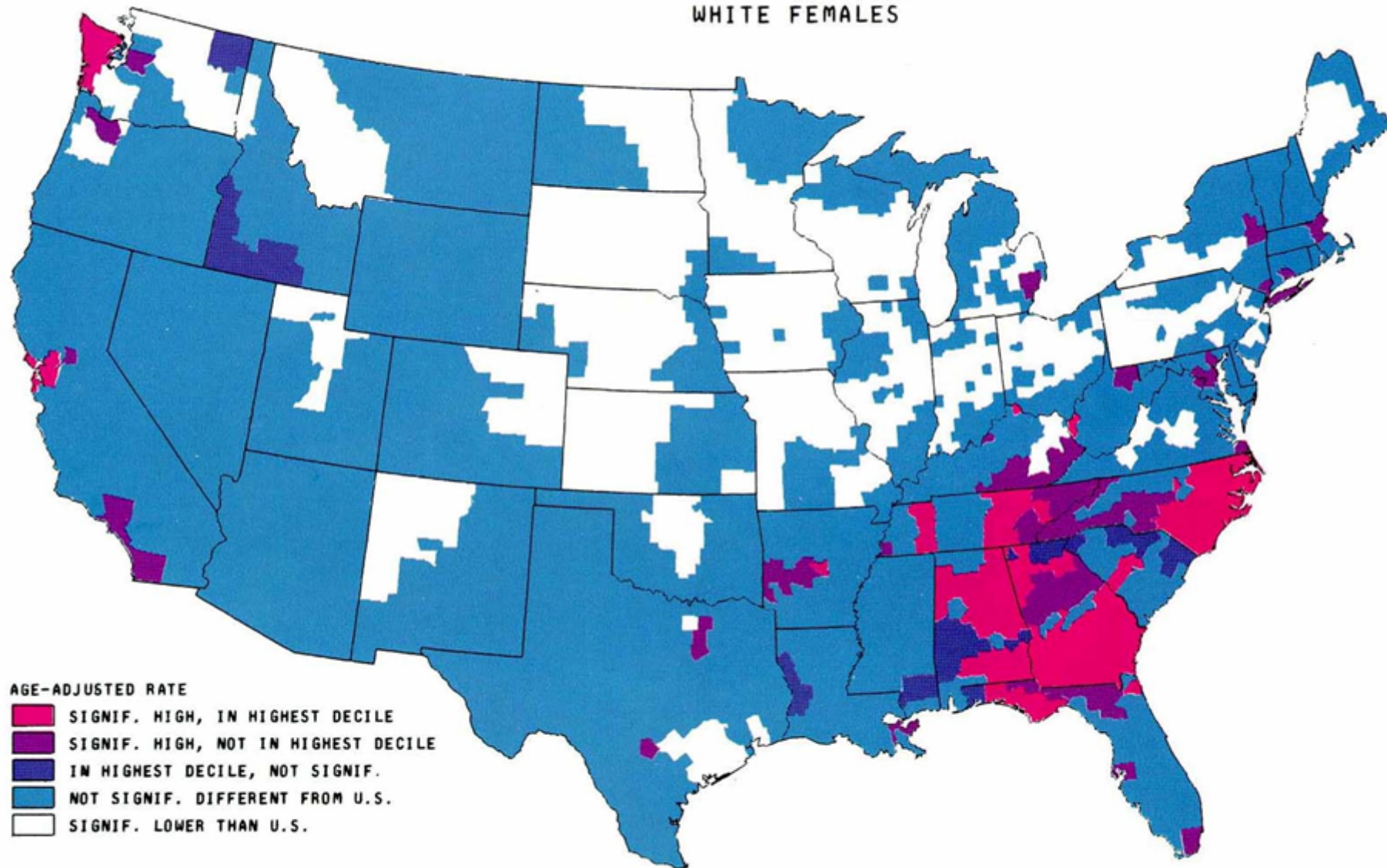
- Background
- Map design research at NCHS & NCI
 - Cognitive research methods
 - Basic map style
 - Legend design
 - Color choices
 - Indication of unreliable rates
 - Classification of rates into color categories
- Development of new graphical tools for communication
 - Smoothing
 - Cluster identification
 - Linked micromap plots
 - Exploratory Spatio-Temporal Analysis Tool (ESTAT)
- Communication over the web
 - NCI Cancer Atlas
 - Long Island Breast Cancer Study GIS
 - State Cancer Profiles

Mortality data by county, sex, race & cancer: Published in tabular form in 1974 (700 p.!)

WHITE: MALIGNANT NEOPLASM OF TONGUE (ICD 141); FLOOR OF MOUTH (ICD 143); OTHER PARTS OF MOUTH AND MOUTH UNSPECIFIED (ICD 144); ORAL MESOPHARYNX (ICD 145); AND PHARYNX, UNSPECIFIED (ICD 148).

MALE			FEMALE			MALE			FEMALE			MALE			FEMALE			MALE			FEMALE		
ST-CO	#	RATE	ST-CO	#	RATE	ST-CO	#	RATE	ST-CO	#	RATE	ST-CO	#	RATE	ST-CO	#	RATE	ST-CO	#	RATE	ST-CO	#	RATE
01001	2	1.9	01105	4	3.2	01105	3	3.6	05049	1	.8	06003	5	3.7	06003	1	32.4	06003	5	3.7	06003	1	32.4
01003	8	2.1	01107	13	8.7	01107	7	3.5	05051	26	4.2	06005	51	5.0	06005	2	1.7	06005	51	5.0	06005	2	1.7
01005	1	.9	01109	1	.6	01109	7	3.7	05053	1	.9	06007	7	4.3	06007	4	2.9	06007	7	4.3	06007	4	2.9
01007	2	1.9	01111	3	1.4	01111	7	3.2	05055	8	2.9	06009	7	4.7	06009	3	2.6	06009	7	4.7	06009	3	2.6
01009	5	2.0	01113	9	4.7	01113	6	2.7	05057	4	2.2	06011	117	4.4	06011	43	1.4	06011	117	4.4	06011	43	1.4
01011	3	6.7	01115	3	1.4	01115	3	1.2	05059	6	3.1	06013	7	5.9	06013	1	.8	06013	7	5.9	06013	1	.8
01013	3	2.0	01117	9	3.8	01117	3	1.2	05061	1	.9	06015	11	3.3	06015	4	1.5	06015	11	3.3	06015	4	1.5
01015	17	3.2	01119	1	1.9	01119	3	.7	05063	5	2.0	06017	133	4.7	06017	35	1.2	06017	133	4.7	06017	35	1.2
01017	10	4.5	01121	10	3.0	01121	7	2.5	05065	2	2.0	06019	17	9.0	06019	3	1.7	06019	17	9.0	06019	3	1.7
01019	1	.7	01123	5	2.2	01123	7	1.0	05067	4	2.3	06021	35	4.3	06021	11	1.4	06021	35	4.3	06021	11	1.4
01021	6	2.6	01125	17	2.5	01125	8	1.6	05069	24	6.8	06023	20	3.6	06023	3	.6	06023	20	3.6	06023	3	.6
01023	6	7.4	01127	14	2.9	01127	2	2.3	05071	4	2.2	06025	10	7.2	06025	2	1.6	06025	10	7.2	06025	2	1.6
01025	7	5.1	01129	2	2.6	01129	1	1.5	05073	2	2.5	06027	92	4.5	06027	31	1.4	06027	92	4.5	06027	31	1.4
01027	1	.7	01131	1	1.5	01131	6	3.8	05075	7	3.7	06029	12	3.0	06029	7	1.7	06029	12	3.0	06029	7	1.7
01029	1	.9	01133	4	2.6	01133	1	1.2	05077	3	3.8	06031	7	2.6	06031	4	2.7	06031	7	2.6	06031	4	2.7
01031	5	2.7	04001	1	1.2	04001	11	3.1	05079	2	3.0	06033	4	2.8	06033	1	.7	06033	4	2.8	06033	1	.7
01033	7	2.7	04003	5	3.2	04003	5	3.2	05081	2	2.9	06035	15	4.2	06035	22	1.6	06035	15	4.2	06035	22	1.6
01035	2	1.7	04005	7	3.5	04005	2	1.8	05083	5	2.0	06037	59	5.0	06037	2	2.8	06037	59	5.0	06037	2	2.8
01037	6	7.0	04007	2	1.9	04007	1	1.8	05085	3	1.3	06039	1	1.1	06039	7	1.4	06039	1	1.1	06039	7	1.4
01039	7	2.2	04009	1	2.6	04009	168	3.3	05087	7	5.2	06041	19	3.5	06041	9	1.6	06041	19	3.5	06041	9	1.6
01041	2	1.7	04011	3	4.3	04011	5	3.8	05089	3	2.9	06043	2	2.1	06043	18	1.2	06043	2	2.1	06043	18	1.2
01043	6	1.4	04013	42	2.1	04013	4	1.2	05091	12	5.0	06045	61	4.8	06045	40	7	06045	61	4.8	06045	40	7
01045	5	2.8	04015	6	1.4	04015	2	1.8	05093	19	5.2	06047	40	4.7	06047	3	.9	06047	40	4.7	06047	3	.9
01047	11	6.5	04017	4	4.6	04017	5	1.4	05095	3	3.2	06049	8	2.5	06049	63	1.0	06049	8	2.5	06049	63	1.0
01049	14	3.5	04019	9	2.2	04019	2	.5	05097	1	1.6	06051	146	3.0	06051	26	4.0	06051	146	3.0	06051	26	4.0
01051	6	2.8	04021	16	5.4	04021	3	1.5	05099	3	2.8	06053	5	3.8	06053	109	3.6	06053	5	3.8	06053	109	3.6
01053	6	3.2	04023	8	4.3	04023	3	2.0	05101	2	1.7	06055	174	4.9	06055	62	1.6	06055	174	4.9	06055	62	1.6
01055	16	2.4	04025	5	3.0	04025	6	1.2	05103	9	4.8	06057	7	4.3	06057	3	1.8	06057	9	4.8	06057	3	1.8
01057	2	1.3	04027	10	2.0	04027	7	4.5	05105	2	1.7	06059	169	4.0	06059	61	1.3	06059	169	4.0	06059	61	1.3
01059	3	1.4	05001	4	3.4	05001	4	3.1	05107	8	3.3	06061	286	3.9	06061	118	1.4	06061	8	3.3	06061	118	1.4
01061	5	2.4	05003	5	2.6	05003	1	.4	05109	2	1.8	06063	683	8.6	06063	203	2.1	06063	2	1.8	06063	203	2.1
01063	1	3.5	05005	5	5.9	05005	2	2.3	05111	78	5.0	06065	123	5.3	06065	27	1.2	06065	78	5.0	06065	27	1.2
01065	1	1.6	05007	6	3.6	05007	5	1.8	05113	2	1.3	06067	37	4.2	06067	4	.5	06067	2	1.3	06067	37	4.2
01067	6	6.8	05009	6	2.4	05009	2	.8	05115	12	4.4	06069	153	4.9	06069	70	1.8	06069	12	4.4	06069	70	1.8
01069	11	3.5	05011	1	.8	05011	1	.9	05117	1	.9	06071	67	4.7	06071	16	.9	06071	1	.9	06071	67	4.7
01071	8	2.6	05013	1	.8	05013	1	.8	05119	1	.8	06073	161	3.8	06073	64	1.2	06073	1	.8	06073	161	3.8
01073	189	5.8	05015	2	1.1	05015	1	1.2	05121	23	3.7	06075	56	5.0	06075	13	1.0	06075	23	3.7	06075	56	5.0
01075	5	3.5	05017	7	5.0	05017	6	4.5	05123	6	4.5	06077	16	3.0	06077	8	1.5	06077	6	4.5	06077	16	3.0
01077	16	4.3	05019	12	2.9	05019	8	1.7	05125	1	1.1	06079	1	2.4	06079	2	.6	06079	1	1.1	06079	1	2.4
01079	3	1.9	05021	6	2.4	05021	2	.7	05127	1	1.3	06081	34	3.6	06081	9	1.0	06081	1	1.3	06081	34	3.6
01081	8	4.3	05023	5	3.6	05023	3	2.5	05129	15	4.4	06083	75	4.4	06083	20	1.1	06083	15	4.4	06083	75	4.4
01083	1	.4	05025	2	2.1	05025	1	.9	05131	10	2.5	06085	66	4.2	06085	23	1.3	06085	10	2.5	06085	66	4.2
01085	1	3.1	05027	2	1.9	05027	2	2.0	05133	6	1.6	06087	7	2.3	06087	2	.7	06087	6	1.6	06087	7	2.3
01087	2	4.9	05029	4	3.4	05029	2	1.5	05135	2	2.0	06089	8	3.0	06089	1	1.4	06089	2	2.0	06089	8	3.0
01089	16	2.9	05031	8	3.4	05031	7	2.6	05137	3	1.8	06091	3	3.5	06091	1	1.4	06091	3	1.8	06091	3	3.5
01091	4	4.3	05033	4	3.3	05033	1	1.4	05139	2	1.2	06093	41	2.7	06093	18	1.2	06093	1	1.4	06093	41	2.7
01093	5	2.2	05035	2	1.4	05035	2	1.4	05141	1	1.1	06095	1	2.7	06095	2	.6	06095	1	1.1	06095	1	2.7
01095	9	2.2	05037	12	2.9	05037	2	.7	05143	15	4.4	06097	3	3.6	06097	9	1.0	06097	15	4.4	06097	3	3.6
01097	85	6.2	05039	6	2.4	05039	3	2.5	05145	3	2.9	06099	20	1.1	06099	1	.1	06099	3	2.9	06099	20	1.1
01099	7	6.7	05041	5	3.6	05041	1	.9	05147	14	2.4	06101	66	4.2	06101	23	1.3	06101	14	2.4	06101	66	4.2
01101	47	6.7	05043	2	1.9	05043	2	2.0	05149	10	2.5	06103	7	2.3	06103	2	.7	06103	10	2.5	06103	7	2.3
01103	15	3.7	05045	4	3.4	05045	2	1.5	06001	368	5.1	06105	8	3.0	06105	3	1.2	06105	368	5.1	06105	8	3.0
			05047	8	3.3	05047	2	1.4				06107	3	3.5	06107	1	1.4				06107	3	3.5
													41	2.7		18	1.2						

CANCER MORTALITY, 1950-69, BY STATE ECONOMIC AREA
OTHER MOUTH & THROAT
WHITE FEMALES



Cognitive Research Methods

- Focus groups
- Designed experiments
 - Focused on a single map element
 - Random order of maps seen
 - Subjects required to answer several types of questions about each map
 - Statistical analysis of % errors
- Think-aloud: “tell me what you are doing”

Statistical map reading tasks

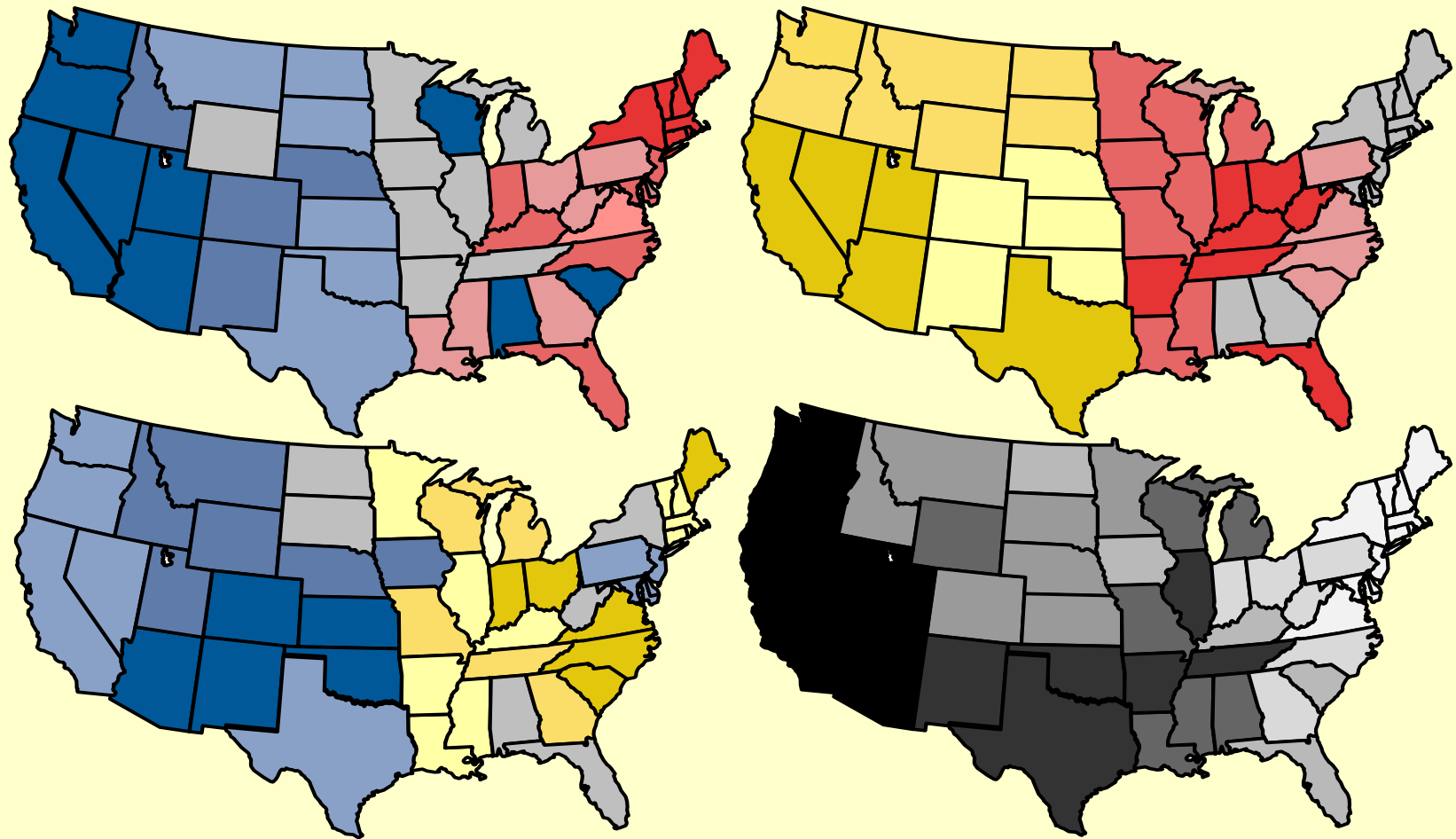
- Rate readout - what is approx. rate?
- Pattern recognition -clusters? outliers?
-regional patterns?
- Pattern comparisons - compare maps

Target audience: Epidemiologists,
public health professionals

Results of early studies

- Choropleth (area-shaded) maps preferred & used most accurately by epidemiologists
- Legend: standard vertical fixed-box style
- Colors:
 - Very distinct colors best for rate readout (Hastie 1995)
 - Color gradient best for pattern recognition (Lewandowsky 1995)
 - Double-ended (diverging) scale combines gradients of 2 distinct hues; further tested for both types of questions
 - Color conventions (expectations) matter: darker or warmer color used for higher rates

What do you expect? Do color conventions matter?

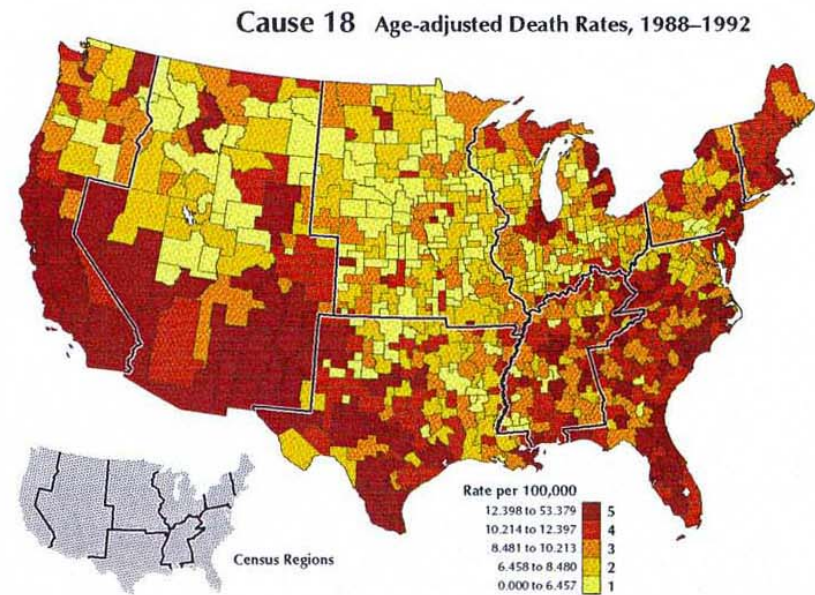
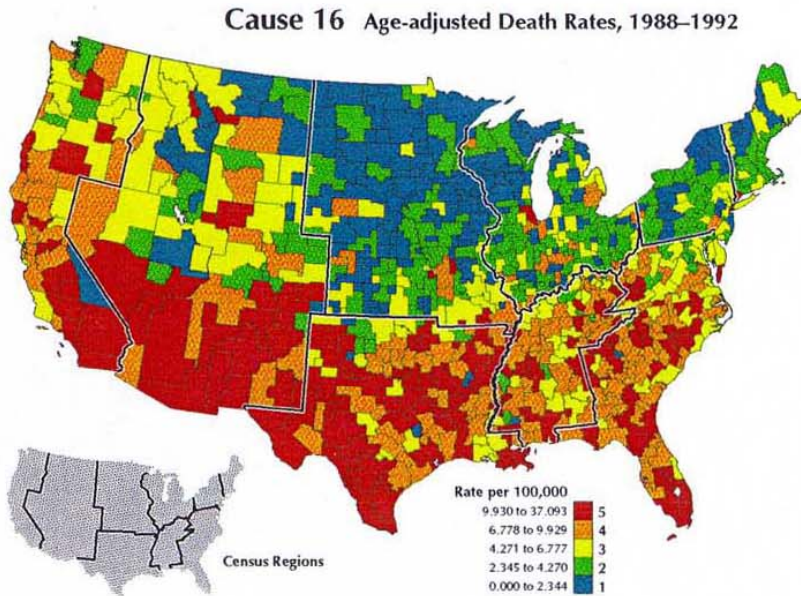
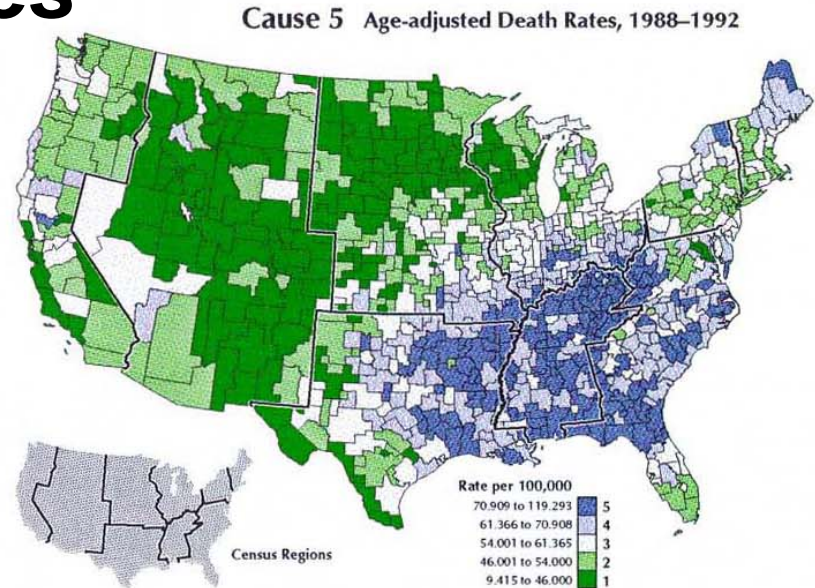


Source: Carswell M, in Pickle & Herrmann, eds., *Cognitive Aspects of Statistical Mapping*, 1995

Evaluating color schemes - Sample test maps

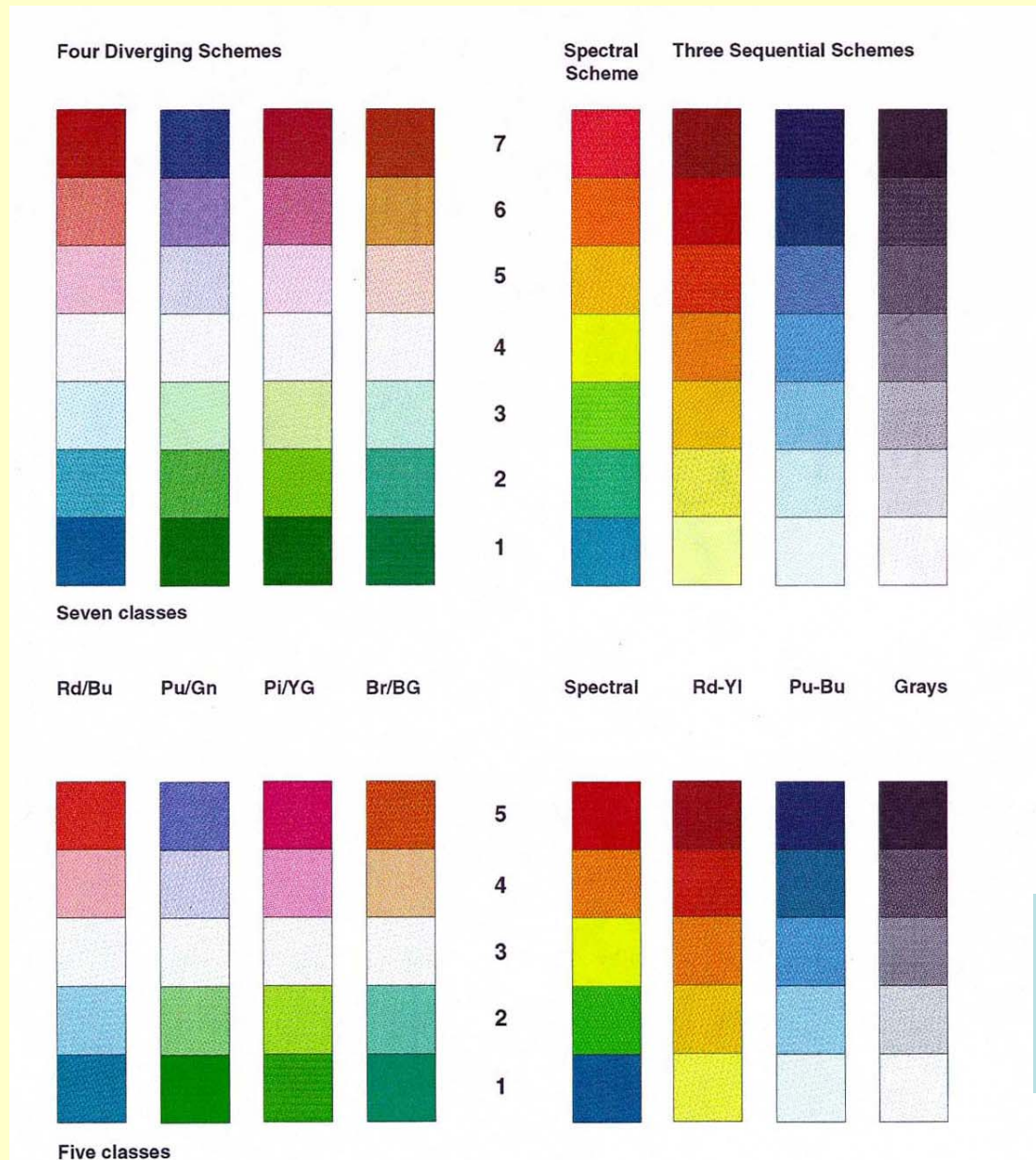
Figure 3. Example Quarter-Scale Test Maps

Mapped variables 5, 16, and 18 are shown with the five-class Purple/Green diverging, Spectral, and Red-Yellow sequential schemes.



Source: Brewer et al., Annals of the Assoc of Amer Geographers, 1997.

Color schemes tested

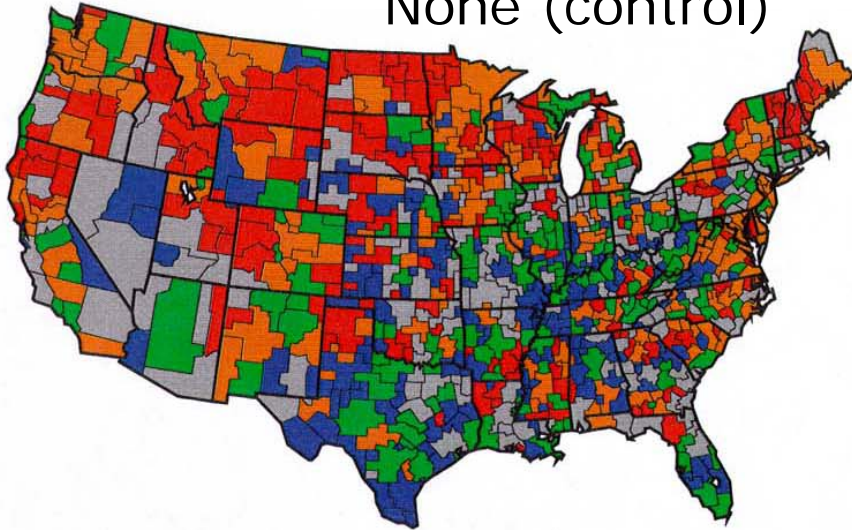


A new web tool for choosing colors: colorbrewer.org

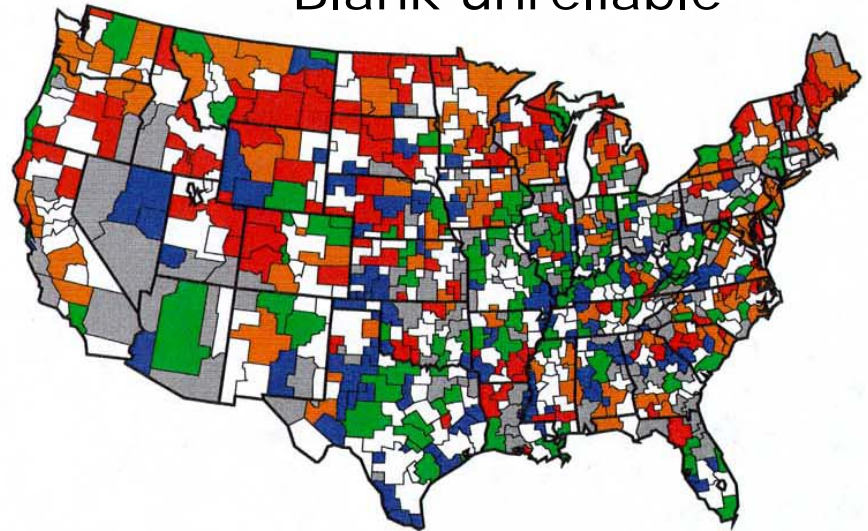
Source: Brewer et al., Annals of the Assoc of Amer Geographers, 1997.

Reliability Representation (study #1)

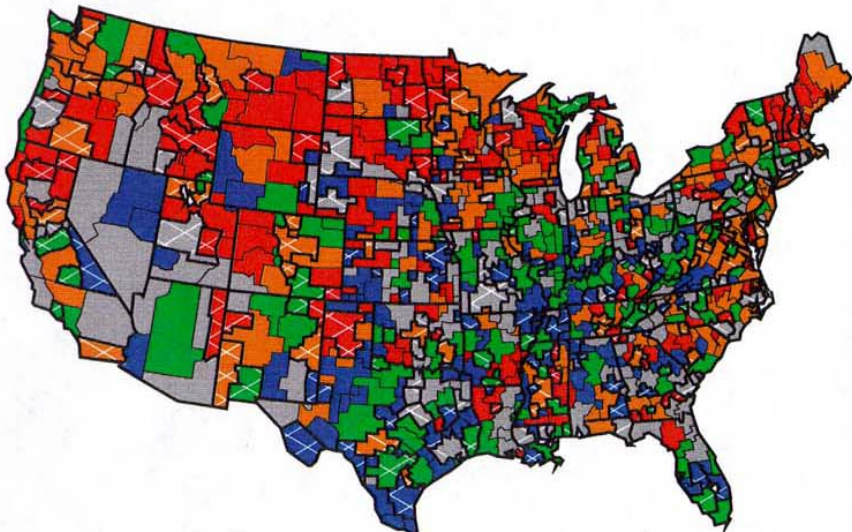
None (control)



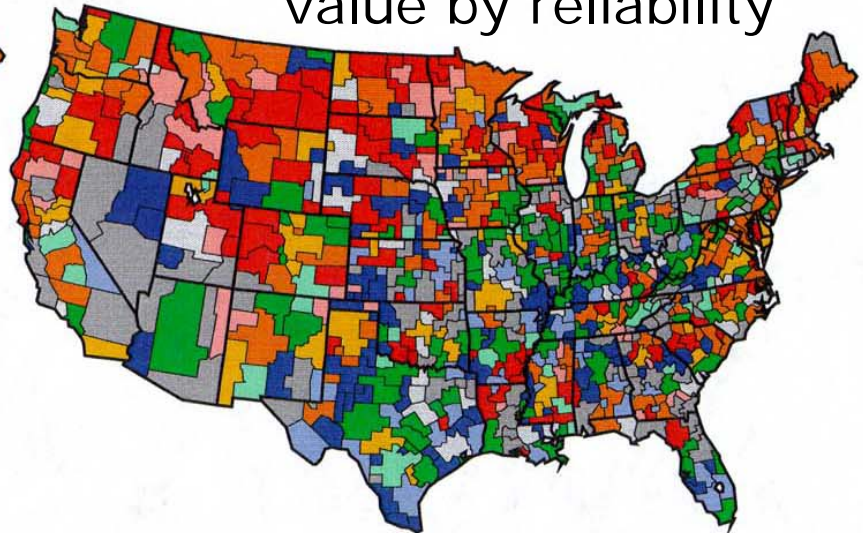
Blank unreliable



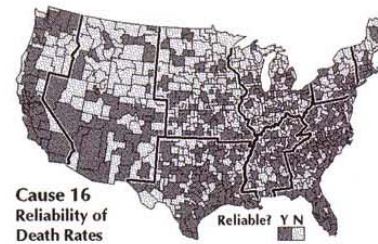
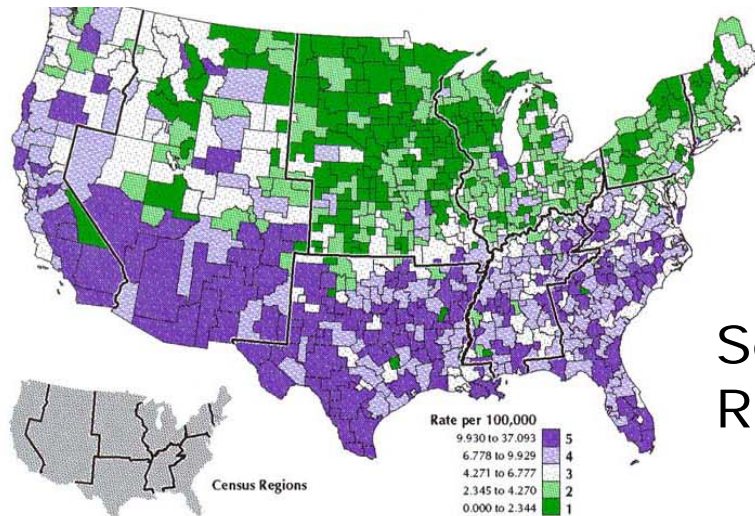
Hatch unreliable



Bivariate color scheme –
value by reliability



Reliability Representation (Study #2)

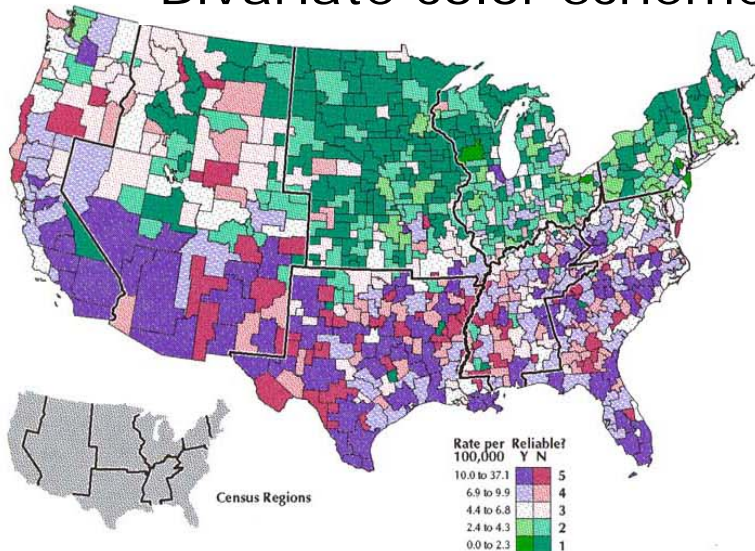


Sample Test Maps:

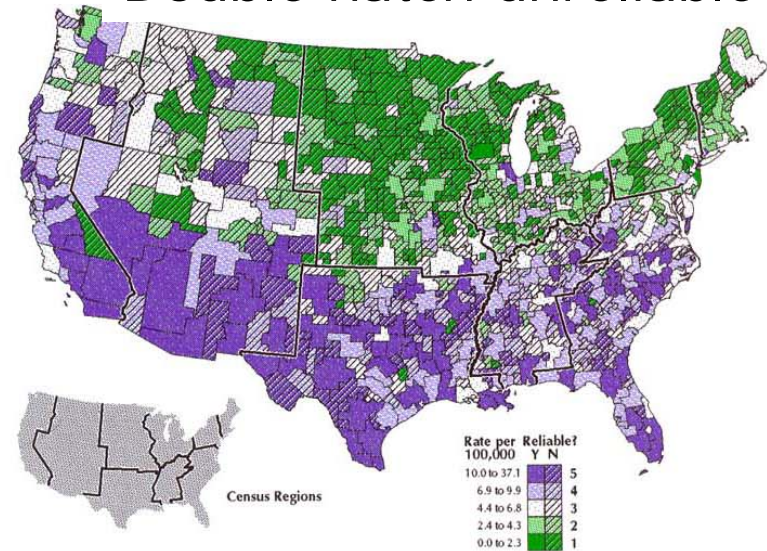
- cause: 16
- scale: quarter
- color scheme: purple-green
- reliability schemes:
 - map pairs
 - color change
 - texture overlay

Separate maps for
Rate and reliability

Bivariate color scheme



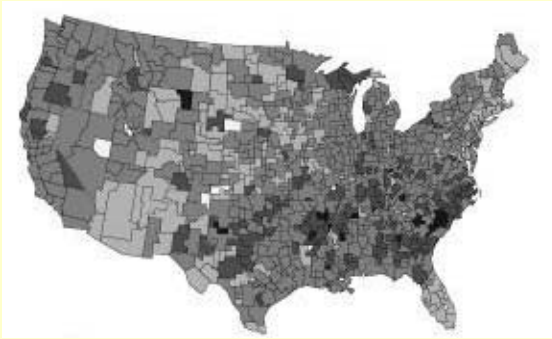
Double hatch unreliable



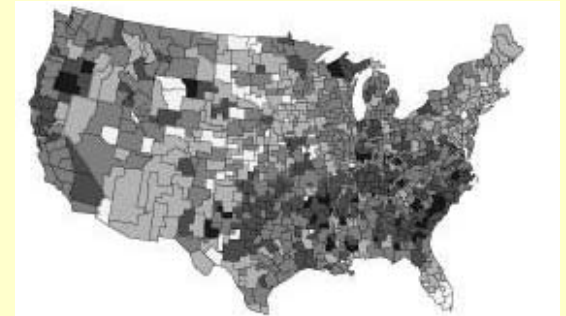
Source: MacEachren et al., Environment & Planning A, 1998.

Cutpoint Methods Tested

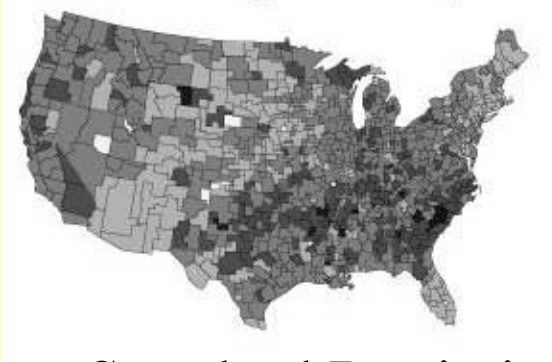
Equal Width



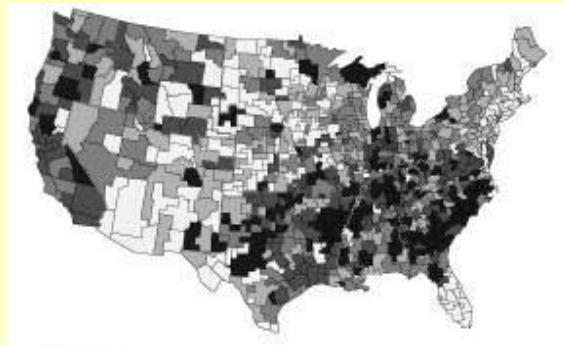
Natural Breaks (Jenks)



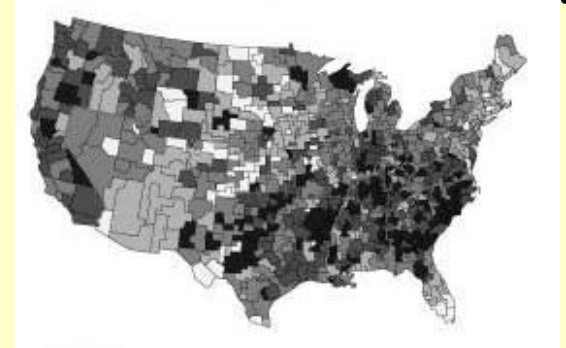
Box Plot



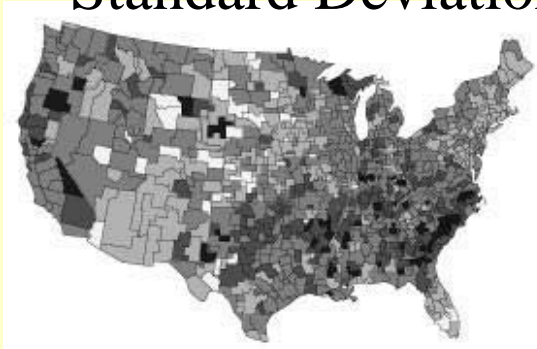
Quintile



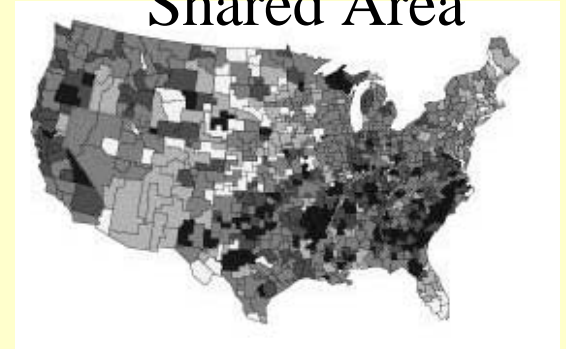
Minimum Boundary



Standard Deviation



Shared Area



Recommendations for rate map design

- Design for particular audience and purpose & TEST PROPOSED DESIGNS FOR THESE
- Quantile-categorized choropleth map works well
- Use standard legend design
- Colors should be chosen for visually impaired and consistent with conventions
- Identify unreliable rates, don't blank out
- Accept that multiple maps are often needed
 - to address different questions,
 - to focus attention on different scales,
 - to compare modeled (smoothed) to observed...

Extensions of Map-based Research at NCI

- Extension of map research to computer-based maps, web-based data dissemination
- Development of new graphical tools for data exploration and communication
- Usability of interactive systems by the public
- Examples
 - **Visualization tools: Smoothing, Cluster identification**
 - Linking maps & graphs: Linked micromap plots, Exploratory Spatio-Temporal Analysis Tool (ESTAT)
 - Communication over the web
 - Cancer atlas
 - Long Island Breast Cancer GIS
 - State Cancer Profiles

Map smoothing methods

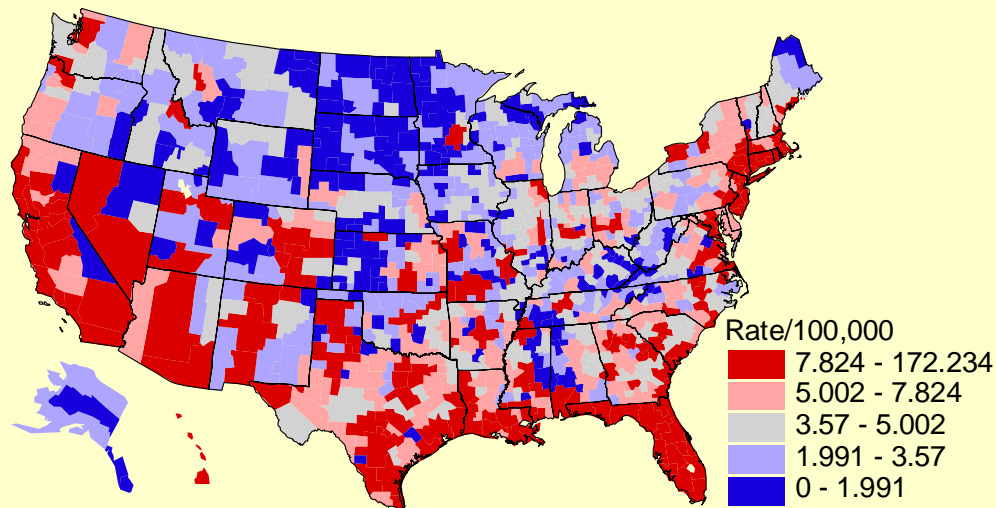
- 2D Smoothing is a method of removing some variability in a quantitative map
- Maps of cancer rates for small areas can be difficult to interpret because of background “noise”
- Previous methods ignored population differences
- Methods now can incorporate weights
 - very stable rates are smoothed less
 - more unstable rates (due to small populations) are smoothed more



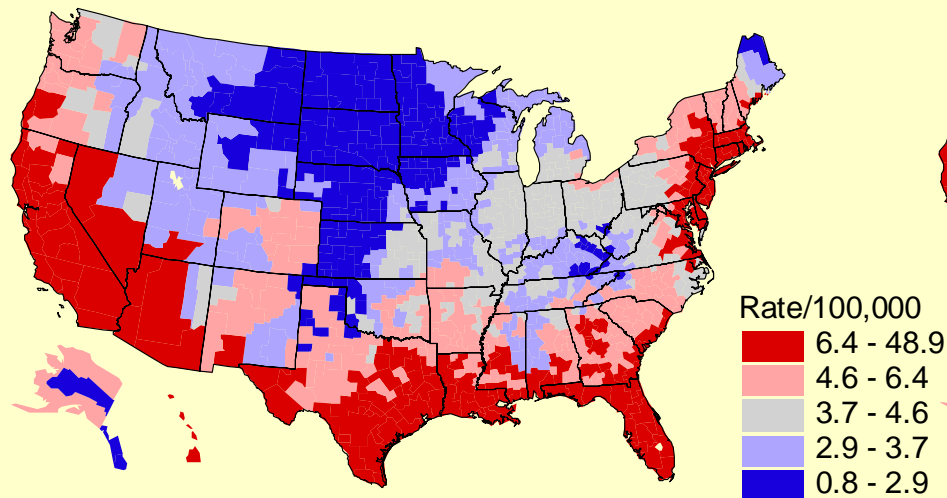
Source: Mungiole, Pickle, Simonson, *Statistics in Medicine*, 1999

HIV mortality rates, 1988-92

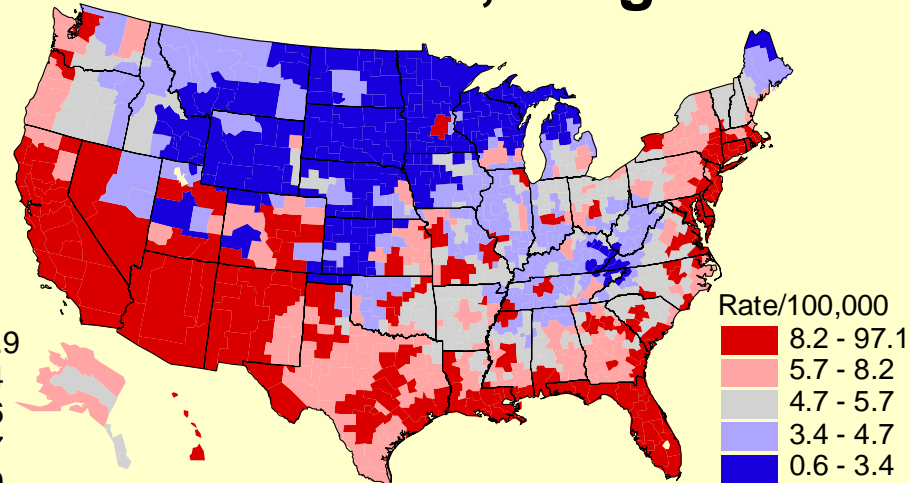
Original data:



Smoothed, unweighted



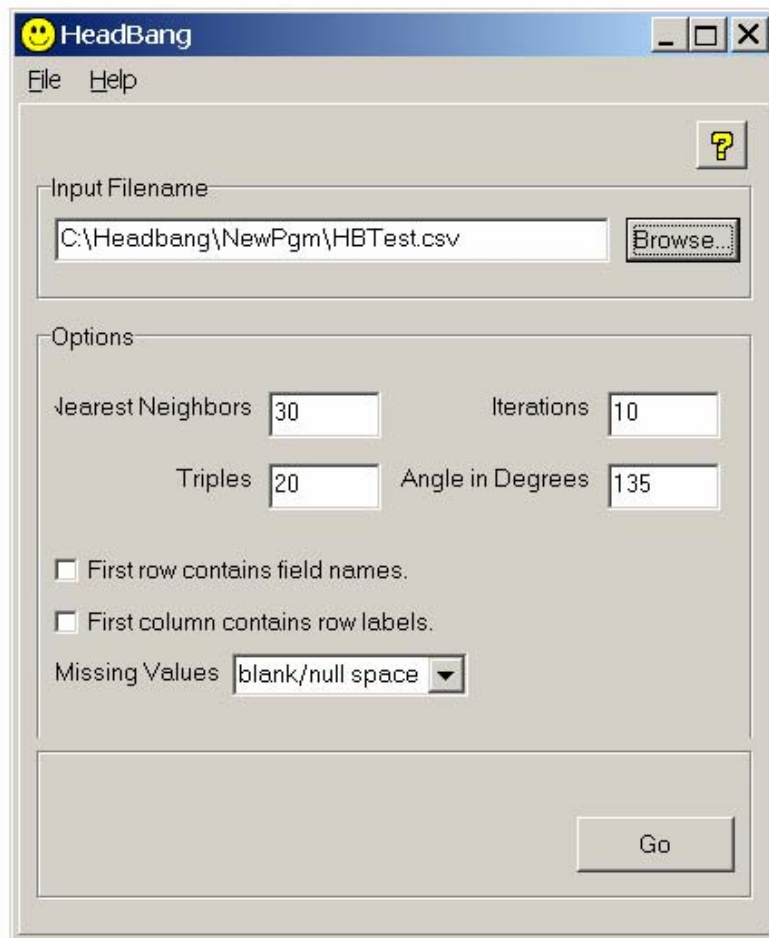
Smoothed, weighted



Source: Pickle et al., Atlas of United States Mortality, NCHS, 1996.

Headbang software available from <http://srab.cancer.gov/headbang/>

GUI Interface



The screenshot shows the HeadBang GUI window. The title bar is blue with a yellow smiley face icon and the text 'HeadBang'. Below the title bar is a menu bar with 'File' and 'Help'. The main area is divided into sections. The first section is 'Input Filename' with a text box containing 'C:\Headbang\NewPgm\HBTest.csv' and a 'Browse...' button. The second section is 'Options' with four input fields: 'Nearest Neighbors' (30), 'Iterations' (10), 'Triples' (20), and 'Angle in Degrees' (135). Below these are two checkboxes: 'First row contains field names.' and 'First column contains row labels.', both of which are unchecked. At the bottom of the options section is a 'Missing Values' dropdown menu set to 'blank/null space'. A 'Go' button is located at the bottom right of the window.

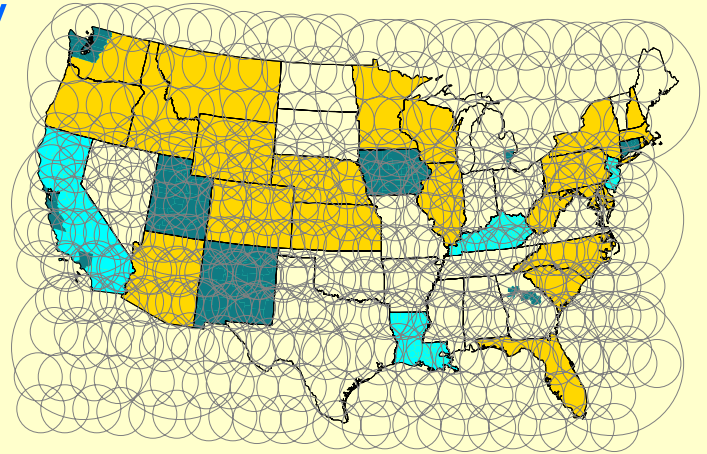
S+ call to C+ program

```
ResultNew<-dos(paste("headbang.exe",  
nn,ntrip,niter,thetastar),rbind(X,Y,rate,wgt))
```

Developers: Katherine Hansen Simonson
and IMS, Inc. staff

Cluster Identification

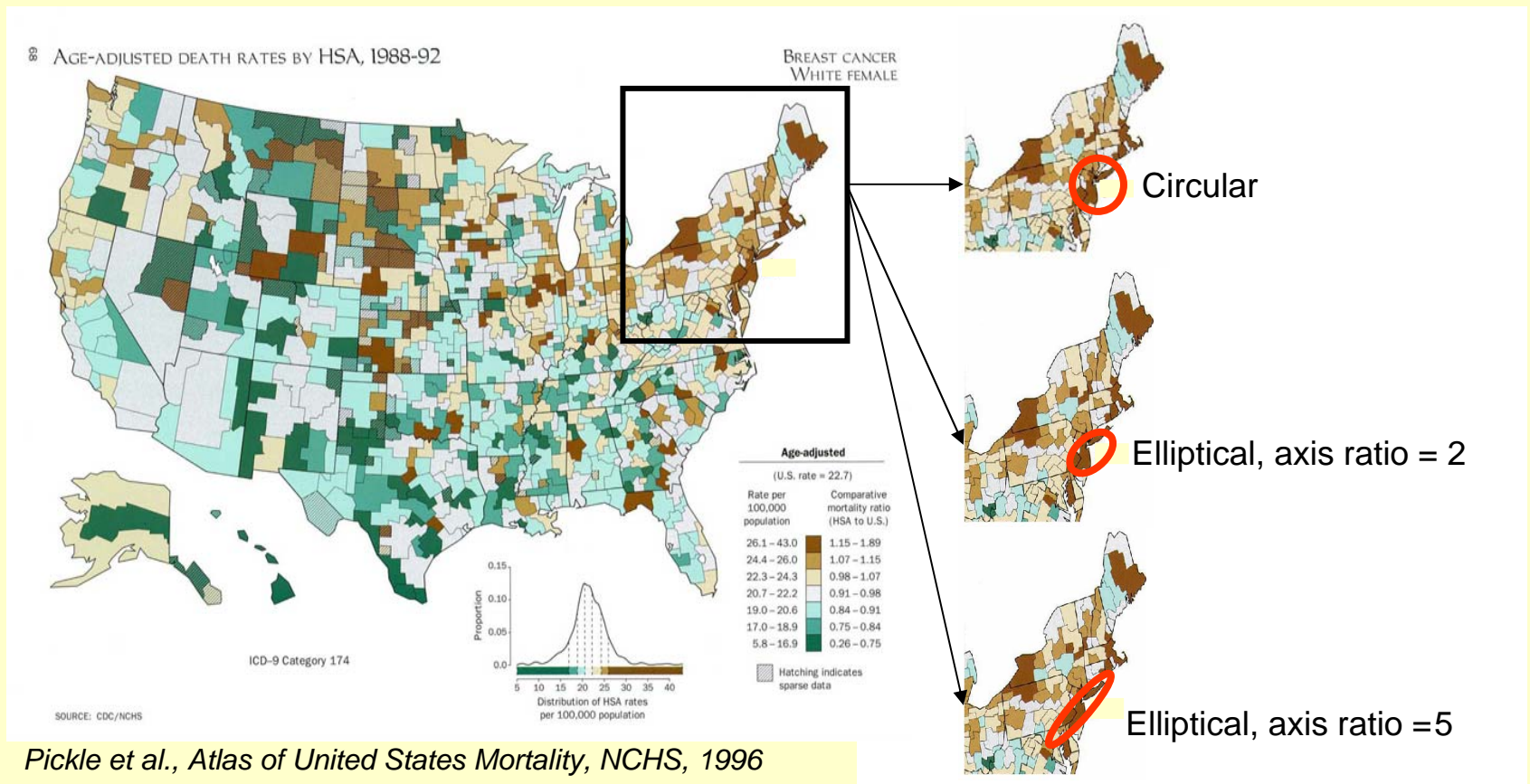
- SaTScan, a space and time scan statistic, was developed at NCI by Martin Kulldorff (see srab.cancer.gov and www.satscan.org)
- Tests null hypothesis that disease risk is the same all over the map
- Creates a set of circles (new version includes ellipses) centered on each geographic unit
- Generates random replicas of the data under H_0 , compares most likely clusters in real & random data sets to identify most likely cluster & its significance level



Example: Breast cancer clusters

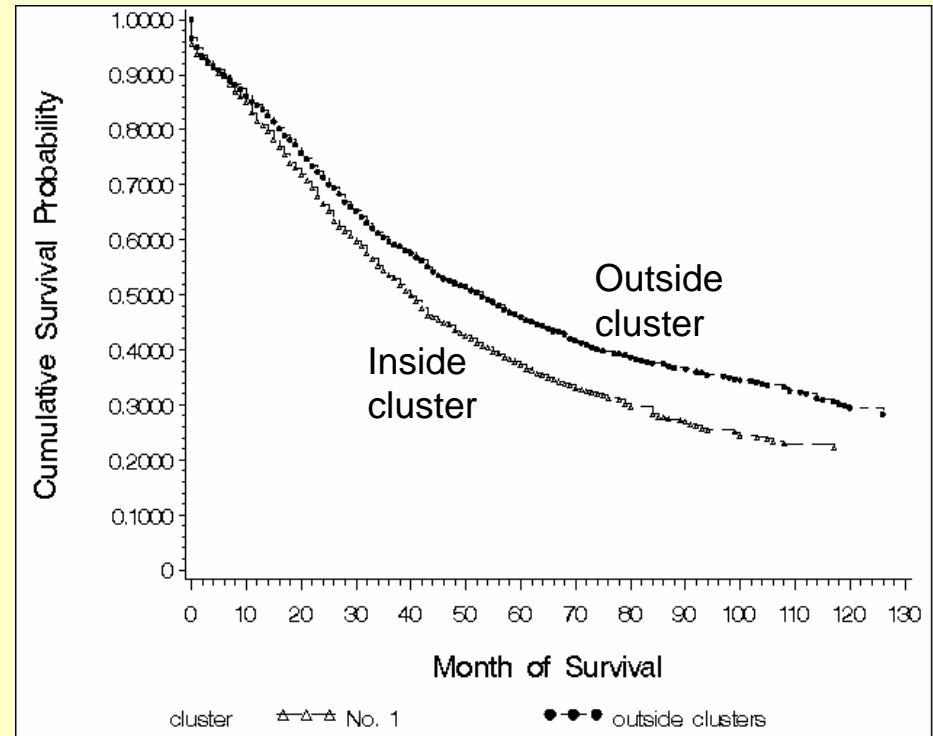
Breast cancer mortality rates

Most likely cluster



Spatial clustering of survival for stage III colorectal cancer in Los Angeles, among male cases diagnosed 1988-2002

Significantly short survival, $p=0.01$, radius=17km



Source: Huang et al. (NCI), manuscript in preparation

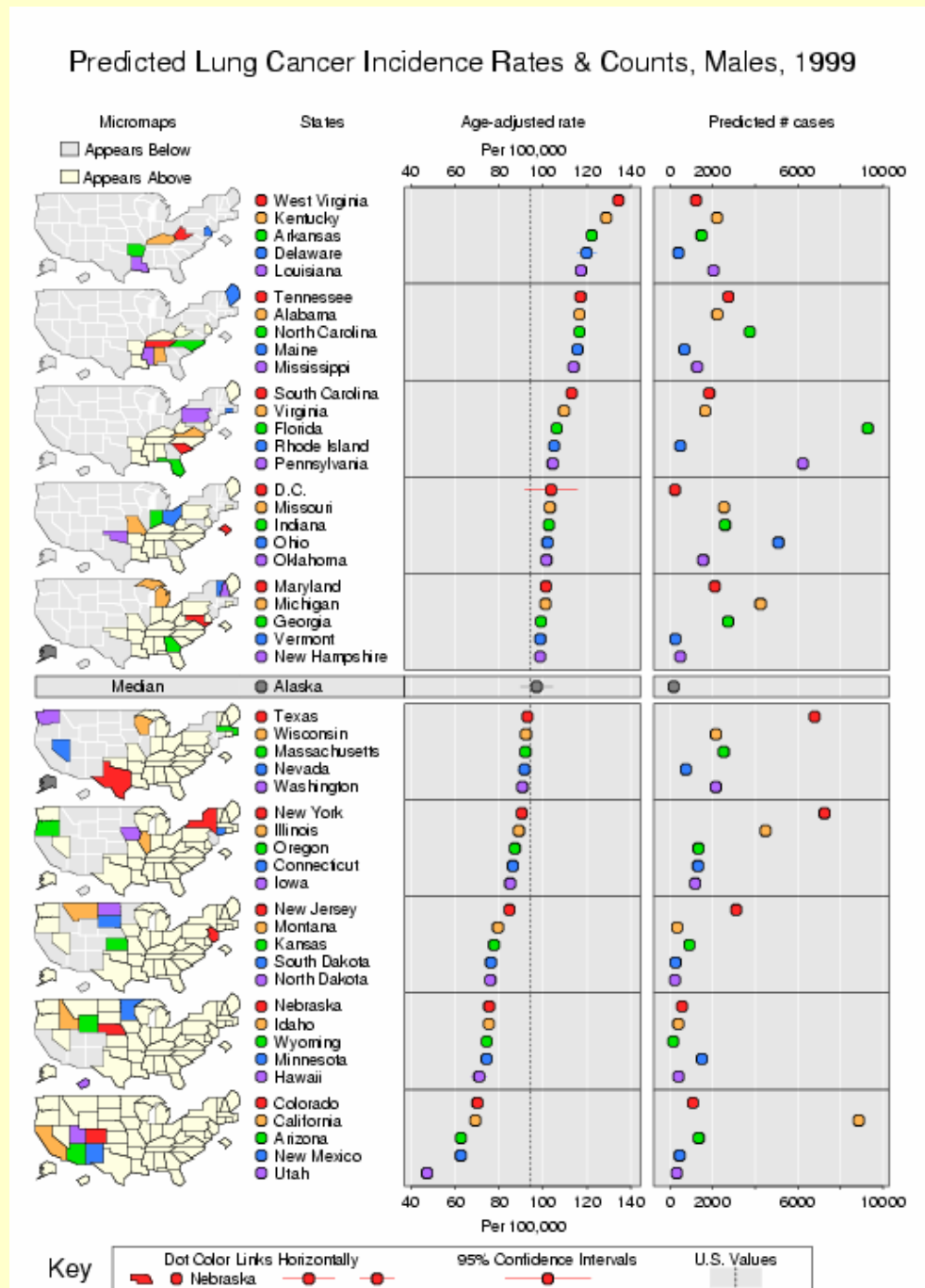
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- Examples
 - Visualization tools: Smoothing, Cluster identification
 - **Linking maps & graphs:** Linked micromap plots, Exploratory Spatio-Temporal Analysis Tool (ESTAT)
 - Communication over the web
 - Cancer atlas
 - Long Island Breast Cancer GIS
 - State Cancer Profiles

Linked Micromap Plot

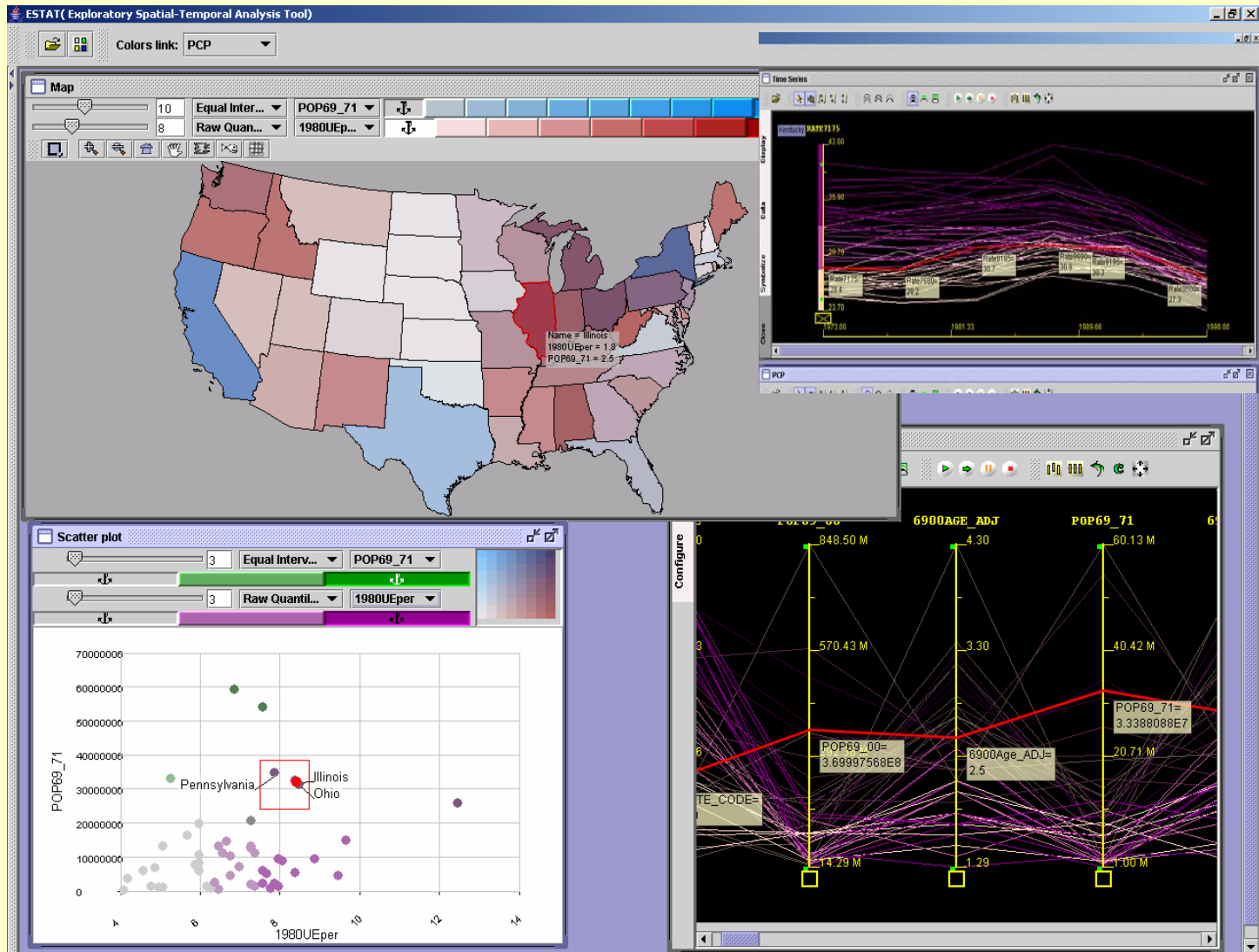
Linking geographic
patterns with
statistical detail

Source: Carr, Wallin & Carr,
Stat in Med 2000



Exploratory Spatio-Temporal Analysis Tool (ESTAT)

Map



Rate
Time
Series
Plot

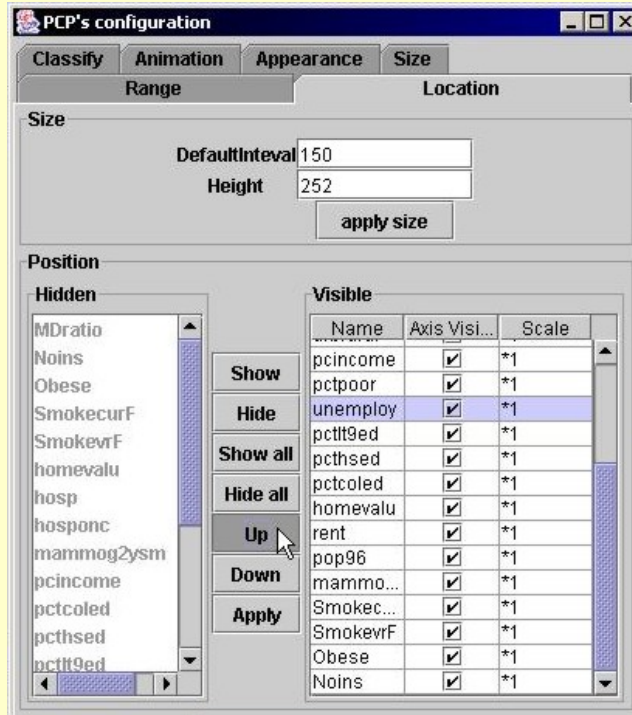
Scatter
plot

Covariate
PCP plot

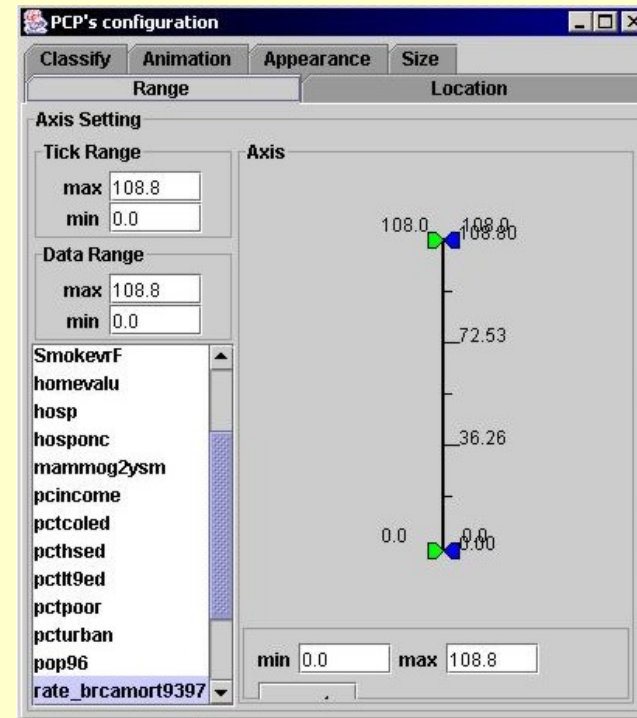
Developed by Alan MacEachren & GeoVista staff, Penn State University

Examples of ESTAT's extensive user controls

Select and order PCP variables



Restrict range of PCP axis



Also, dynamic linking & brushing, color specification, simple summary statistics, etc.

Extensions of Map-based Research at NCI

- Extension of map research to computer-based maps, web-based data dissemination
- Development of new graphical tools for data exploration and communication
- Usability of interactive systems by the public
- Examples
 - Visualization tools: Smoothing, Cluster identification
 - Linking maps & graphs: Linked micromap plots, Exploratory Spatio-Temporal Analysis Tool (ESTAT)
 - Communication over the web
 - **Cancer atlas**
 - **Long Island Breast Cancer GIS**
 - **State Cancer Profiles**

Web-based interactive cancer mortality maps

www.cancer.gov/atlasplus

s Tools Help

Search Favorites Media

controlplanet.cancer.gov:8080/atlas/index.jsp

Search Web 111 blocked AutoFill Options

NATIONAL CANCER INSTITUTE **CancerMortality Maps & Graphs** Home Contact Us Dictionary

Customizable Mortality Maps [Charts and Graphs Home](#)

Create maps by selecting from the variables below. View values associated with a geographic area by moving cursor over that area. Drill down from state to county by clicking on state (or "Detail for [state name]" for [d] link).

View Entire US by	Age	Race/Gender	Time Period	Rate intervals for color shading
<input type="radio"/> State	<input type="radio"/> All Ages	<input type="radio"/> White Male	<input type="radio"/> 1950-1994	<input checked="" type="radio"/> 10 Intervals with equal no. of regions
<input checked="" type="radio"/> State Economic Area	<input type="radio"/> 0-19	<input type="radio"/> White Female	<input type="radio"/> 1950-1969	<input type="radio"/> User-defined intervals
<input type="radio"/> County	<input type="radio"/> 20-49	<input type="radio"/> Black Male	<input type="radio"/> 1950-1954	
	<input type="radio"/> 50-74	<input type="radio"/> Black Female	<input type="radio"/> 1955-1959	
	<input type="radio"/> 75+		<input type="radio"/> 1960-1964	
			<input type="radio"/> 1965-1969	
			<input type="radio"/> 1970-1974	
			<input type="radio"/> 1975-1979	
			<input type="radio"/> 1980-1984	
			<input type="radio"/> 1985-1989	
			<input type="radio"/> 1990-1994	

Map color scale (high rates/low rates)

☐ Atlas (red/blue)

☒ Monochrome (red/white)

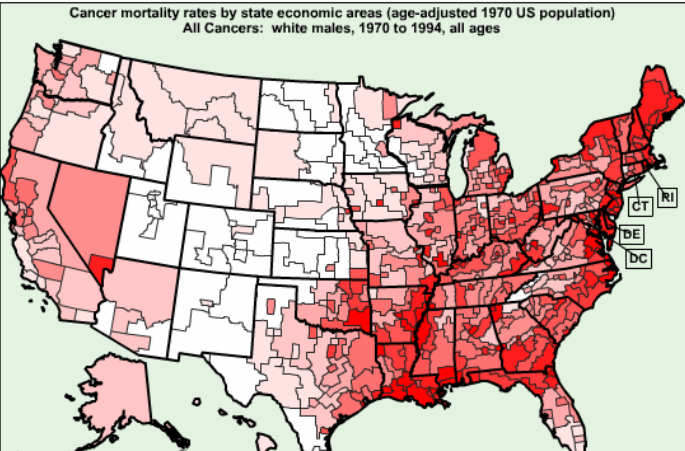
Compare maps

Map image format: ☐ [D] ☒ Flash ☐ JPEG ☐ SVG

Place cursor over map to view geographic location, rate, lower bound to upper bound, no. of deaths, and/or to drill down (outline around state indicates drill down capability)

To print, right-click anywhere on graph and select Print from the popup menu

Cancer mortality rates by state economic areas (age-adjusted 1970 US population)
All Cancers: white males, 1970 to 1994, all ages



Cancer

- ☒ All Cancers
- ☐ Bladder
- ☐ Bones and joints
- ☐ Brain and other nervous system
- ☐ Breast
- ☐ Cervix uteri
- ☐ Colon
- ☐ Connective tissue
- ☐ Corpus uteri and uterus NOS
- ☐ Endocrine glands, other
- ☐ Esophagus
- ☐ Eye
- ☐ Hodgkin's disease
- ☐ Kidney, renal pelvis, and ureter
- ☐ Larynx
- ☐ Leukemia

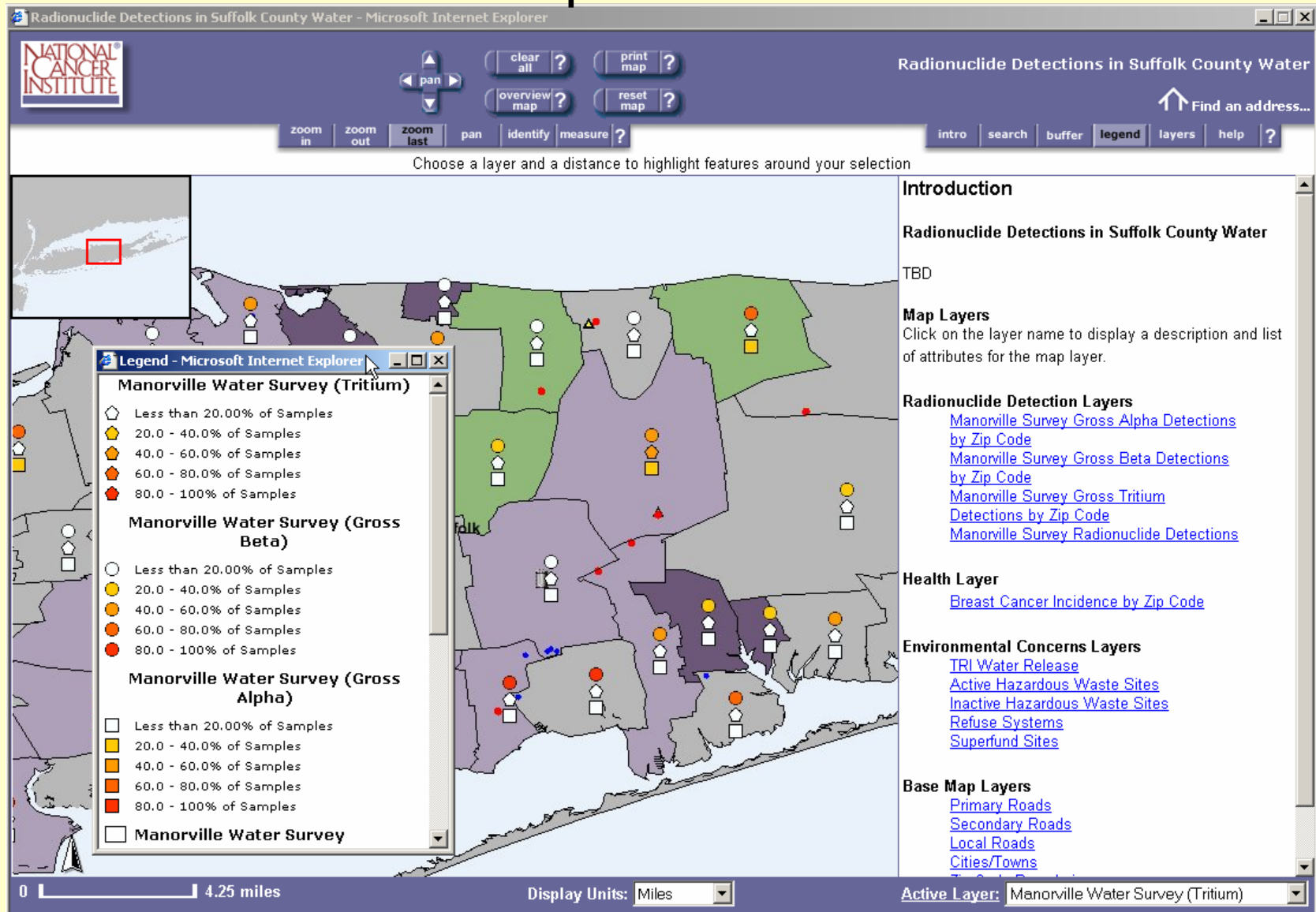
Print Presentation Author: James Cucinelli Title: Slide 3.73 MB

My Computer

My Computer

My Computer Presentation1 GIS-SEER PI ... L:\DCCPS\SR... LIGIS2004.ppt

Long Island Breast Cancer Study Project GIS: A more complex web-based tool




Web-based Communication of Cancer Statistics: State Cancer Profiles Web Site

- Goal: provide a system to characterize the cancer burden in a standardized manner to:
 - Motivate action
 - Integrate surveillance into cancer control planning
 - Characterize areas & demographic groups
 - Expose health disparities
- Target audiences:
 - Health planners
 - Policy makers
 - Cancer information providers

Extensive usability testing

- Tested at several professional meetings that members of target audience attended as well as in NCI Usability Lab
- Focus groups + hands-on testing conducted by a specialist in usability tests of web pages
- Tested on and/or approved by federal, state and local health department staff; cancer control professionals; policy makers
- Many iterations of prototypes
- Released to state health departments a week early so that they could verify their own data before general release


URL: statecancerprofiles.cancer.gov



State Cancer Profiles

Dynamic views of cancer statistics for prioritizing cancer control efforts in the nation, states, and counties

[Help us improve! Contact us with feedback.](#)




Profiles Home

Quick Profiles

Area

Cancer

Comparison Tables



[Rate/Trend Comparisons](#)


set higher priority for cancer control when rates are high or rising
[learn more...](#)

- by [State/County](#) prioritize cancer sites
- by [Cancer](#) prioritize states or counties in a state



[Death Rates](#)


for states or for counties in a state
[learn more...](#)



[Incidence Rates](#)


for states with high quality cancer registries
[learn more...](#)

Interactive Graphs and Maps




[5-Year Rate Changes](#)

in cancer mortality or incidence for all major cancer sites by user selectable criteria
[learn more...](#)




[Historical Trends](#)

compare trends in cancer mortality and incidence by user selectable criteria
[learn more...](#)



[Latest Rates, Percents, and Counts](#)

explore relationships across geography of mortality, incidence, demographics, or risk factors
[learn more...](#)



[Interactive Maps](#)


for states or for counties in a state
[learn more...](#)

Support Data




[Screening and Risk Factors](#)

prevalence percents by state from behavioral surveys
[learn more...](#)




[Peer Counties](#)

identify counties that are comparable based on a user specified criteria
[learn more...](#)



[Age Distribution](#)

male and female population sizes by age groups by user selectable criteria
[learn more...](#)

[Cancer Control PLANET Home](#)

New Releases

[2002 & 2003 BRFSS Survey Data](#)

[2001 USCS Incidence Data](#)

2002 SEER Incidence Data (also released in the [Cancer Statistics Review](#))

[2002 Mortality Data](#)

[Release Schedule](#)

Help & About

[About this Site](#)

[Quick Reference Guides](#)

[Tutorials](#)

[Interpret Rankings](#)

[Data Use Restrictions](#)

[Low Vision/Accessibility](#)

Note: This Web site is best viewed in [Internet Explorer](#) (version 5.0 or higher) or [Netscape](#) (version 7.0 or higher) at a [screen resolution](#) of 1024 by 768 or more.

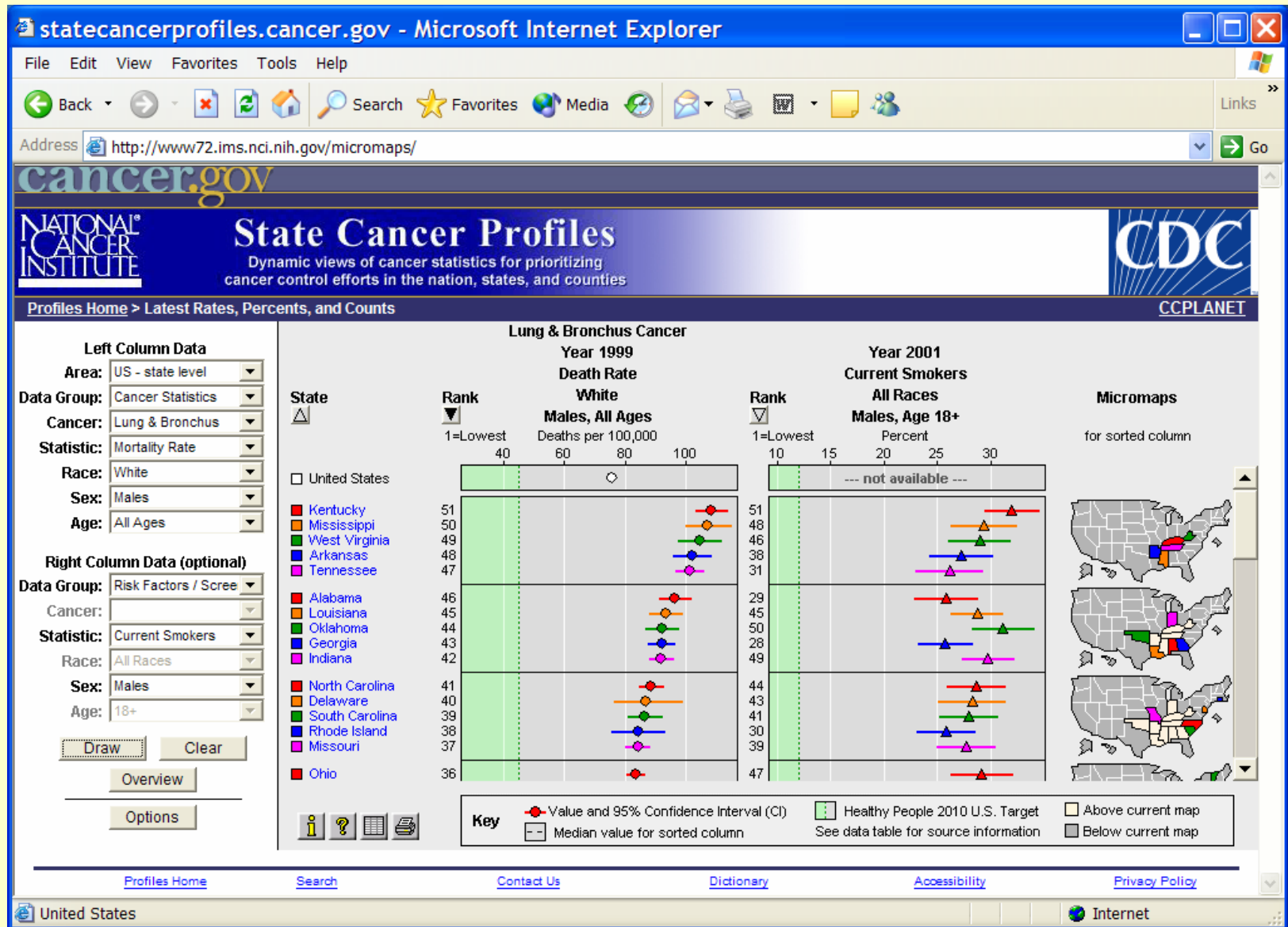
Links

[State Registry Contacts](#)

[US Cancer Statistics: 2001 Incidence](#)

[Resources for Cancer Control: Cancercontrolplanet.cancer.gov](#)

Includes linked micromap plots...



New interactive map feature

Area: [? About this Map](#)
Cancer: [Quick Reference Guide](#)
Race: [Tutorial](#)
Sex:
Age:
Year(s):

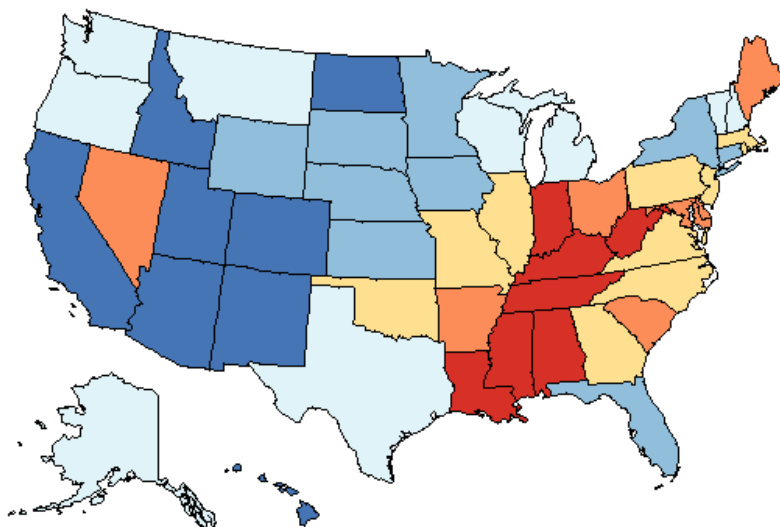
Map Options

Interval Type: [? Interval Type](#)
Number of Intervals:
Color Scheme: [Color Scheme](#)

[Data Use Restrictions](#)

Age-Adjusted Death Rates for United States, 1998 - 2002

All Cancer Sites
All Races, Both Sexes, All Ages



**Age-Adjusted
Annual Death Rate
(Deaths per 100,000)**
[Quantile Interval](#)

■ 211.8 to 238.7
■ 207.2 to 211.7
■ 202.5 to 207.1
■ 190.8 to 202.4
■ 183.3 to 190.7
■ 150.6 to 183.2

**United States
Rate (95% C.I.)**
197.8 (197.6 - 198.1)

**Healthy People 2010
Goal 03-01**
159.9

[Save Map Image](#)

[Data Table](#)

[Export Data](#)

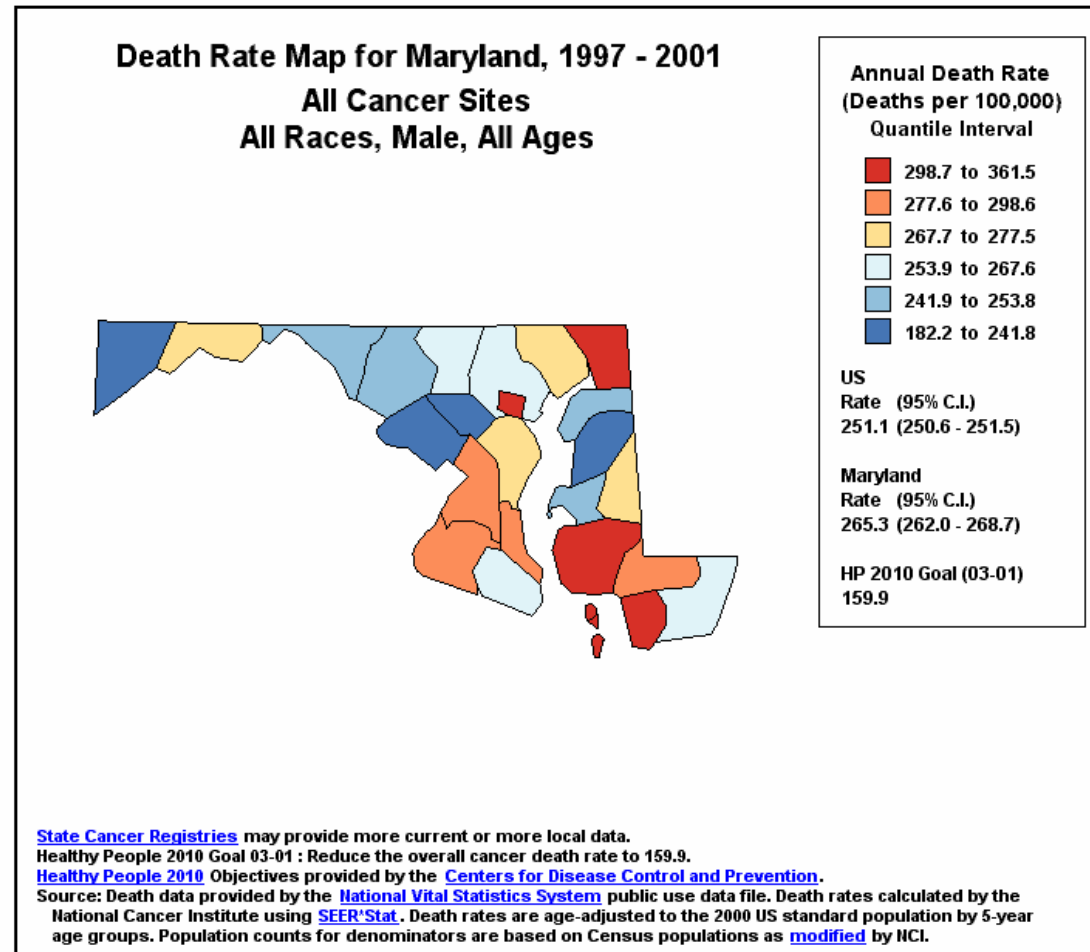
[Interpret](#)

[Printable View](#)

Action Notes

- Rollover a state with your mouse to see the rate (and 95% C.I.)
- Click on a state to show the counties of that state
- Scroll to the top of the web page to change the parameters of the map

Basic mapping functions for states or counties within state



Data Table

CSV Export Data

Interpret

Printable View

Zoom To

Maryland

Zoom

Zoom from Center

Zoom In

Zoom Out

Reset View

Pan Control

North

East

South

West

All Cancer Sites All Races, Male, All Ages				
County	Rate 95% Confidence Interval	Count	Group Range	Map Color
Maryland	265.3 (262.0 - 268.7)	26,108	N/A	N/A
United States	251.1 (250.6 - 251.5)	1,422,173	N/A	N/A
Baltimore City	361.5 (351.0 - 372.2)	4,660	298.7 - 361.5	
Dorchester	331.6 (293.3 - 374.5)	279	298.7 - 361.5	
Somerset	330.4 (283.2 - 384.2)	184	298.7 - 361.5	
Cecil	322.0 (291.6 - 355.3)	478	298.7 - 361.5	
Calvert	298.6 (266.0 - 335.0)	356	277.6 - 298.6	
Charles	295.5 (267.5 - 326.4)	507	277.6 - 298.6	
Wicomico	283.2 (257.8 - 311.0)	484	277.6 - 298.6	
Prince Georges	283.1 (272.2 - 294.5)	3,107	277.6 - 298.6	
Caroline	277.5 (238.5 - 321.8)	187	267.7 - 277.5	
Allegany	272.2 (249.4 - 296.8)	542	267.7 - 277.5	
Anne Arundel	272.1 (260.2 - 284.6)	2,298	267.7 - 277.5	
Harford	269.3 (251.2 - 288.7)	980	267.7 - 277.5	
Carroll	267.6 (247.6 - 289.0)	718	253.9 - 267.6	
Baltimore	263.7 (255.9 - 271.7)	4,497	253.9 - 267.6	
Worcester	259.0 (232.3 - 288.6)	381	253.9 - 267.6	
St. Marys	256.7 (230.5 - 285.6)	381	253.9 - 267.6	
Frederick	253.8 (236.0 - 272.9)	828	241.9 - 253.8	
Kent	253.1 (213.9 - 299.2)	150	241.9 - 253.8	
Washington	252.4 (234.2 - 271.8)	741	241.9 - 253.8	
Talbot	249.8 (220.4 - 283.1)	269	241.9 - 253.8	
Queen Annes	241.8 (210.1 - 277.8)	225	182.2 - 241.8	

Done

return to top

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Done

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F:\CI

Where is there a problem?

Color & position classify rates & trends

Death Rate/Trend Comparison by Cancer, death years through 2001					
US States versus US					
Lung & Bronchus					
All Races, Both Sexes					
		Above US Rate	Similar to US Rate	Below US Rate	
Rising Trend	Priority 1: rising ↑ and above ↑	Mississippi	Priority 2: rising ↑ and similar =	Priority 3: rising ↑ and below ↓ [none]	
	Priority 4: stable → and above ↑	Indiana Kentucky Oklahoma Tennessee West Virginia	Priority 6: stable → and similar =	Priority 7: stable → and below ↓ Idaho Utah	
Stable Trend	Priority 5: falling ↓ and above ↑	Arkansas Delaware Louisiana Nevada	Priority 8: falling ↓ and similar =	Priority 9: falling ↓ and below ↓ Arizona Colorado Hawaii New Mexico	
	Priority 10: falling ↓ and similar =	Alabama California Connecticut Florida Georgia Illinois Maine Maryland Massachusetts Michigan Minnesota Mississippi Missouri Nebraska New Hampshire New Jersey New York North Carolina North Dakota Pennsylvania Rhode Island South Carolina South Dakota Tennessee Texas Virginia Washington West Virginia Wisconsin Wyoming			
Falling Trend	Priority 11: rising ↑ and below ↓	Alabama California Connecticut Florida Georgia Illinois Maine Maryland Massachusetts Michigan Minnesota Mississippi Missouri Nebraska New Hampshire New Jersey New York North Carolina North Dakota Pennsylvania Rhode Island South Carolina South Dakota Tennessee Texas Virginia Washington West Virginia Wisconsin Wyoming	Priority 12: rising ↑ and similar =	Priority 13: rising ↑ and below ↓ Alabama California Connecticut Florida Georgia Illinois Maine Maryland Massachusetts Michigan Minnesota Mississippi Missouri Nebraska New Hampshire New Jersey New York North Carolina North Dakota Pennsylvania Rhode Island South Carolina South Dakota Tennessee Texas Virginia Washington West Virginia Wisconsin Wyoming	
	Priority 14: stable → and above ↑	Alabama California Connecticut Florida Georgia Illinois Maine Maryland Massachusetts Michigan Minnesota Mississippi Missouri Nebraska New Hampshire New Jersey New York North Carolina North Dakota Pennsylvania Rhode Island South Carolina South Dakota Tennessee Texas Virginia Washington West Virginia Wisconsin Wyoming	Priority 15: stable → and similar =	Priority 16: stable → and below ↓ Alabama California Connecticut Florida Georgia Illinois Maine Maryland Massachusetts Michigan Minnesota Mississippi Missouri Nebraska New Hampshire New Jersey New York North Carolina North Dakota Pennsylvania Rhode Island South Carolina South Dakota Tennessee Texas Virginia Washington West Virginia Wisconsin Wyoming	

Experimental Rate/Trend Table with Maps

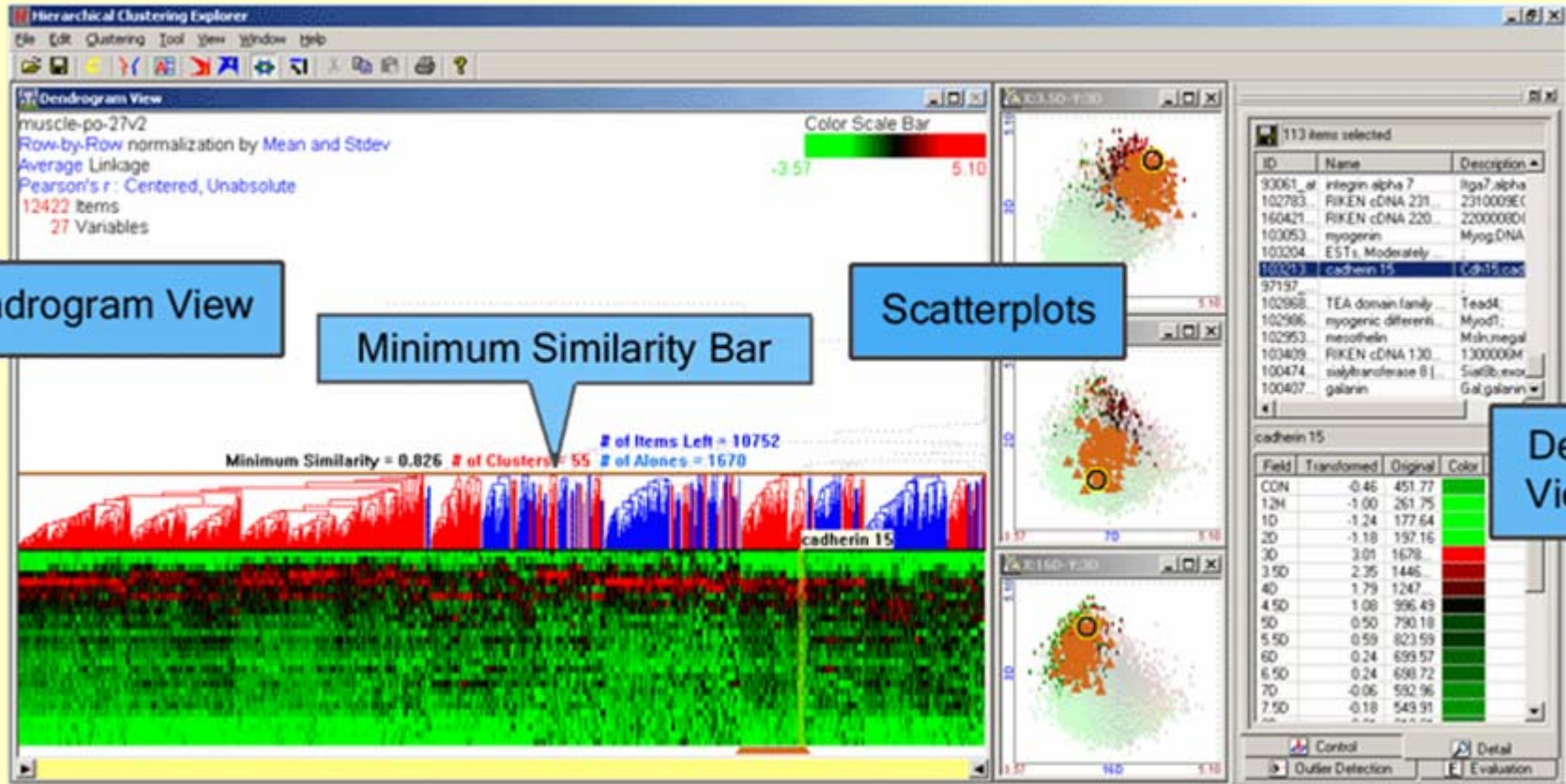
	Above US Rate	Similar to US Rate	Below US Rate
Rising Trend	Priority 1: rising ↑ and above ↑  Mississippi	Priority 2: rising ↑ and similar =  Montana Vermont Wyoming	Priority 3: rising ↑ and below ↓  [none]
Stable Trend	Priority 4: stable → and above ↑  Indiana Kentucky Oklahoma Tennessee West Virginia	Priority 6: stable → and similar =  Alabama Iowa Kansas Minnesota Missouri Nebraska North Carolina North Dakota South Carolina South Dakota Wisconsin	Priority 7: stable → and below ↓  Idaho Utah
Falling Trend	Priority 5: falling ↓ and above ↑  Arkansas Delaware	Priority 8: falling ↓ and similar =  Alaska California	Priority 9: falling ↓ and below ↓  Arizona Colorado

Cf. Conditioned
Choropleth
Maps: Carr,
Wallin, & Carr,
*Statistics in
Medicine*, 2000

Identification of Peer Counties in State Cancer Profiles system

- A common question: One county in my state has unusually high cancer rates compared to the rest of the state, but we know that county is different from the others, e.g., in terms of income, education, etc.
How do the rates in this county compare with others in the US with a similar sociodemographic profile?
- How to identify “peer counties” for this comparison?

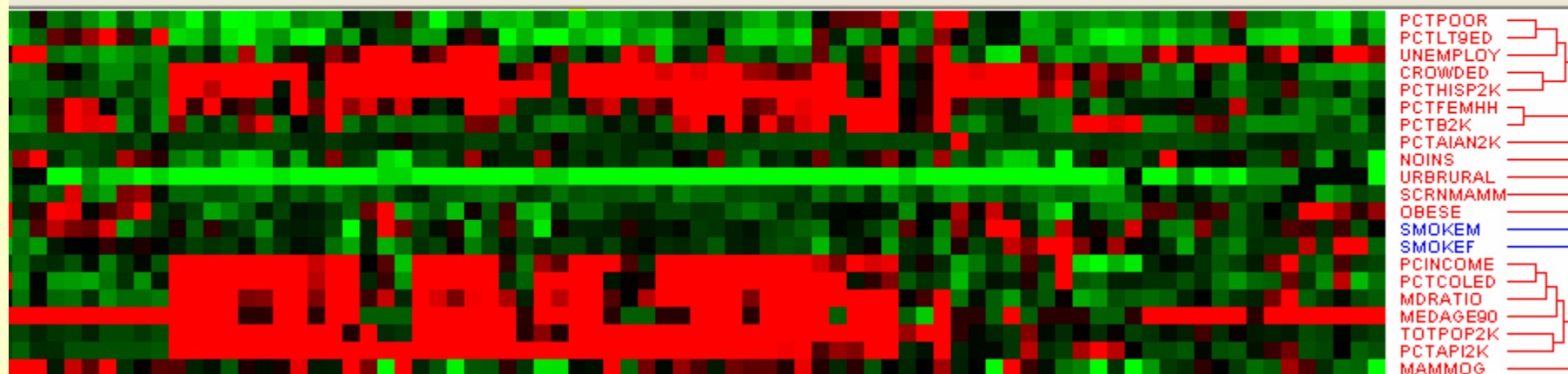
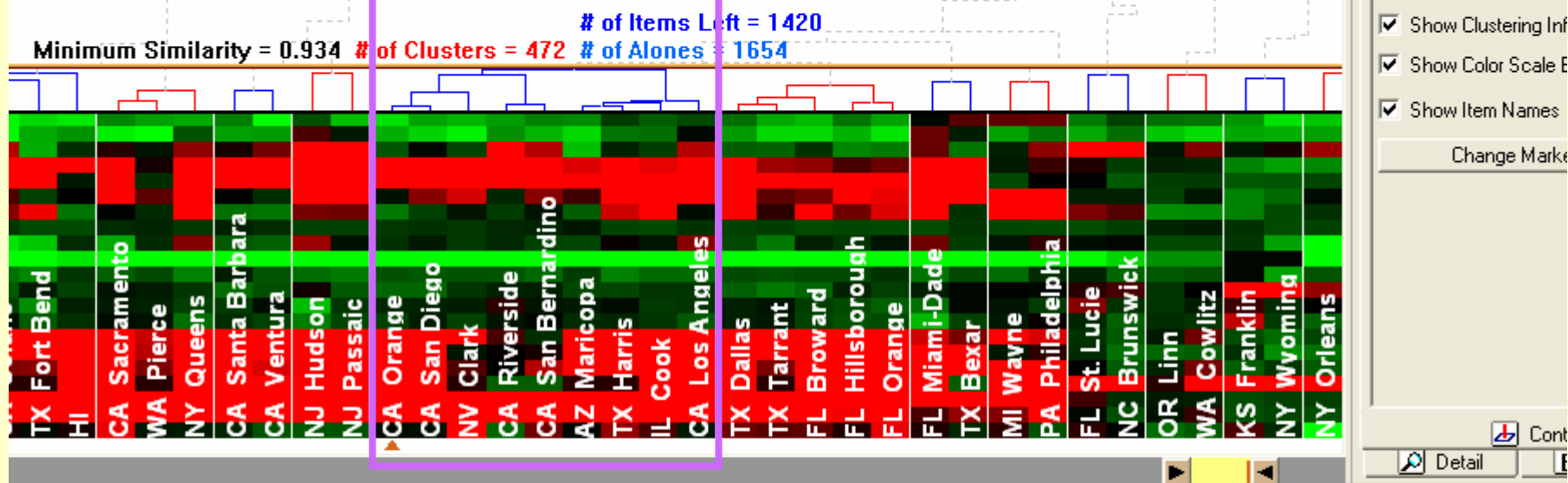
Hierarchical Clustering Explorer for Interactive Exploration of Multidimensional Data



Peers of Orange County, CA

Primary common factors:

- Crowding
- Urban/rural
- % Hispanic
- % Asian/Pacific



Collaborators

- **NCI was a partner in an NSF Digital Government Initiative grant to develop better visualization tools (web site: diggov.org)**

Dan Carr, George Mason University

Alan MacEachren, Penn State University

David Scott, Rice University

- **NCI geographic information systems grant & contracts to develop ESTAT**

Alan MacEachren, Penn State University

- **NCI sabbatical**

Dan Carr, George Mason University

- **Web sites for more info:**

- gis.cancer.gov (for a poster on NCI research in GIS)
- srab.cancer.gov (for headbang, SaTScan, etc)
- statecancerprofiles.cancer.gov

- **Email: PICKLEL@MAIL.NIH.GOV**