IHME

Communicating Results Visually:

Lessons from the Global Burden of Disease Study

Abraham D. Flaxman, 10/26/2016

UNIVERSITY of WASHINGTON

Institute for Health Metrics and Evaluation

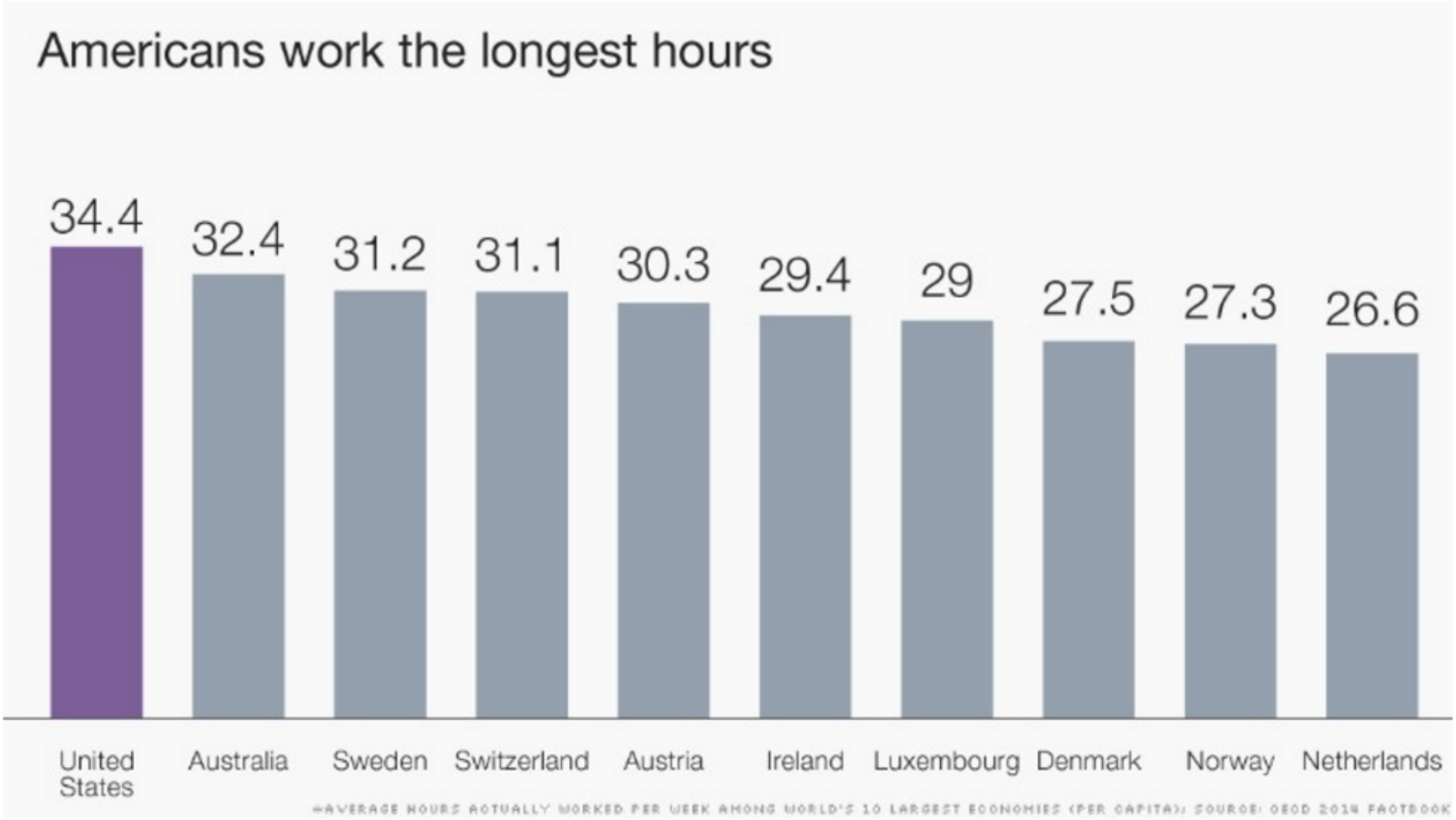
Who is busy?

Medical Specialty	Hours per Week
Ob/Gyn	54.0
Surgical Specialties	53.1
Medical Specialties	52.9
Internal Medicine	51.4
Family/GP	49.1
Psychiatry	45.4
Pediatrics	45.2

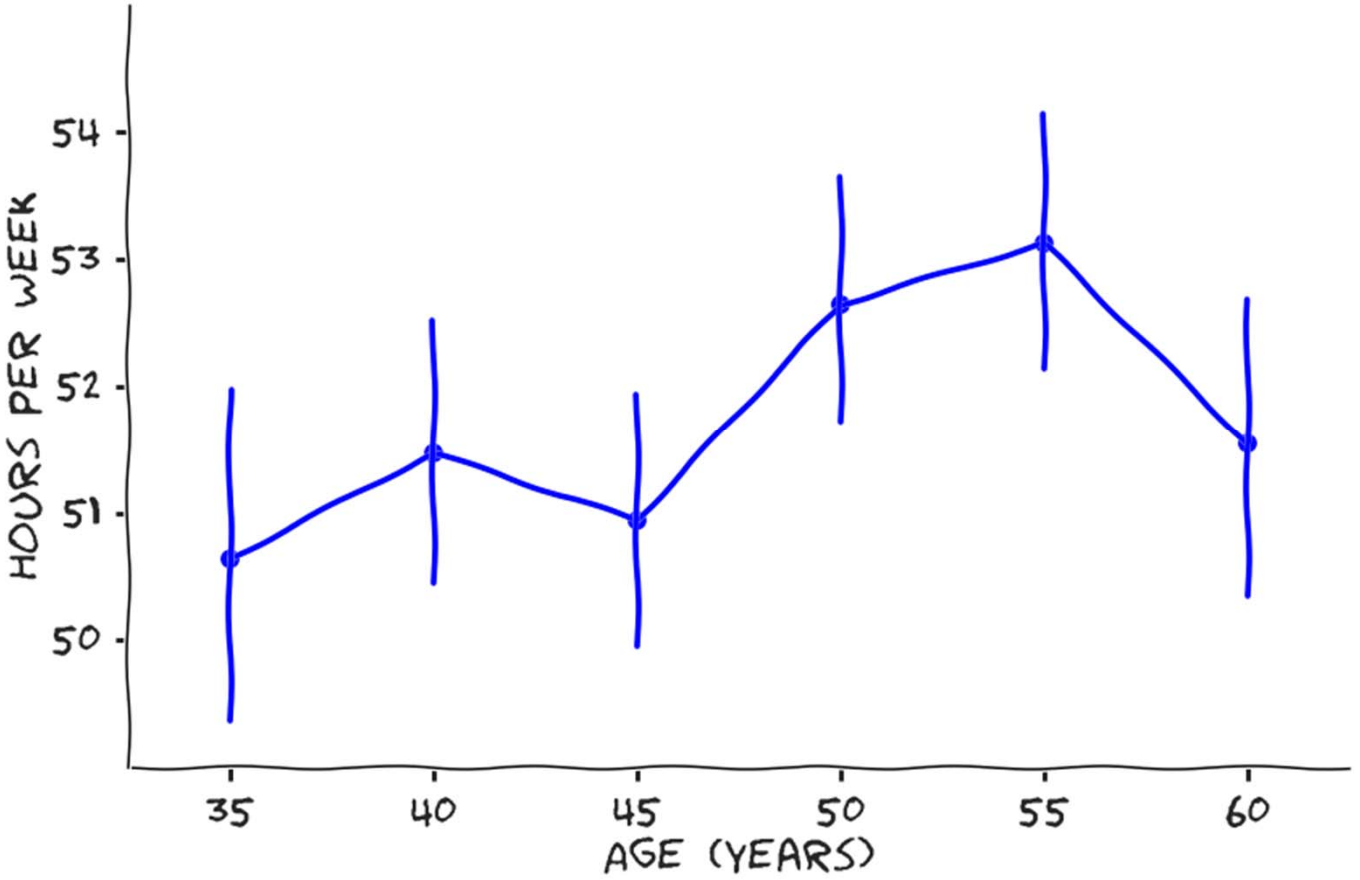
Source: HSC 2008 Health Tracking Physician Survey

CNN Money Business **Markets** Tech Personal Finance

CNNMoney gives you a little more context about the American worker.



Older members of your audience are busier



Source: HSC 2008 Health Tracking Physician Survey

Plan for this seminar:

- Common and novel displays from the Global Burden of Disease
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THE LANCET

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Global Burden of Disease

Home | 2013 | 2010

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Infographic

Interactive visualisations

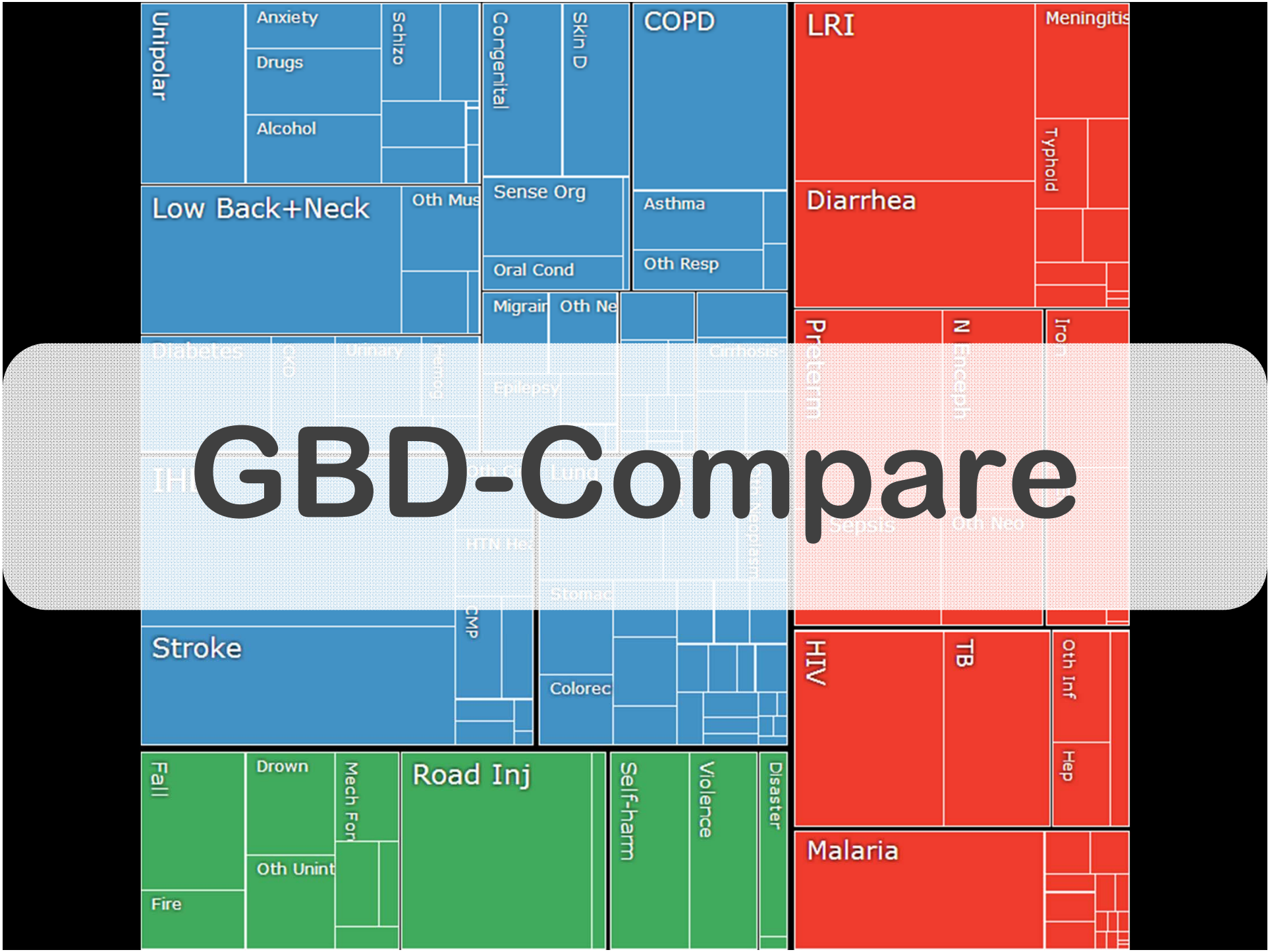
Executive Summary

The Global Burden of Disease Study (GBD) is the most comprehensive worldwide observational epidemiological study to date. It describes mortality and morbidity from major diseases, injuries and risk factors to health at global, national and regional levels. Examining trends from 1990 to the present and making comparisons across populations enables understanding of the changing health challenges facing people across the world in the 21st century.

Audio

1 2

Download


GBD-Compare
Unipolar
Anxiety
Drugs
Alcohol
Schizo
Congenital
Skin D
COPD
LRI
Meningitis
Typhoid
Diarrhea
Low Back+Neck
Oth Mus
Sense Org
Oral Cond
Asthma
Oth Resp
Migrain
Oth Ne
Diabetes
Urinary
Epilepsy
Cirrhosis
Lung
Sepsis
Oth Neo
HTN He
Stomac
Stroke
Colorec
HIV
TB
Oth Inf
Hep
Malaria
Fall
Fire
Drown
Oth Unint
Mech For
Road Inj
Self-harm
Violence
Disaster

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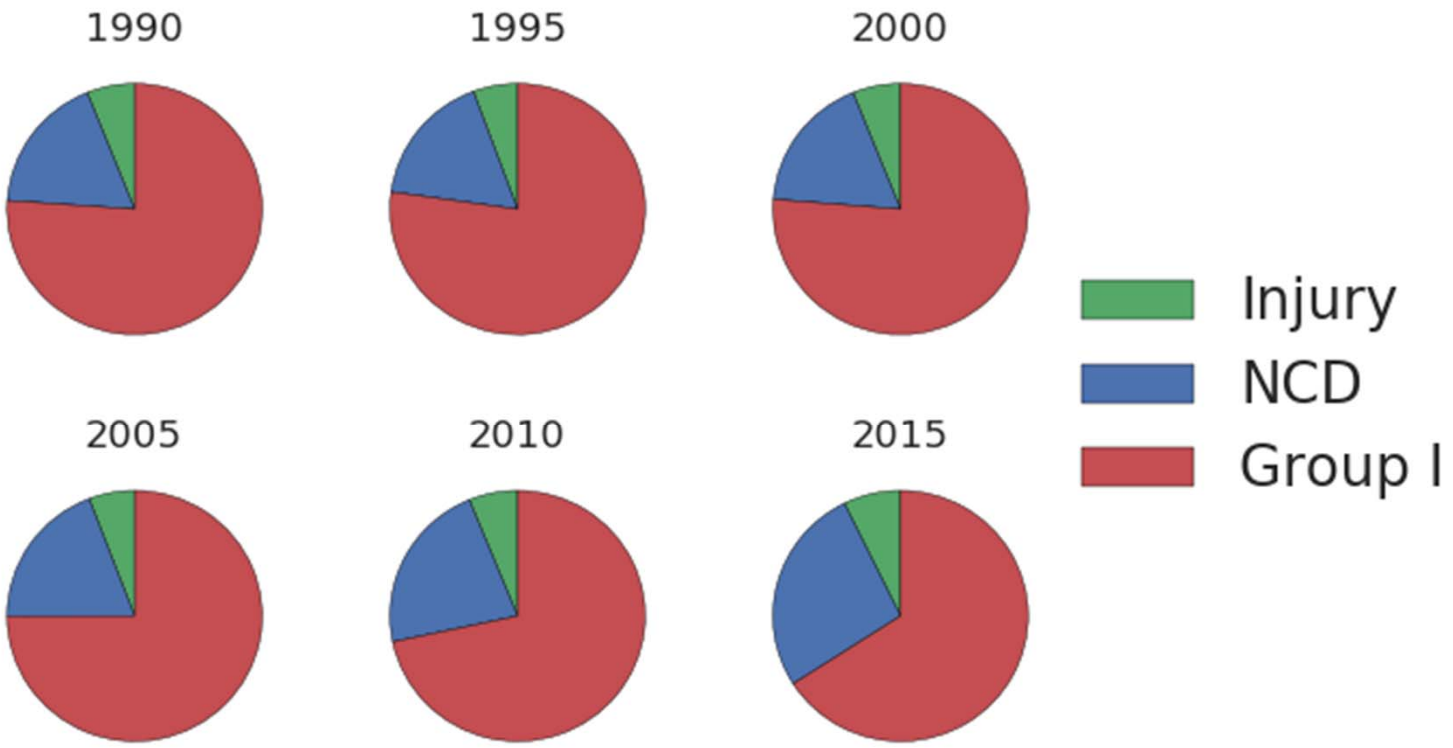
Anti-pattern I: TMI Table

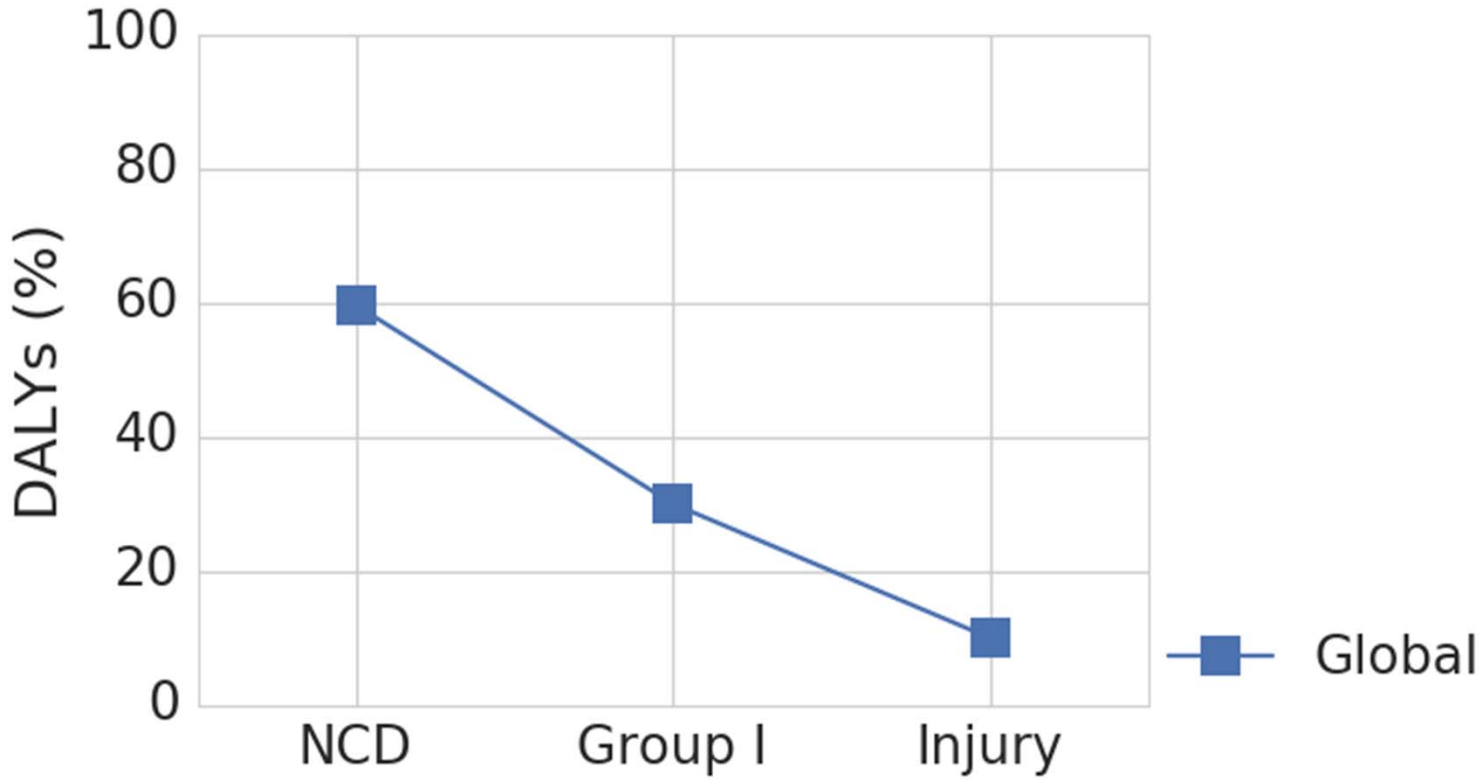
Year	Cause	China	DRC	Global	India	United States
1990	Group I	28.52	76.09	46.73	60.43	8.43
	Injury	14.59	6.07	10.63	8.59	11.85
	NCD	56.89	17.84	42.64	30.98	79.72
1995	Group I	21.36	77.20	43.41	55.93	8.89
	Injury	14.82	5.64	10.73	9.34	11.08
	NCD	63.83	17.16	45.86	34.72	80.03
2000	Group I	15.70	76.25	40.79	51.77	7.09
	Injury	13.85	6.08	10.50	9.53	10.61
	NCD	70.45	17.67	48.71	38.69	82.30
2005	Group I	11.25	74.96	37.94	48.34	6.68
	Injury	12.97	5.80	10.31	9.61	10.92
	NCD	75.78	19.24	51.75	42.05	82.40

Anti-pattern II: Bury the Lede

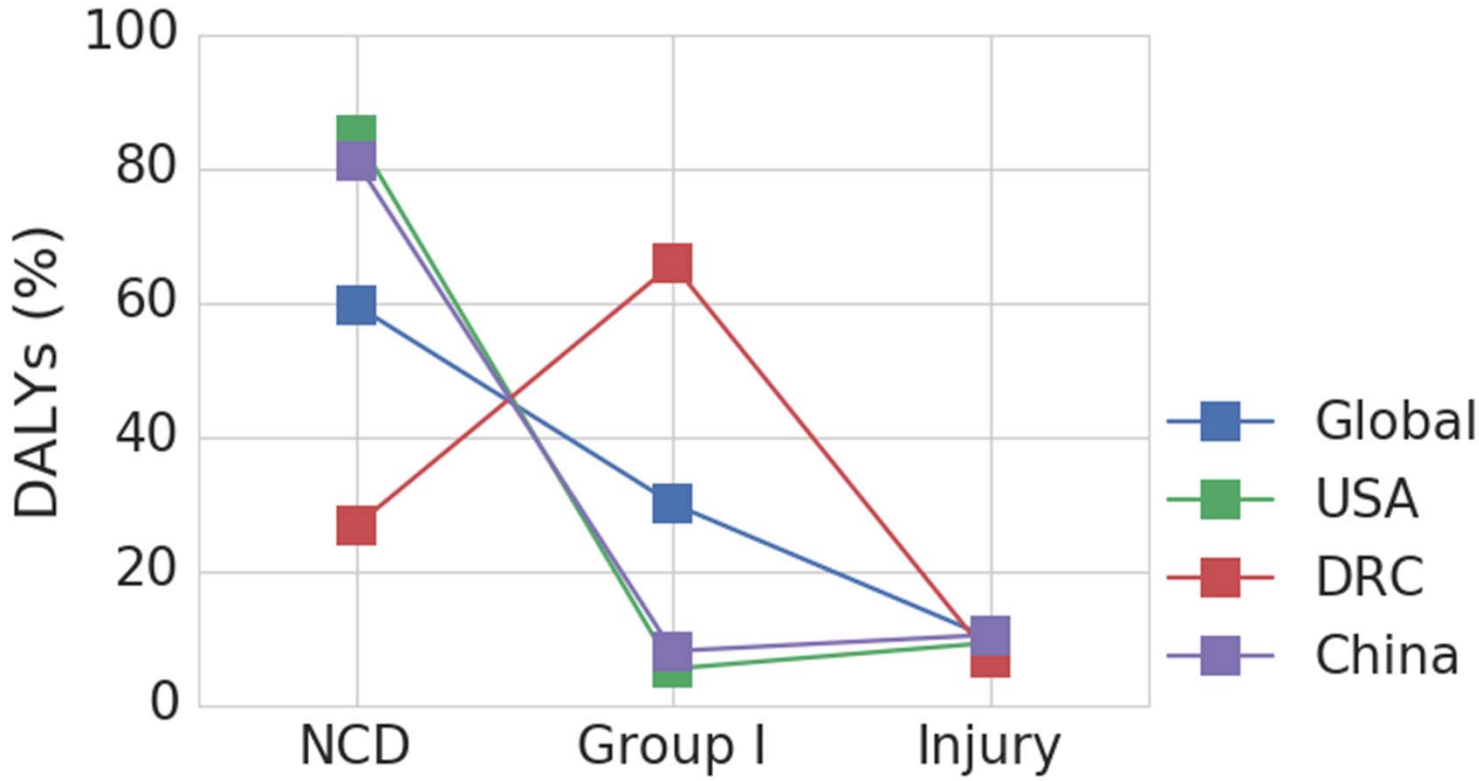
DALYs in Democratic Republic of Congo over time



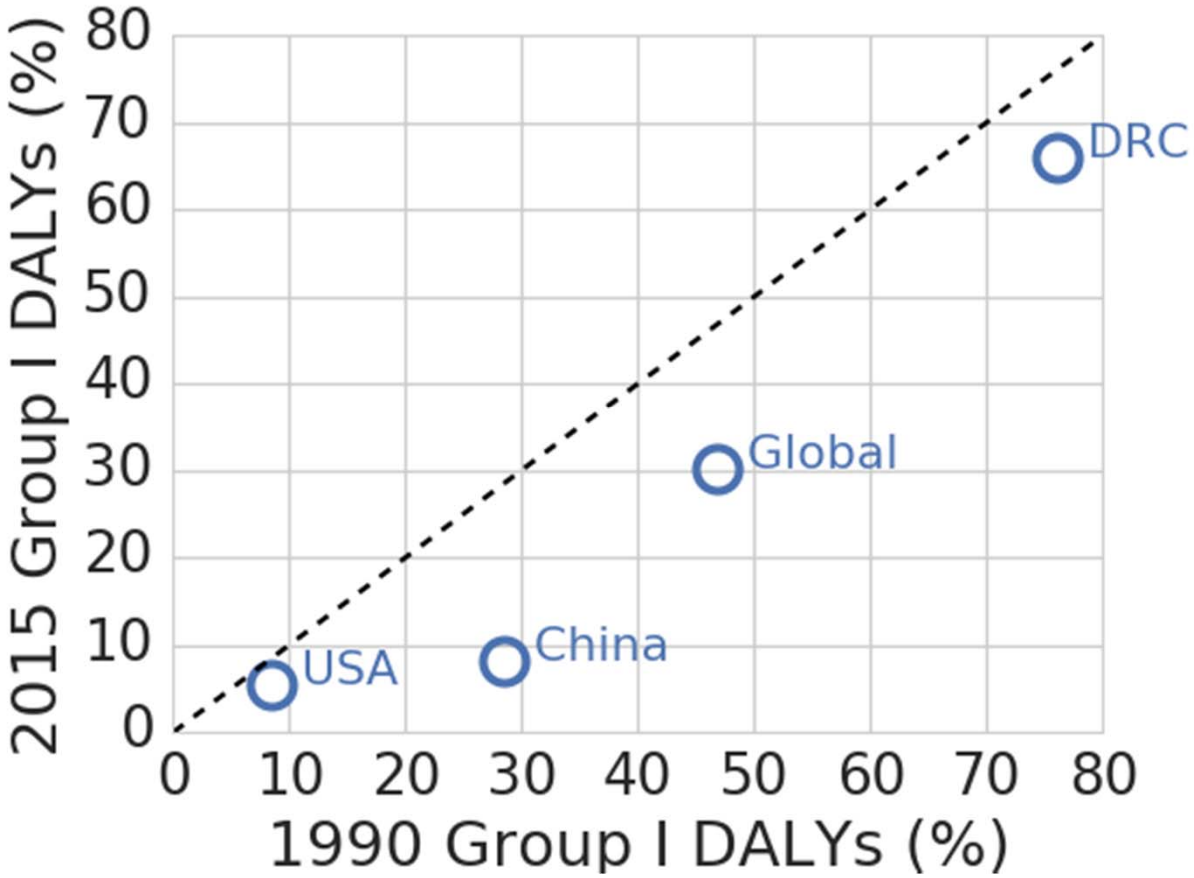
Anti-pattern III



(but this advice is complicated)



Anti-pattern IV



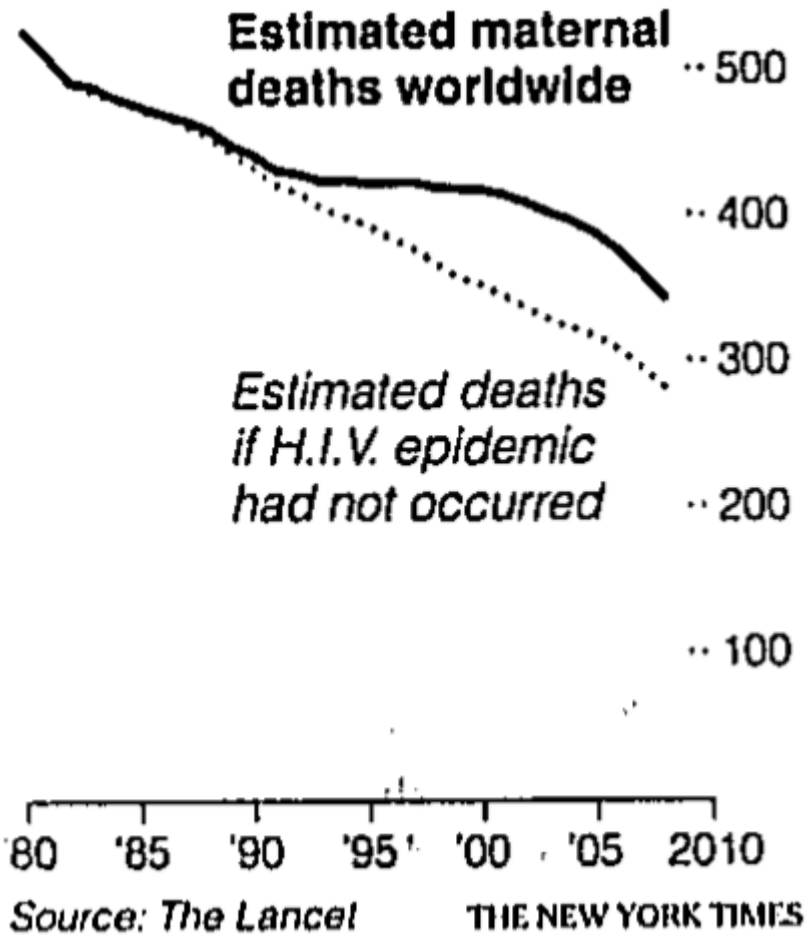
Success Stories

A Long-Term Trend

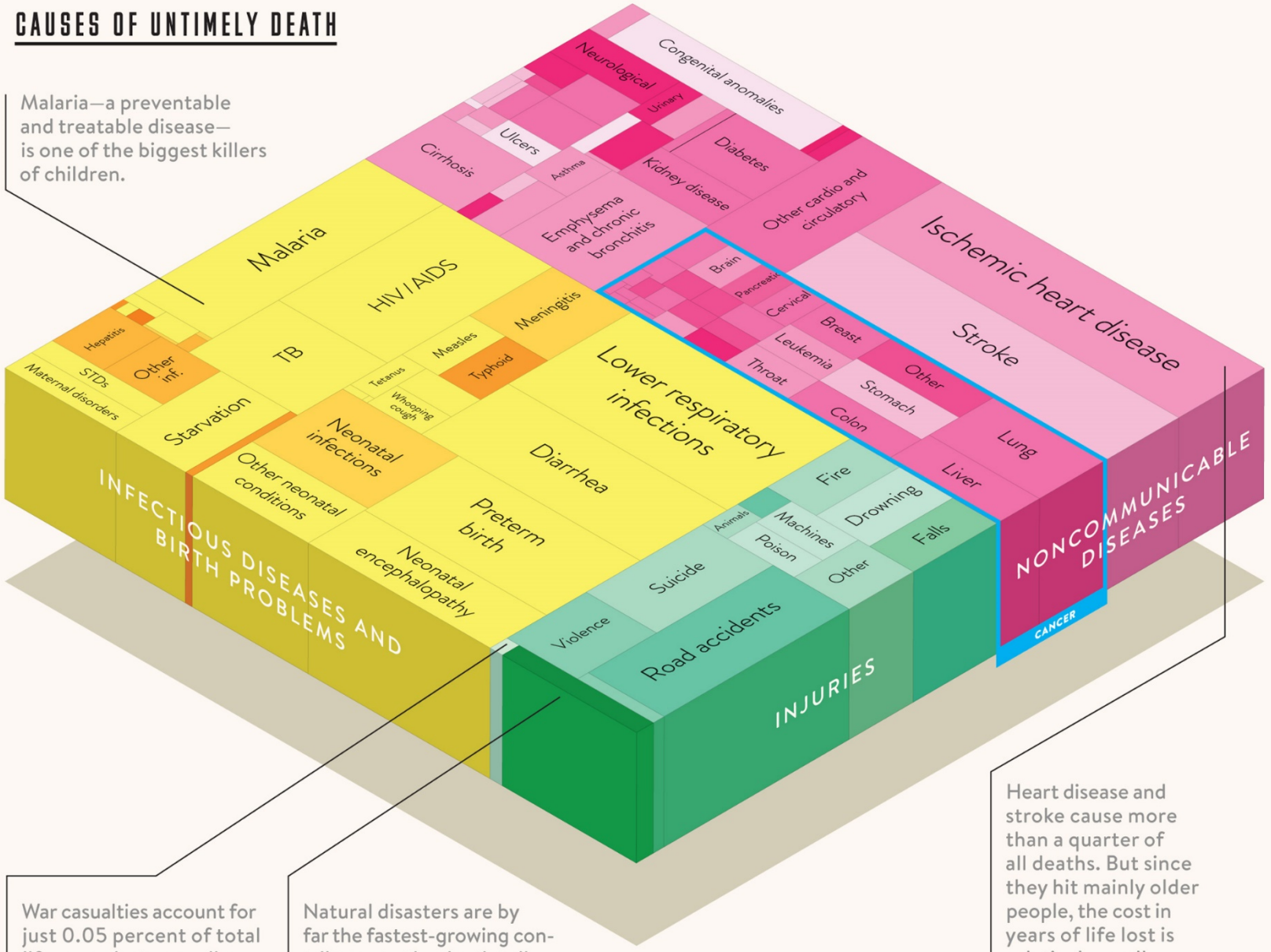
A broad survey of data from 181 countries has found that the number of women dying from childbirth or pregnancy worldwide has been declining steadily.

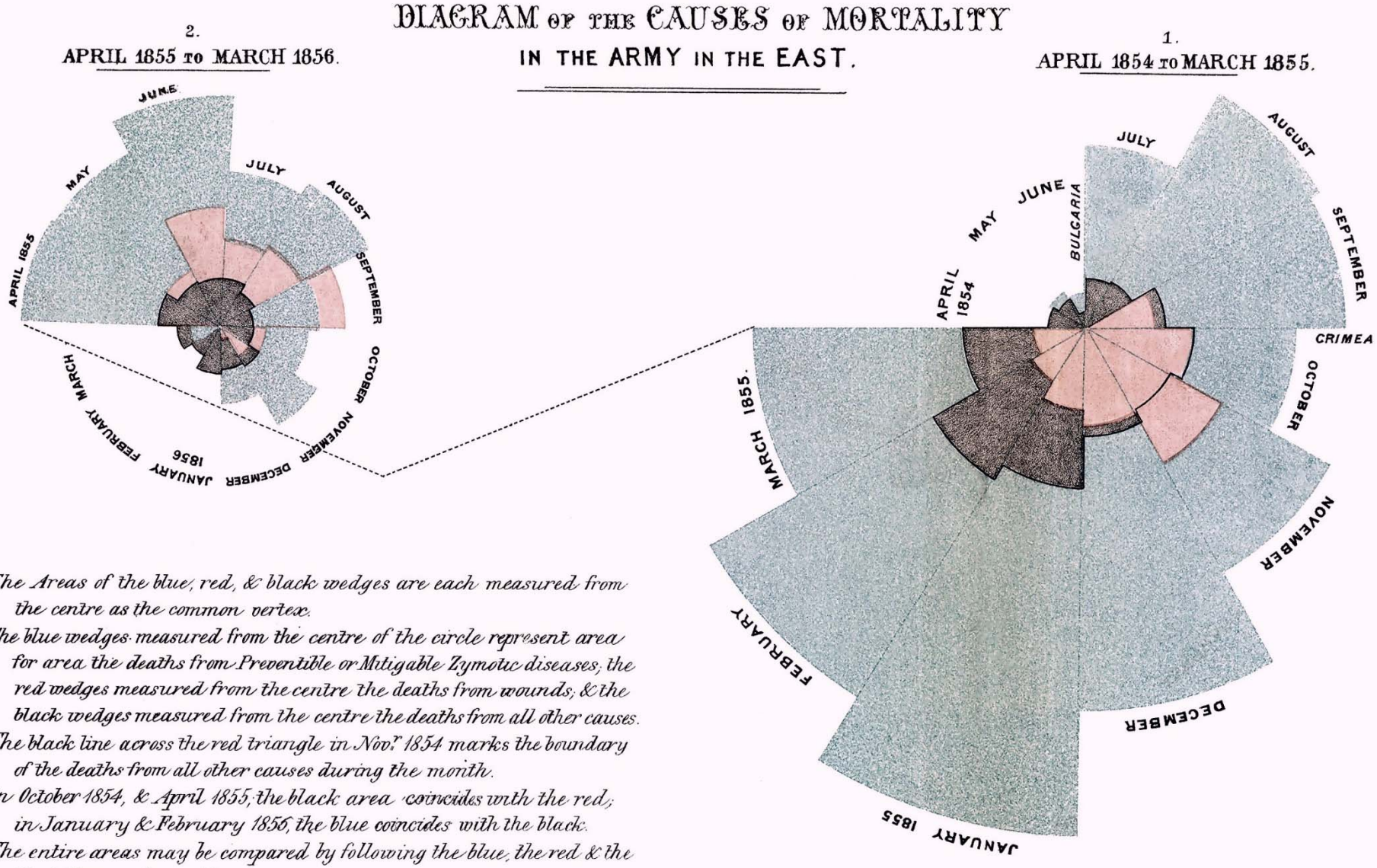
PROGRESS OVER DECADES

Pressure to Delay Report Cited — Countering Prevailing View



CAUSES OF UNTIMELY DEATH





The Areas of the blue, red, & black wedges are each measured from the centre as the common vertex.

The blue wedges measured from the centre of the circle represent area for area the deaths from Preventible or Mitigable Zymotic diseases; the red wedges measured from the centre the deaths from wounds; & the black wedges measured from the centre the deaths from all other causes.

The black line across the red triangle in Nov.r 1854 marks the boundary of the deaths from all other causes during the month.

In October 1854, & April 1855, the black area coincides with the red; in January & February 1856, the blue coincides with the black.

The entire areas may be compared by following the blue, the red & the black lines enclosing them.

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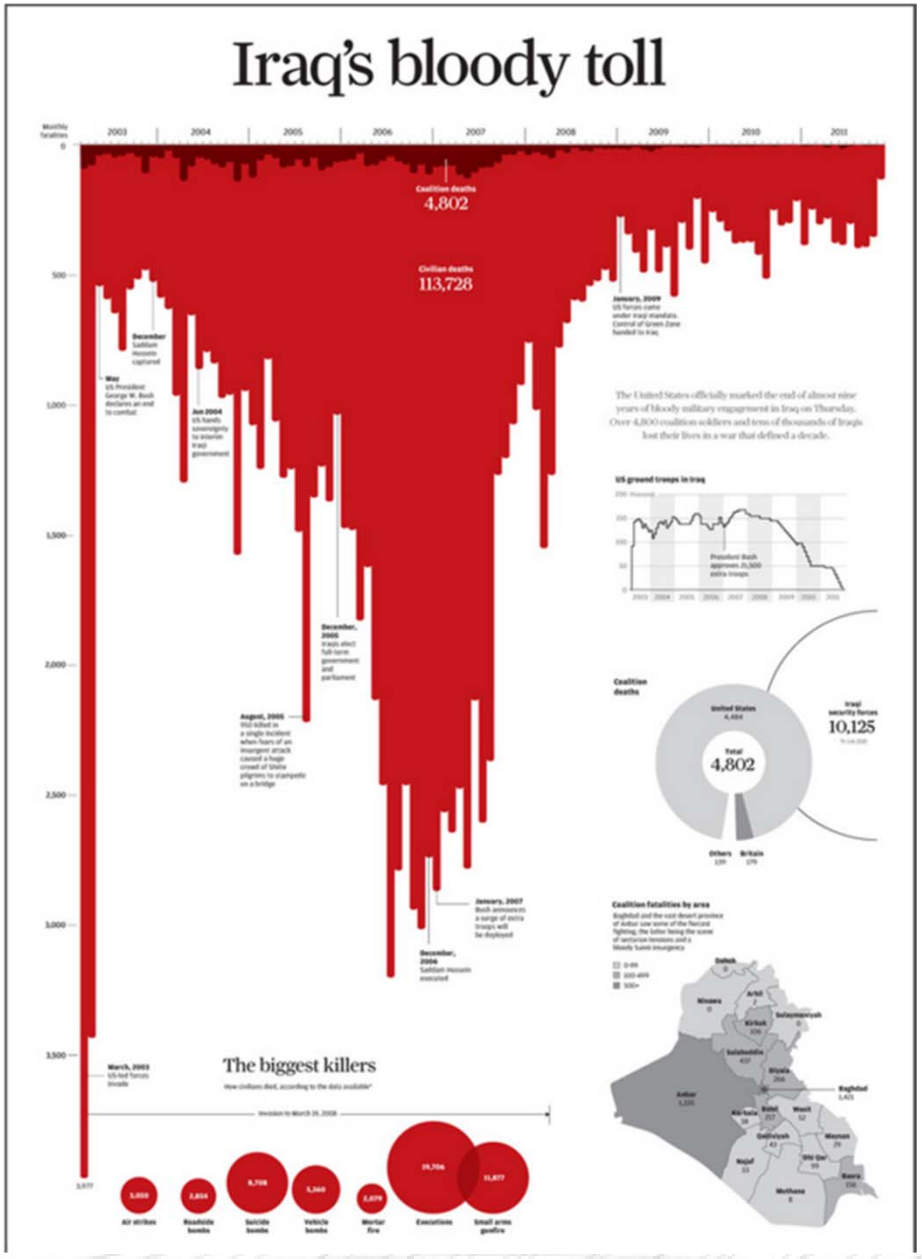
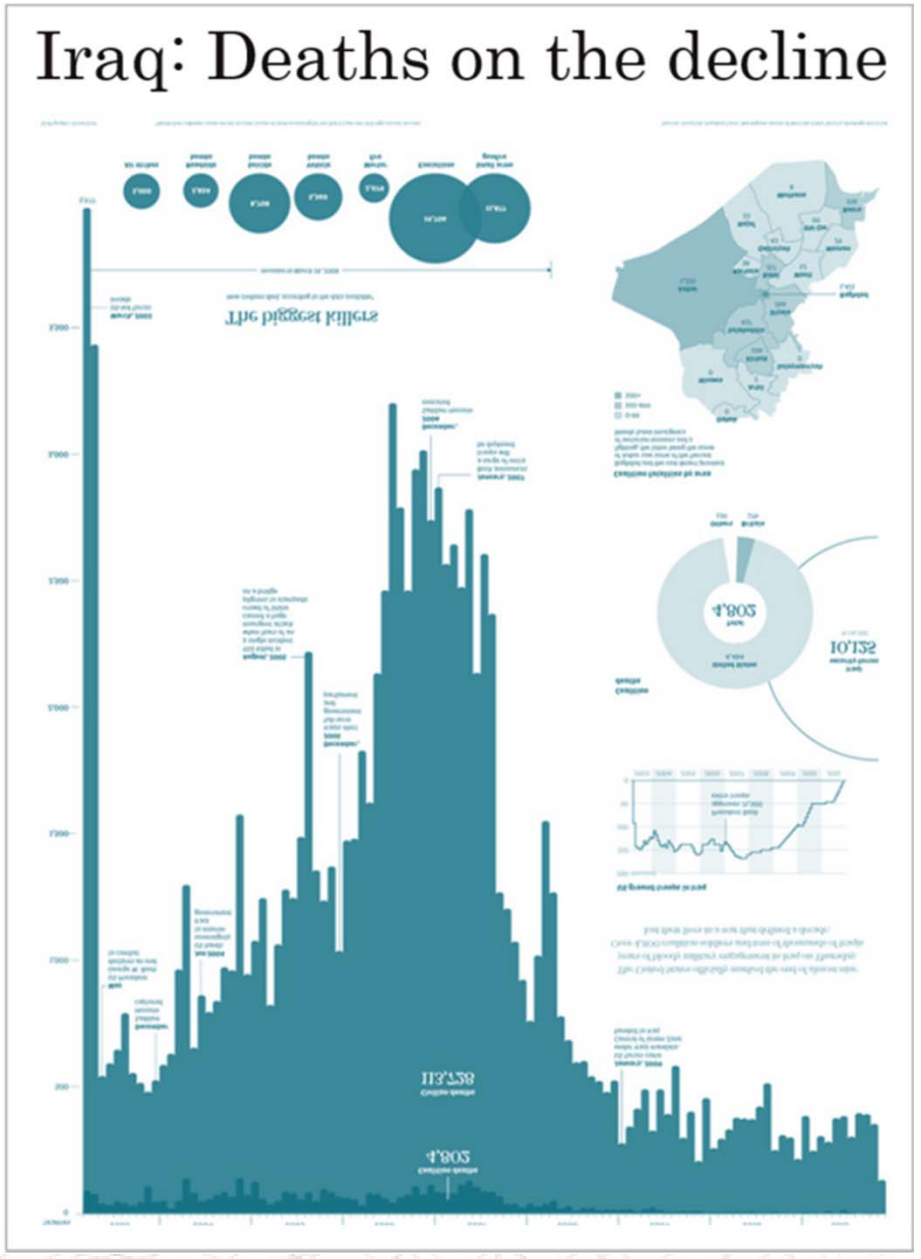
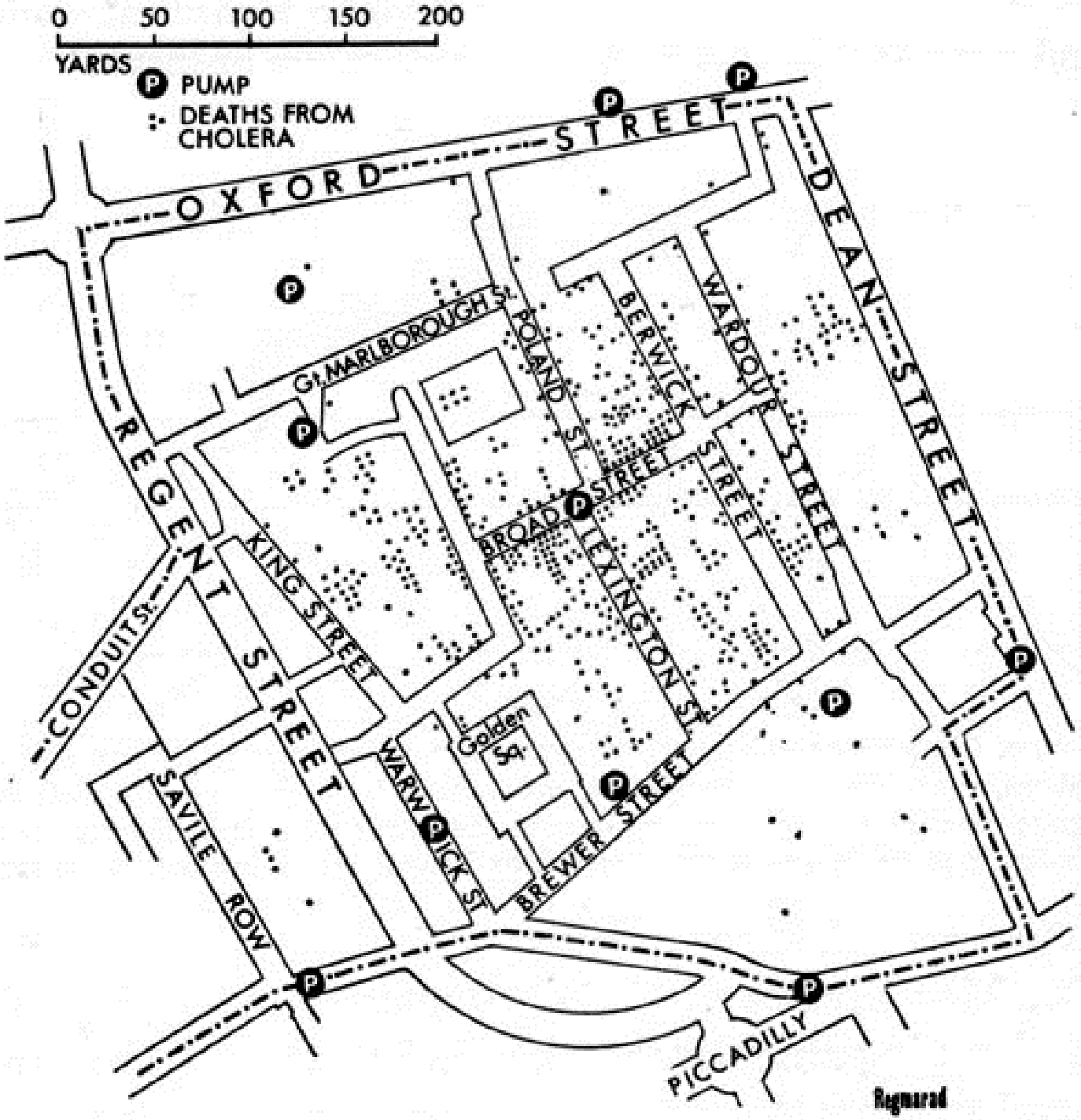
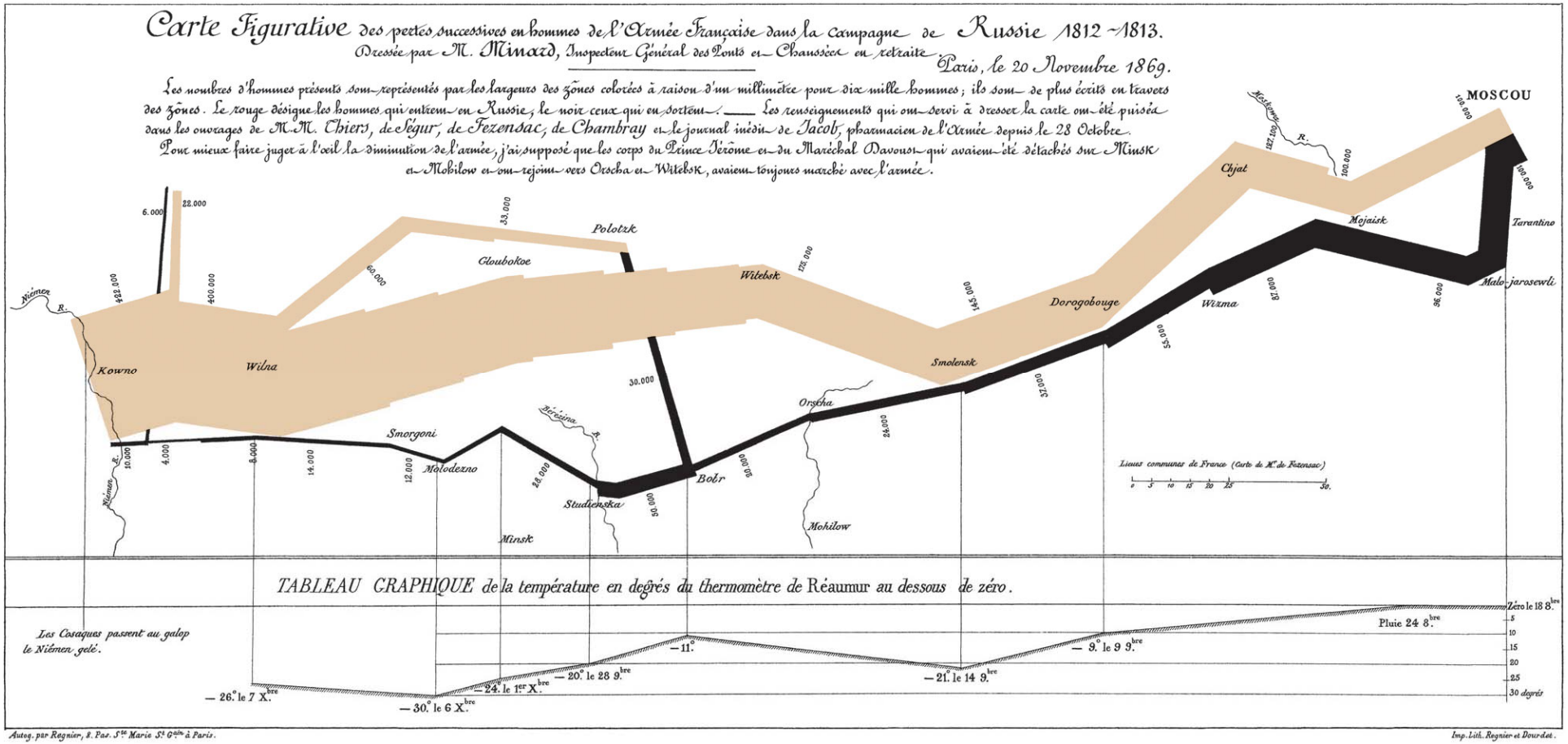
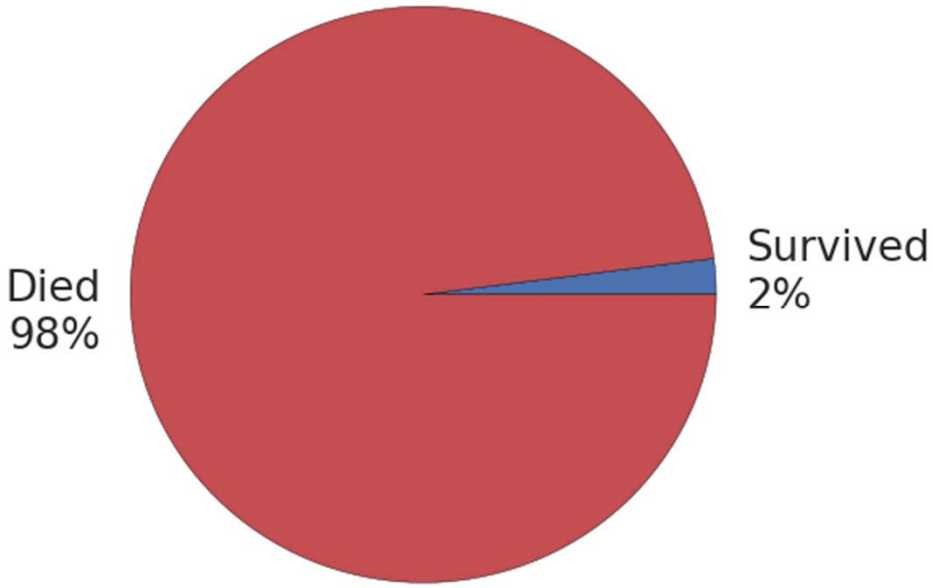

Iraq's bloody toll
2003
2004
2005
2006
2007
2008
2009
2010
2011
Coalition deaths
4,802
Civilian deaths
113,728
The United States officially marked the end of almost nine years of bloody military engagement in Iraq on Thursday. Over 4,800 coalition soldiers and tens of thousands of Iraqis lost their lives in a war that defined a decade.
US ground troops in Iraq
Coalition deaths
Total
4,802
United States
Others
Britain
Iraqi security forces
10,125
Coalition fatalities by area
The biggest killers
Air strikes
Roadside bombs
Suicide bombs
Vehicle bombs
Mortar fire
Executions
Small arms gunfire


Iraq: Deaths on the decline


0 50 100 150 200
YARDS
PUMP
DEATHS FROM CHOLERA
OXFORD STREET
DEAN STREET
G. MARLBOROUGH ST.
POLAND ST.
BERWICK STREET
WARDOUR STREET
REGENT STREET
CONDUIT ST.
KING STREET
BROAD STREET
LEXINGTON ST.
Golden Sq.
WARWICK ST.
BREWER STREET
SAVILE ROW
PICCADILLY
Reynard


Carte Figurative des pertes successives en hommes de l'Armée Française dans la campagne de Russie 1812-1813.
Dressée par M. Minard, Inspecteur Général des Ponts et Chaussées en retraite.
Paris, le 20 Novembre 1869.
Les nombres d'hommes présents sont représentés par les largeurs des zônes colorées à raison d'un millimètre pour dix mille hommes; ils sont de plus écrits en travers des zônes. Le rouge désigne les hommes qui entrent en Russie, le noir ceux qui en sortent. — Les renseignements qui ont servi à dresser la carte ont été puisés dans les ouvrages de M.M. Thiers, de Ségur, de Fezensac, de Chambray et le journal inédit de Jacob, pharmacien de l'Armée depuis le 28 Octobre.
Pour mieux faire juger à l'oeil la diminution de l'armée, j'ai supposé que les corps du Prince Jérôme et du Maréchal Davoust qui avaient été détachés sur Minsk et Mobilow et ont rejoint vers Orscha et Witebsk, avaient toujours marché avec l'armée.
Niémen R.
Kowno
Wilna
Smorgoni
Molodezno
Minsk
Studienska
Bobr
Berézina R.
Polotzk
Gloubokoe
Witebsk
Orscha
Mohilow
Smolensk
Dorogobouge
Chjat
Moskowa R.
Mojaisk
Wizma
Malo-jarosewli
Tarantino
MOSCOU
Lieues communes de France (Carte de M.r de Fezensac)
TABLEAU CRAPHIQUE de la température en degrés du thermomètre de Réaumur au dessous de zéro.
Les Cosaques passent au galop le Niémen gelé.
— 26.° le 7 X.bre
— 30.° le 6 X.bre
— 24. le 1.er X.bre
— 20.° le 28 9.bre
— 11.°
— 21. le 14 9.bre
— 9.° le 9 9.bre
Pluie 24 8.bre
Zéro le 18 8.bre
30 degrés
Autog. par Regnier, 8. Pas. Ste Marie St Gilles à Paris.
Imp. Lith. Regnier et Dourdet.

Summary of Napolean's Disastrous March



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Say it with Charts – The Executive's Guide to Visual Communication

- Gene Zelazny, *Say it with Charts* – there are 5 types of charts
- Can you think of all 5? Can you think of some more? There are more.
- I'll give you two minutes… go!

Zelazny's Approach

Comparison of:

1. Components (% of total)
2. Items (Ranking)
3. Time series (Changes)
4. Distribution
5. Correlation (Relationships)

Chart form:

1. Pie
2. Bar
3. Horizontal Bar
4. Line
5. Scatter

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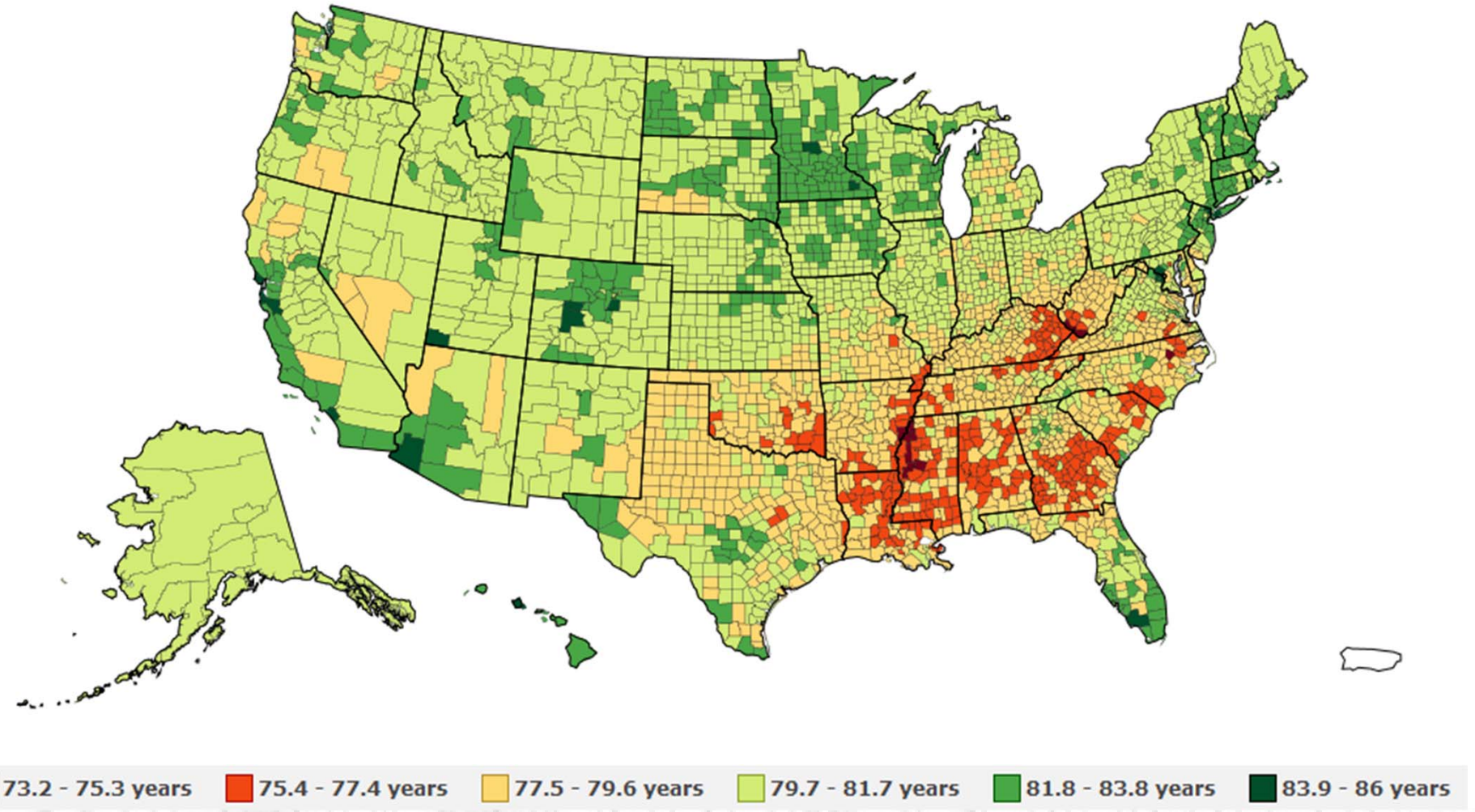
5. Scatter

Missing: thematic maps



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MIT Technology Review

Menu

Computing

The First Visual Search Engine for Scientific Diagrams

A machine-vision algorithm has learned to analyze and categorize scientific figures.

by Emerging Technology from the arXiv May 27, 2016

In 1973, the statistician Francis Anscombe devised a fascinating demonstration showing why data should always be plotted before it is analyzed. The demonstration consisted of four data sets that had almost identical statistical properties. By this measure they are essentially the same.

VizioMetrics

viziometrics.org/?keywords=population%20health&art_view

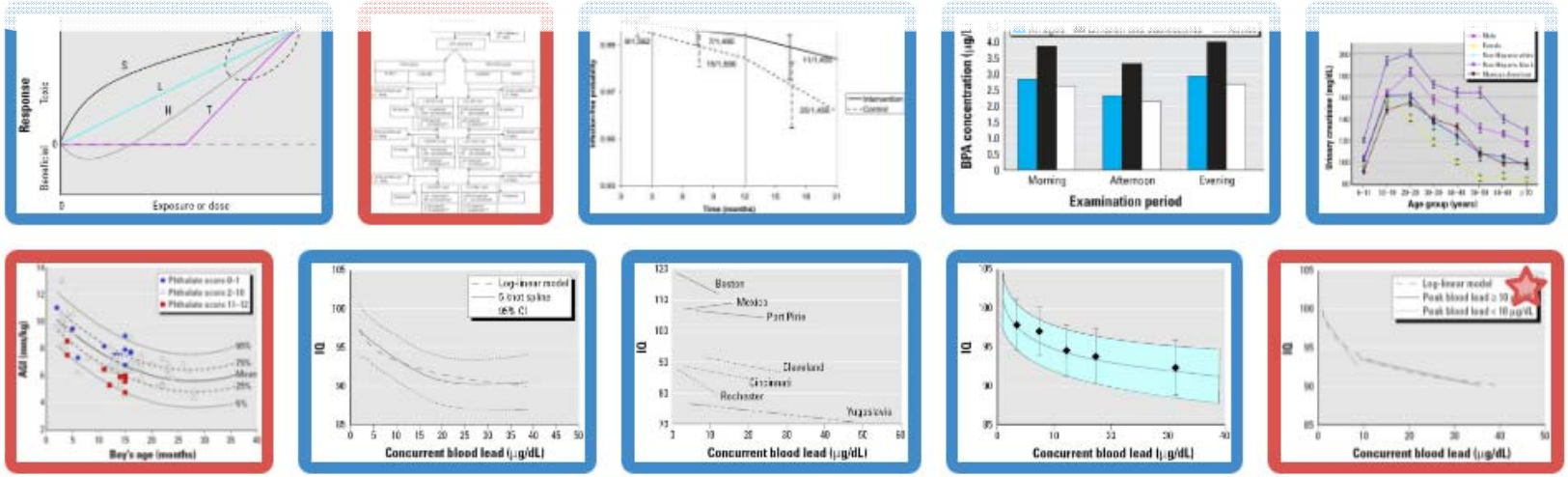
VizioMetrics

Impact | population health | Search

Composite Equation Diagram

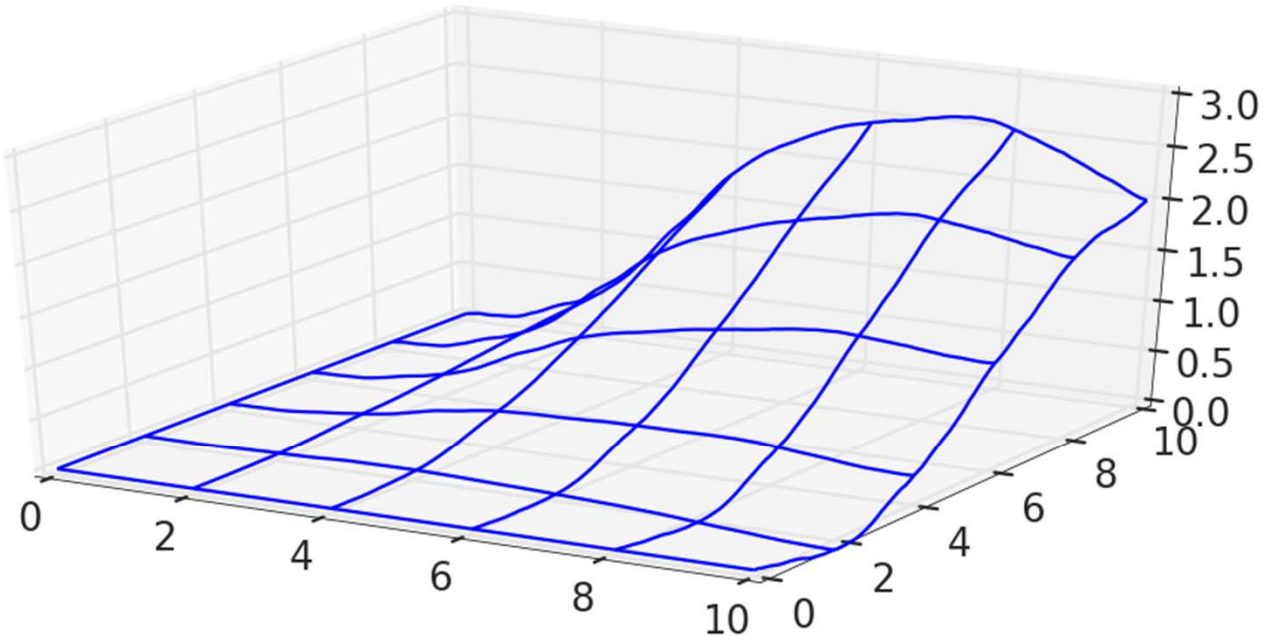
Photo Plot Table

bit.ly/2evKcnR



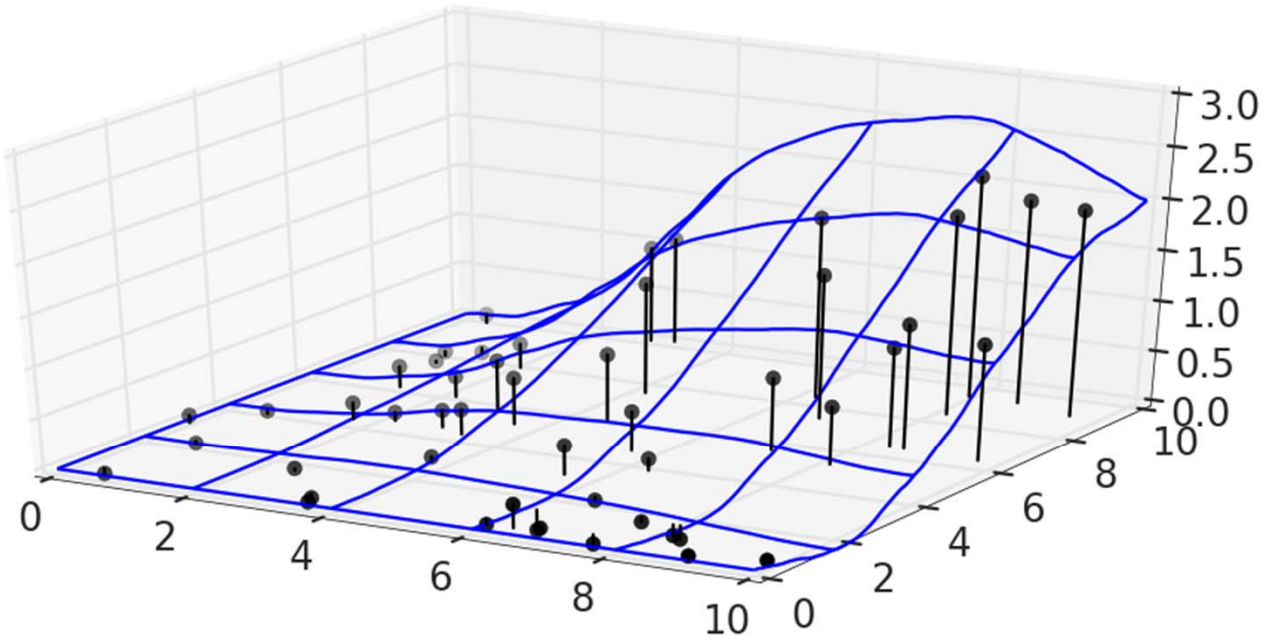
Three Dimensional Plots

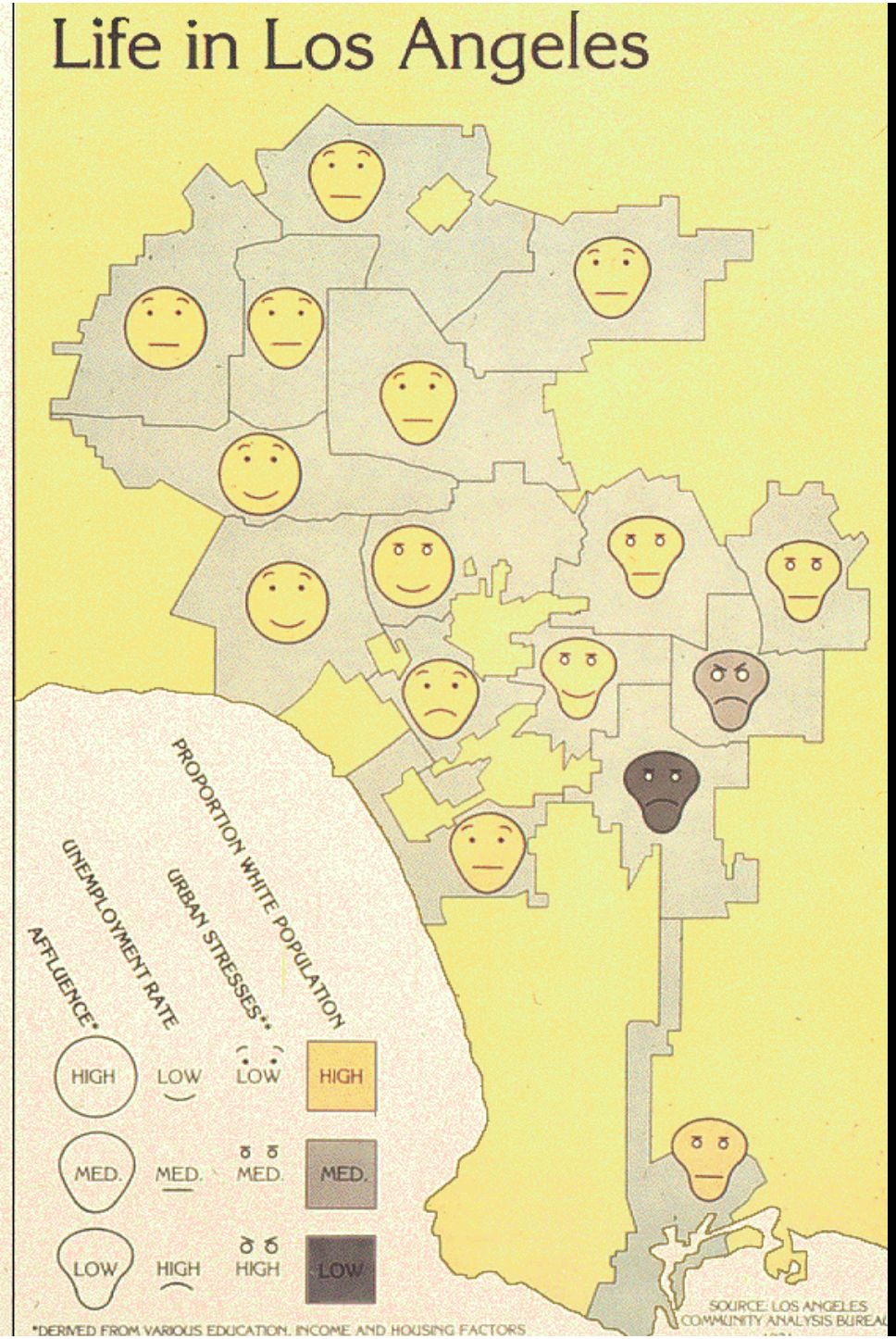
Smooth a Gaussian Field to get values for all pixels on a grid:



Three Dimensional Plots

For point data, sample random locations with noise:




Life in Los Angeles
AFFLUENCE*
UNEMPLOYMENT RATE
URBAN STRESSES**
PROPORTION WHITE POPULATION
HIGH
LOW
LOW
HIGH
MED.
MED.
MED.
MED.
LOW
HIGH
HIGH
LOW
*DERIVED FROM VARIOUS EDUCATION, INCOME AND HOUSING FACTORS
SOURCE: LOS ANGELES
COMMUNITY ANALYSIS BUREAU

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Sketch as many ways to display this information as you can think of (3 minutes)

age	sex	race	specialty	hours	it_use
55	M	White	Medical Specialties	41	Available and used
65	M	White	Surgical Specialties	60	Not available
60	M	White	Medical Specialties	55	Available and used
40	F	Black	Internal Medicine	60	Available and used
35	M	White	Family/GP	50	Available and used
…	…	…	…	…	…

Busy, Busy Doctors –TMI Table

Specialty	Hours per Week						
	All ages	Age group					
		<37	40yo	45yo	50	55	60
Ob/Gyn	54.0	56	53	55	59	54	52
Surgical Specialty	53.1	58	55	54	56	56	50
Medical Specialty	52.9	51	52	54	54	55	54
Internal	51.4	51	50	52	52	55	55
Family	49.1	49	50	48	50	51	51
Psych	45.4	46	46	42	46	49	46
Peds	45.2	43	47	43	45	48	48

Source: HSC 2008 Health Tracking Physician Survey

Now pick your favorite and sketch a big version of it, for sharing (1 minute)

Specialty	Hours per Week						
	All ages	Age group					
		<37	40yo	45yo	50	55	60
Ob/Gyn	54.0	56	53	55	59	54	52
Surgical Specialty	53.1	58	55	54	56	56	50
Medical Specialty	52.9	51	52	54	54	55	54
Internal	51.4	51	50	52	52	55	55
Family	49.1	49	50	48	50	51	51
Psych	45.4	46	46	42	46	49	46
Peds	45.2	43	47	43	45	48	48

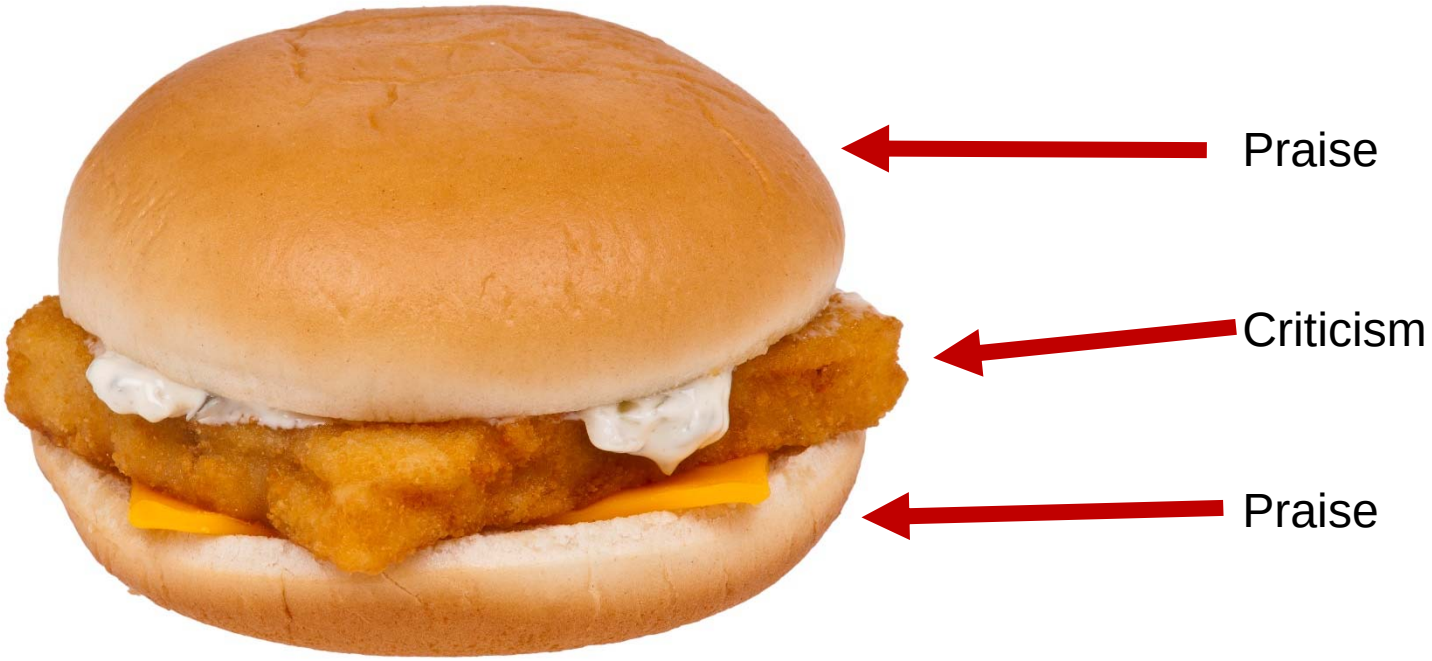
Choosing between alternatives

- Critique exercise (teams of two, three minutes each)

- Three levels of constructive criticism
  1. Conceptual (What are its goals and does it accomplish them?)
  2. Aesthetic (Overall appeal, objects, iconography, contrast, value, size, positioning, hierarchy, consistency, ...)
  3. Technical details

How to offer criticism: the sandwich

- Should I not tell you this?



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Resources for Further Study

Chart Suggestions Thought-Starter

Resources at UW

- Jeff Heer, CSE 512, and Interactive Data Lab
- Jessica Hullman, iSchool
- Mike Freeman, iSchool
- Jake Vanderplas, eScience
- Chris Adolph, CSSS 569
- Viziometric search engine
- Center for Social Science Computation and Research

- Tableau
- Microsoft Power BI

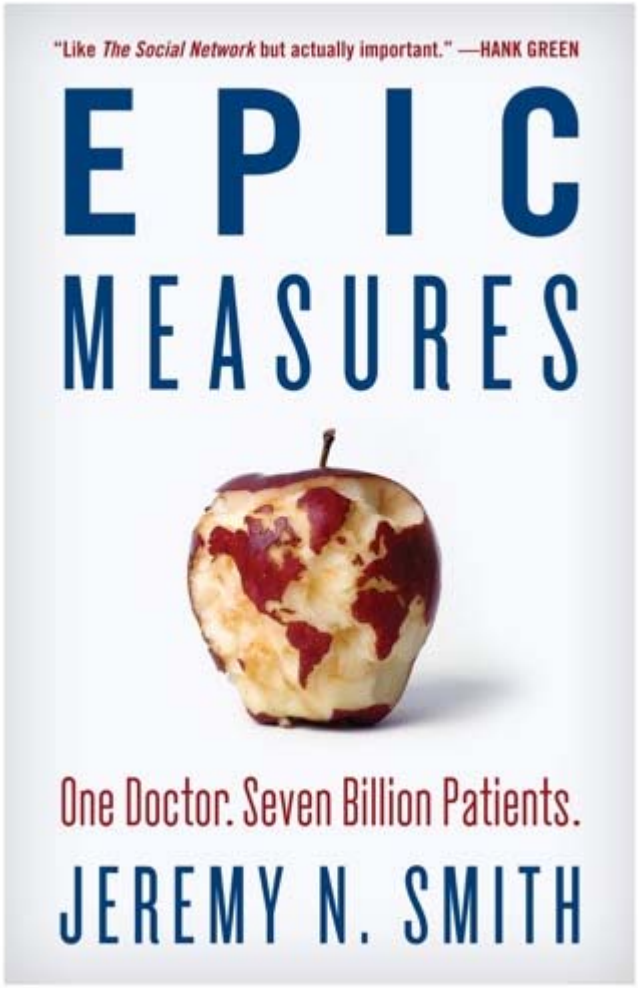
Other resources

- Stephen Few
- @albertocairo
- ggplot, seaborn, better defaults for Stata

I'm always looking for more, please send them to me: `abie@uw` by email, or `@healthyalgo` on twitter.

Thank you.

Questions?



"Jeremy Smith's engaging story of a man obsessed with the numbers, and the mortal dramas they tell, reads like a novel and is better than any textbook or survey of this planet's health." ---*Paul Farmer*