Strategies for Presenting Results

Saturday June 4, 8:30-10:00am

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Training Course in MCH Epidemiology

Presentation of Data

Tables, charts and graphs provide an effective method for communicating person, place, and time data to your audience

The organization and format of these tables, charts and graphs may differ depending on your goal and the type of results displayed (ie descriptive statistics, measures of effect, results of multivariable methods, etc)

1

Presenting Data Visually

1. Start with the message/content you are trying to convey and identify the data that will be used
2. Consider your audience
   - General Public
   - Stakeholders
   - Scientific Community
3. Consider the form of the data
   - Prevalence estimates (“row percents”)
   - Distributions (“column percents”)
   - Measures of effect (conveying significance)

2

Presenting Data Visually

4. Determine if a table, chart (what type?), or both are needed to communicate the message
5. Determine where to display each variable
6. Determine the best design for the remaining objects
7. Determine if particular data should be featured, and if so, how

Modified from Stephen Few’s Whitepaper “Communicating Numbers”
http://www.perceptualedge.com/articles/Whitepapers/Communicating_Numbers.pdf

3

Presenting Data Visually

Tables: *Convey large amount of data in systematic way*

Effective tables include:

- Table number and title that clearly identifies the data displayed
- Column and row headings
- Decimal alignment
- Expanded forms of abbreviations used in the tables, generally as footnotes
- Additional explanatory footnotes as needed

"Guidelines for Conducting Birth Defects Surveillance: Chapter 11 -Data Presentation": http://www.nbdpn.org/docs/Ch11_DataPresentation.pdf

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Effective Tables

Table 2-6
America's sweet tooth increased 39 percent between 1950–59 and 2000 as use of corn sweeteners octupled

Item	1950–59	1960–69	1970–79	1980–89	1990–99	2000
	Annual averages					
	Pounds per capita, dry weight					
Total caloric sweeteners	109.6	114.4	123.7	126.5	145.9	152.4
Cane and beet sugar	96.7	98.0	96.0	68.4	64.7	65.6
Corn sweeteners	11.0	14.9	26.3	56.8	79.9	85.3
High fructose corn syrup	.0	.0	5.5	37.3	56.8	63.8
Glucose	7.4	10.9	16.6	16.0	19.3	18.1
Dextrose	3.5	4.1	4.3	3.5	3.8	3.4
Other caloric sweeteners	2.0	1.5	1.4	1.3	1.3	1.5

Note: Totals may not add due to rounding.
1Edible syrups (sugarcane, sorgo, maple, and refiner's), edible molasses, and honey.
Source: USDA's Economic Research Service.

Also see handout on cancer survival rate tables

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Presenting Data Visually

Charts: *Summarize data and highlight main points for audience*

Line Charts:
- Trend
- Continuous variables
- Survival Data

Bar Charts (vertical and horizontal):
- Trend
- Prevalence data for discrete groups
- Distributions/Proportions (100% stacked bars)

Pie Charts:
- Distributions/Proportions
- Population Attributable Fractions (PAFs)

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Line Chart Guidelines

- Lines should only be used when variable is on an ordinal or continuous scale
- Do not connect the points on a line if there are missing values in between existing data
- Intervals should be equally sized
  - Exception: Extreme outliers can be lumped at the lower or upper end (ie income)
- Tick marks on the x-axis should accurately reflect the distance between the values

http://www.perceptualedge.com/articles/visual_business_intelligence/line_graphs_and_irregular_intervals.pdf

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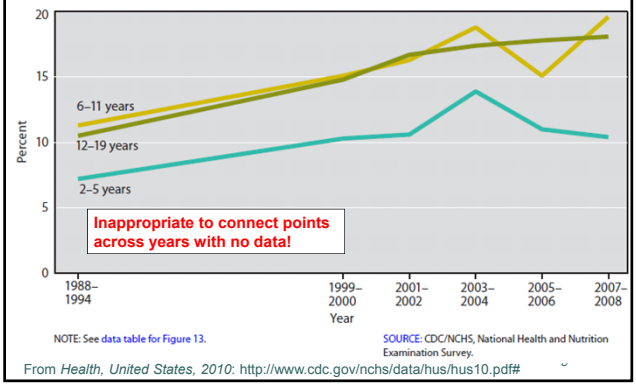
Line Chart - Trend

Figure 13. Obesity among children, by age: United States, 1988–1994 through 2007–2008



Inappropriate to connect points across years with no data!

NOTE: See data table for Figure 13.

SOURCE: CDC/NCHS, National Health and Nutrition Examination Survey.

From *Health, United States, 2010*: http://www.cdc.gov/nchs/data/hus/hus10.pdf#

Line Chart with Missing Data

Omit the line altogether when data are missing along the line

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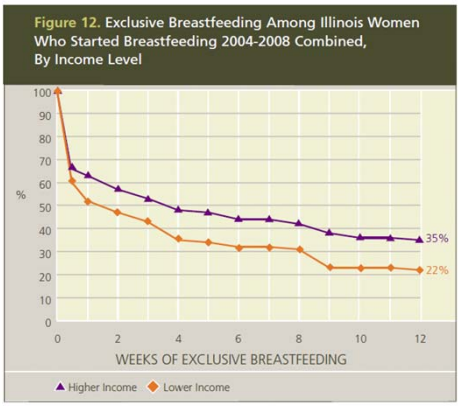
Which one is correctly displayed?

10

Effective Line Chart – "Survival" Data



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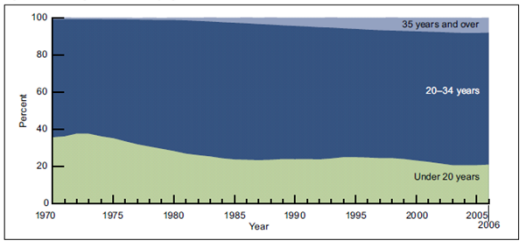
Line Chart – Distribution + Trend

NCHS Data Brief ■ No. 21 ■ August 2009

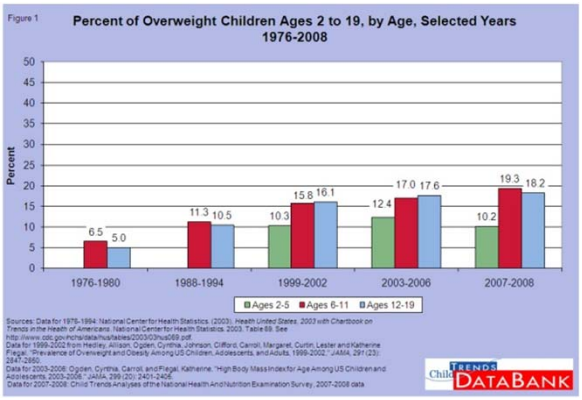
From 1970 to 2006 the proportion of first births to women aged 35 years and over increased nearly eight times (1,2). In 2006, about 1 out of 12 first births were to women aged 35 years and over compared with 1 out of 100 in 1970. According to preliminary data, the proportion for 2007 was the same as in 2006 (3). In 2006, only 21% of first births were to mothers under age 20, down from 36% in 1970 (Figure 2).

Figure 2. Percentage of first births, by age of mother: United States, 1970–2006

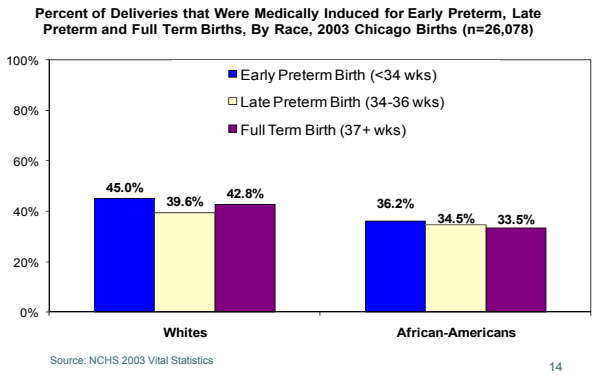


SOURCE: CDC/NCHS, National Vital Statistics System.

Vertical Bar Chart - Trend



Vertical Bar Chart - Prevalence



Source: NCHS 2003 Vital Statistics

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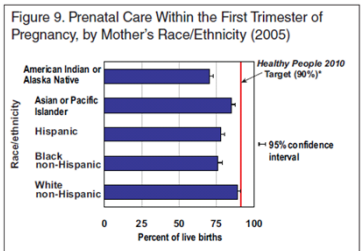
Horizontal Bar Chart - Prevalence

Use horizontal bar charts when text labels associated with bars are long or there are many bars to display



* The *Healthy People 2010* target calls for an increase in this measure.

NOTE: Data are based on birth certificates filed in 37 States, New York City, and the District of Columbia. See Technical Appendix for more information.

Source: Centers for Disease Control and Prevention, National Center for Health Statistics, National Vital Statistics System—Natality.

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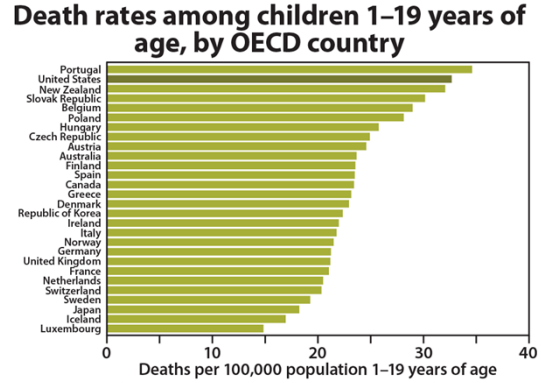
Horizontal Bar Chart - Rates



Stacked Bar Charts

- If possible, avoid using stacked bars, especially when the percentages don't add to 100% - they make it difficult to compare across groups
- Sometimes 100% stacked bars make sense for comparing distributions, but:
  - Only use with a small number of categories
  - Display the data label in each portion of the bar

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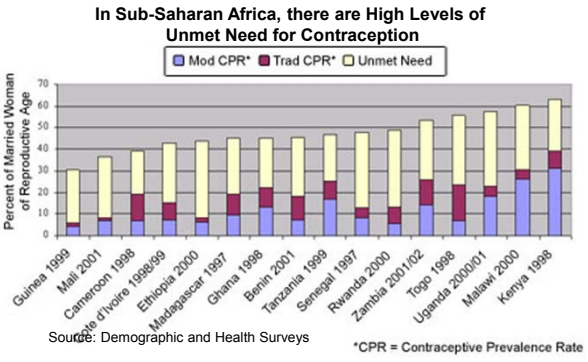
Ineffective Stacked Bar Chart



http://www.usaid.gov/our_work/global_health/pop/news/aidsday.html

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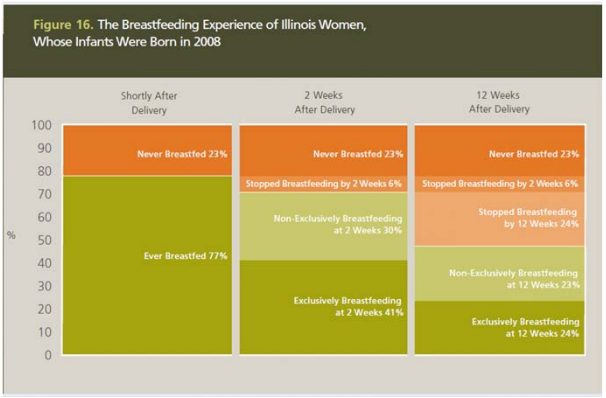
Effective 100% Stacked Bar Chart



Pie Charts

In general, it is difficult to make comparisons effectively with pie charts, but they are sometimes useful for displaying the parts of a whole / distributions

If using pies, keep the ordering and positioning of pie slices the same across pies when comparing multiple pies

Order slices by magnitude when possible

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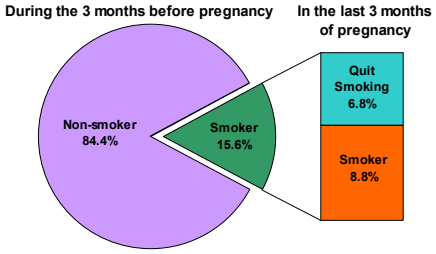
Pie Chart Plus Vertical Bar - Distribution

Smoking and Quitting Behaviors During Pregnancy, State A 2005



Source: State A PRAMS Data 2005

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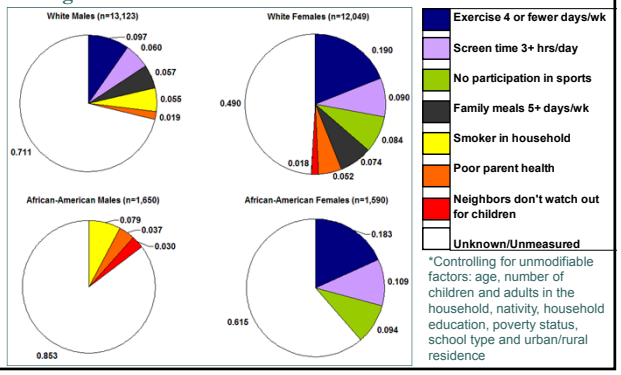
Pie Chart – Population Attributable Fractions

Average PAFs* For Modifiable Risk Factors for Overweight Among White and African-American Male and Female Adolescents



*Controlling for unmodifiable factors: age, number of children and adults in the household, nativity, household education, poverty status, school type and urban/rural residence

Presenting Data Visually

Maps: *Show geographic comparisons and associations*

Descriptive

- Plotting locations of events as points on a map (**dot-density maps**)
- Displaying rates/prevalences for polygons (census tract, zip code, county, state, country) on a map (**choropleth/thematic maps**)

Analytic

- Spatial relationships between exposures and health outcomes

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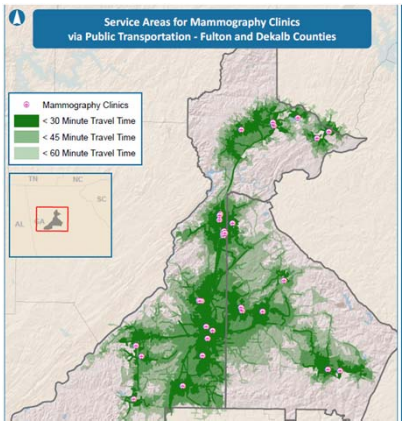

http://cehi.nicholas.duke.edu/gisexchange/mapgallery/maps/pdf/mammography_clinics.pdf

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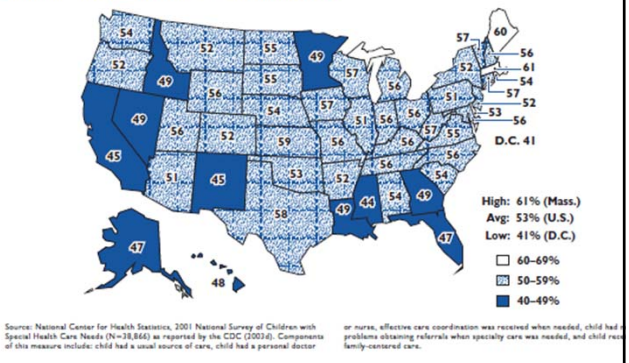

http://www.commonwealthfund.org/usr_doc/leatherman_pedchartbook_700.pdf

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Analytic Design Principles

1. Comparisons
2. Causality, Mechanism, Structure, Explanation
3. Multivariate Analysis
4. Integration of evidence
5. Documentation
6. Content Counts Most of All

Edward Tufte, *Beautiful Evidence*, Cheshire Ct: Graphics Press, pp126-139

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Principle 1: Comparisons

Show appropriate comparisons, contrasts, differences

- Understand whether row percents or column percents more effectively make comparison
- Order bars/pie pieces in charts to show comparison of interest
- Display benchmarks or overall averages to provide a frame of reference when appropriat
- Highlight value of interest to be compared to others, using a darker color or outline

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Column vs Row Percents in Tables

Table 1. Distribution (%) of Selected Maternal Characteristics Among Low Birth Weight and Non-Low Birth Weight Infants, Cook County, Illinois, 1989–1991

Characteristic	LBW Infants (n = 5,365)	Non-LBW Infants (n = 35,283)
Maternal age, years*		
<20	23.1	26.1
20–35	76.9	73.9
Maternal education, years*		
Missing data	1.0	0.8
<12	39.5	32.5
12	37.0	37.6
>12	22.5	29.0
Adequacy of prenatal-care utilization (13)*		
Missing data	7.2	3.3
None or inadequate	31.6	29.5
Intermediate	15.3	23.6
Adequate	17.7	25.4
More than adequate	28.1	18.2

Abbreviation: LBW, low birth weight.
* $P < 0.05$.

Table 1. LBW Rates by Selected Maternal Characteristics, Cook County, Illinois, 1989-1991

Characteristic	LBW Infants % LBW (n=40,648)
Maternal age, years*	
<20	11.9
20–35	13.7
Maternal education, years*	
Missing data	16.0
<12	15.6
12	13.0
>12	10.5
Adequacy of prenatal-care utilization (13)*	
Missing data	24.9
None or inadequate	14.0
Intermediate	9.0
Adequate	9.6
More than adequate	19.0

Abbreviation: LBW, low birth w...
* $P < 0.05$.

From Collins, et al. (2009). Transgenerational Effect of Neighborhood Poverty on Low Birth Weight Among African Americans in Cook County, Illinois, AJE

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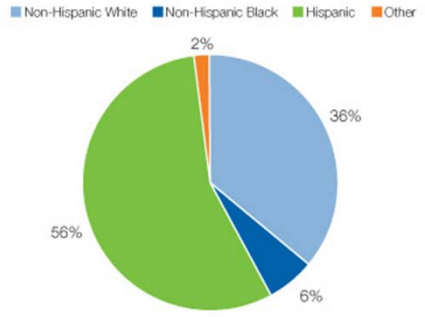
Column vs Row Percents in Charts

Proportions of Teen Births Among 15- to 19-Year-Olds by Race and Hispanic Ethnicity, Colorado, 2006



http://www.cdc.gov/TeenPregnancy/Colorado.htm

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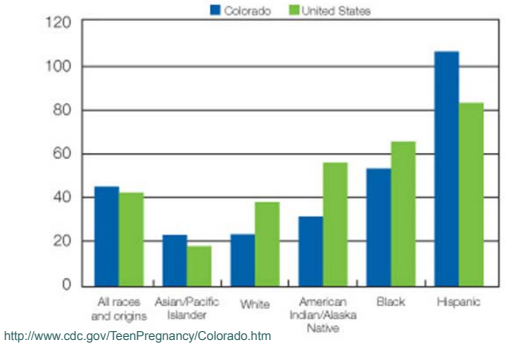
Column vs Row Percents in Charts

Birth Rates (live births) per 1,000 Women Aged 15–19 Years, by Race and Hispanic Ethnicity: Colorado and United States, 2006



http://www.cdc.gov/TeenPregnancy/Colorado.htm

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Ordering Bars to Show Comparison of Interest

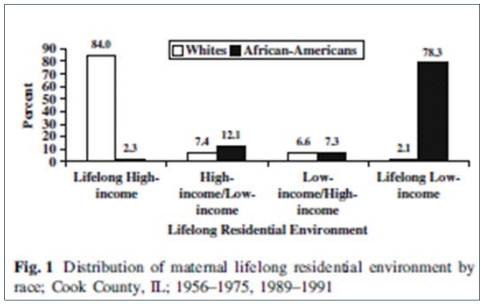

Fig. 1 Distribution of maternal lifelong residential environment by race; Cook County, IL; 1956–1975, 1989–1991

Collins, et al. 2008, *MCH Journal*

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Ordering Bars to Show Comparison of Interest

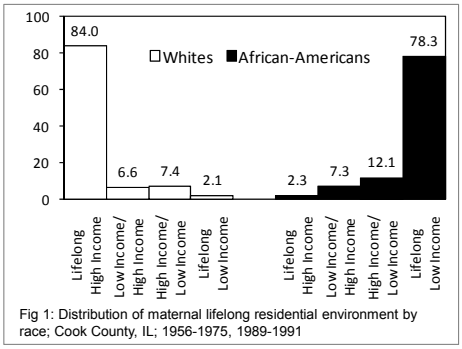

Fig 1: Distribution of maternal lifelong residential environment by race; Cook County, IL; 1956-1975, 1989-1991

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Comparison to a Benchmark

The 2010 CDC Breastfeeding Report Card: Data from the National Immunization Survey	Illinois 2007 (%)	HP2020 Objective (%)
Breastfeeding Initiation	70.2	≥ 81.9
Breastfeeding to 6 Months	36.0	≥ 60.5
Breastfeeding to 12 Months	16.4	≥ 34.1
Exclusive Breastfeeding to 3 Months	27.9	≥ 44.3
Exclusive Breastfeeding to 6 Months	11.2	≥ 23.7
Percent of Live Births Occurring at Baby Friendly Facilities	1.3	≥ 8.1
Percent of breastfed Infants Receiving Formula Before 2 Days of Age	28.1	≤ 15.6

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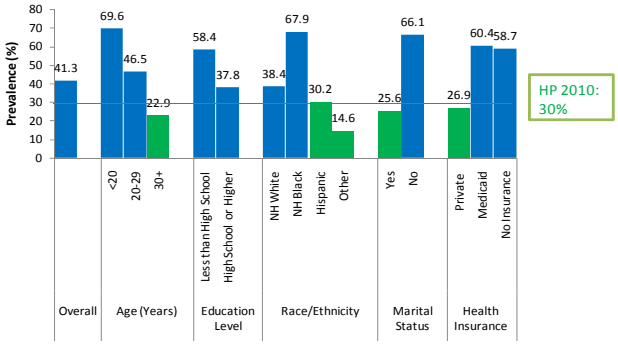
Comparison to a Benchmark

Prevalence (%) of unintended pregnancy by selected maternal characteristics, MOPRA, 2005

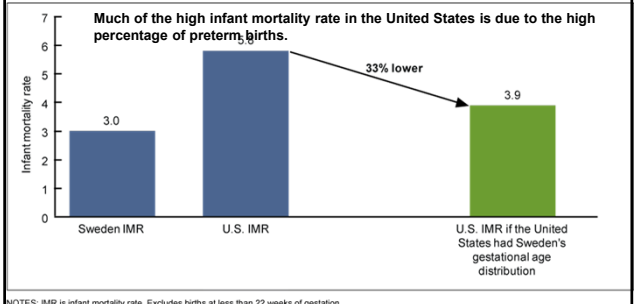


Choosing Appropriate Comparison Groups

Breastfeeding-Related Maternity Care Practices	All States		Big 5 States California, New York, Illinois, Florida, and Texas	
	State with Best Ranking in US	Illinois Rank in US (1 to 52, 1=best)	Big 5 State with Best Ranking	Illinois Rank in Big 5 (1 to 5, 1=best)
Total Score	VT	35	CA-#11	4
Labor and Delivery *e.g. skin-to-skin contact, BF in first half hour*	VT	43	FL-#18	5
Breastfeeding assistance *e.g. BF information, assessment, documentation*	VT	32	FL-#21	4
Mother-newborn contact *e.g. separation, rooming-in*	AK	37	FL, NY-#11	4
Newborn feeding practices *e.g. first feeding and supplemental feedings*	VT	36	CA-#9	3
Breastfeeding support after discharge *e.g. types of support, formula packs*	RI	24	CA-#12	4
Nurse/birth attendant BF training and education *e.g. staff education and assessment*	MA	16	CA-#9	4
Structural/ organizational factors related to BF *e.g. policies*	RI	22	NY-#6	4

Choosing Appropriate Comparison Groups

Figure 4. Infant mortality rates for the United States and Sweden, and the U.S. infant mortality rate standardized for Sweden's gestational age distribution, 2004



NOTES: IMR is infant mortality rate. Excludes births at less than 22 weeks of gestation.
SOURCE: NCHS linked birth/infant death data set (for U.S. data) and *European Perinatal Health Report* (for Swedish data).

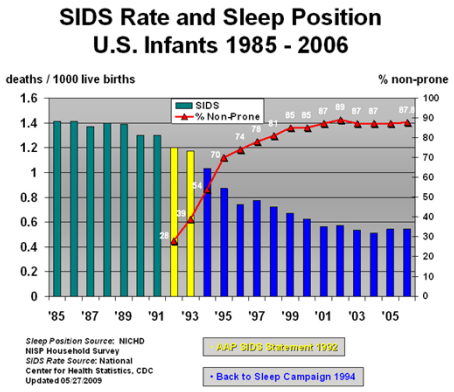
http://www.cdc.gov/nchs/data/databriefs/db23_Fig4.png

Principle 2: Causality, Mechanism, Structure, Explanation

Show causality, mechanism, explanation, systematic structure

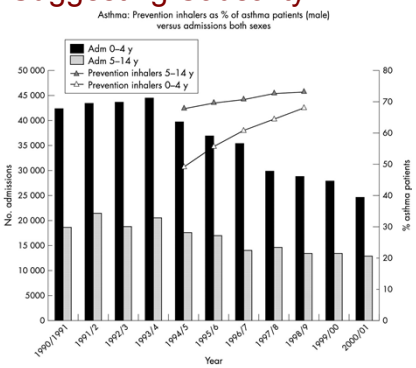
- Highlight policies, interventions, risk factors, or changes in human behavior that may have caused a trend or association

Suggesting Causality

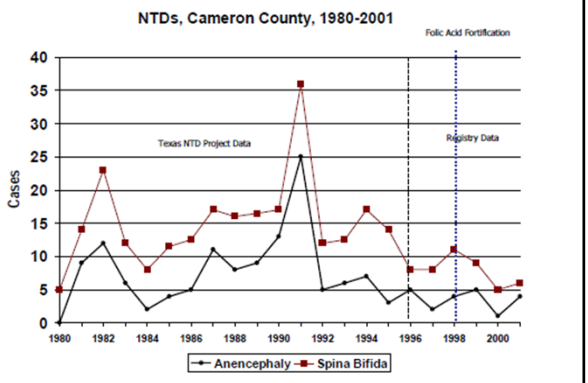


http://emedicine.medscape.com/article/1004238-overview

Suggesting Causality



MacFaul (2004). Trends in asthma hospitalization: is this related to prevention inhaler use? *Arch Dis Child* 89:1158-1160.



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Principle 3: Multivariate Analysis

Show more than 1 or 2 variables

- Use stratification to show differences across groups
- Use regression modeling when appropriate to capture multivariable nature of problem
- Use and communicate adjustment procedures

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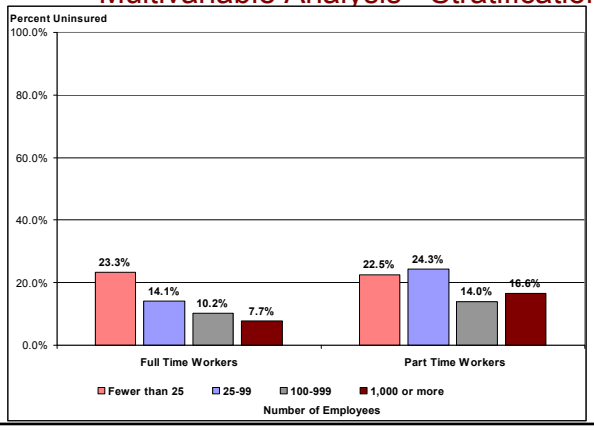
Multivariable Analysis - Stratification



Presenting Results of Multivariable Models in Charts

- Present a series of adjusted ratio measures (OR, RR, HR, etc) on one ***chart*** for comparison
- The scale is different for ratio measures that are less than one (protective factors) versus those that are greater than one
- Include error bars to represent both the precision of the estimate (width of the confidence intervals) and the significance level of the estimate

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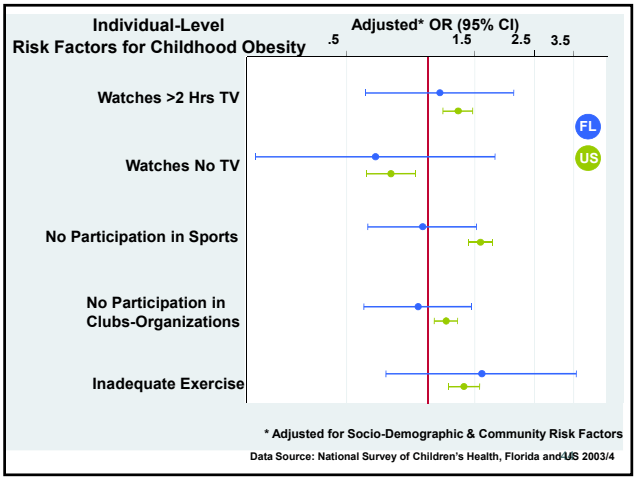

Presenting Predicted Values from Multivariable Models in Charts

- Estimate predicted probabilities from binomial regression models for groups of women with different risk status
- Use beta estimates from model to determine highest/lowest risk value for each variable and write contrast/estimate statement to estimate the predicted probability for each group.

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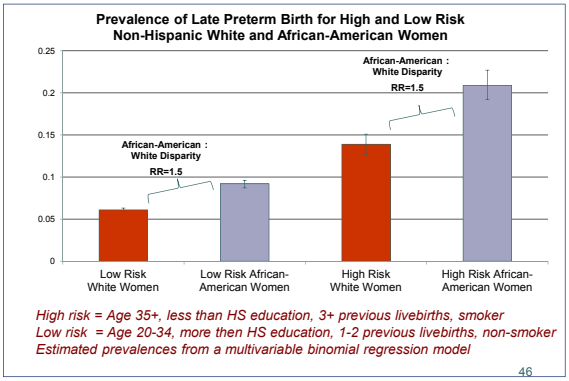
Presenting Predicted Values from Multivariable Models in Charts



High risk = Age 35+, less than HS education, 3+ previous livebirths, smoker
Low risk = Age 20-34, more then HS education, 1-2 previous livebirths, non-smoker
Estimated prevalences from a multivariable binomial regression model

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Principle 4: Integration of Evidence

Completely integrate words, numbers, images, diagrams

- Use clear titles, direct labels and footnotes
- Avoid legends as much as possible or put them inside the chart to maximize the chart area and keep the labels closer to the data
- Blend graphical representations of data with short narrative to help with interpretation

Detail adds precision, clarity and credibility

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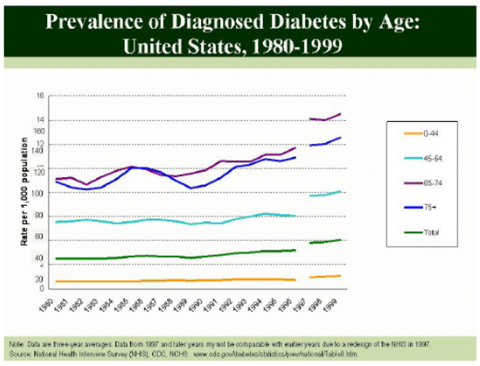
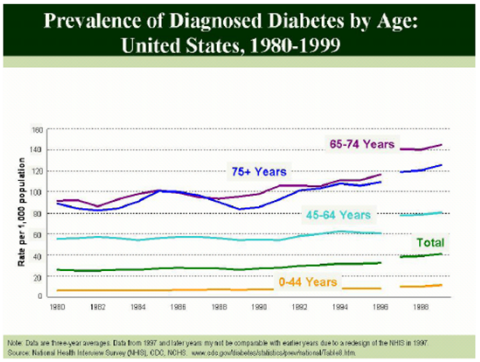
Indirect Labeling



Direct Labeling



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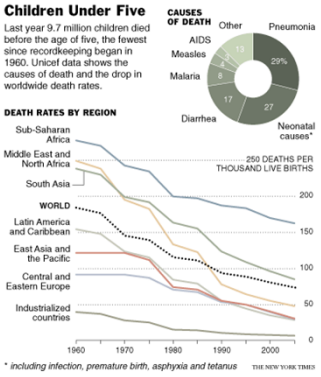
Integration of Evidence



Child Mortality at Record Low; Further Drop Seen
By DONALD G. McNEIL Jr.
Published: September 13, 2007 in the ***New York Times***

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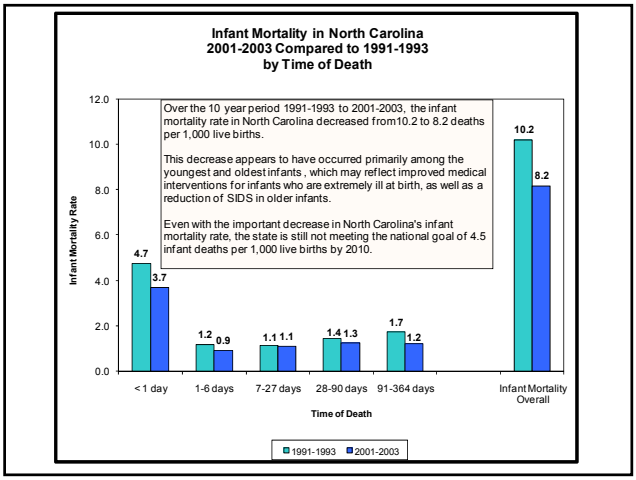
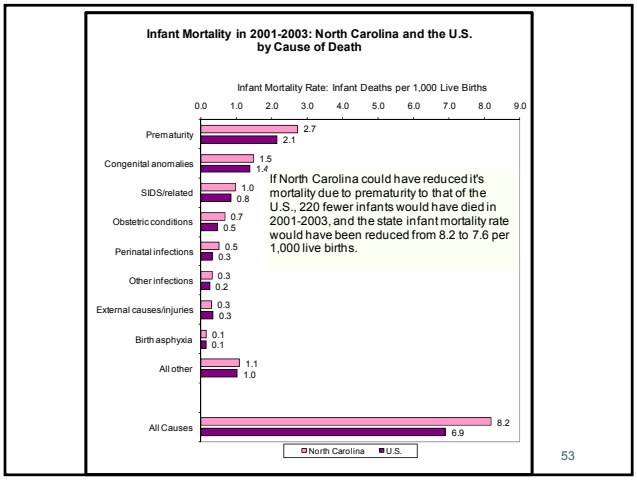
Narrating Charts

- Narrative inserted directly in charts or in accompanying text helps guide your audience (ie the general public in your jurisdiction, advocates, policy makers) to interpret the charts and can be used to highlight particularly important or meaningful results
- Clear titles and labels are still needed in case the reader skips over this additional text

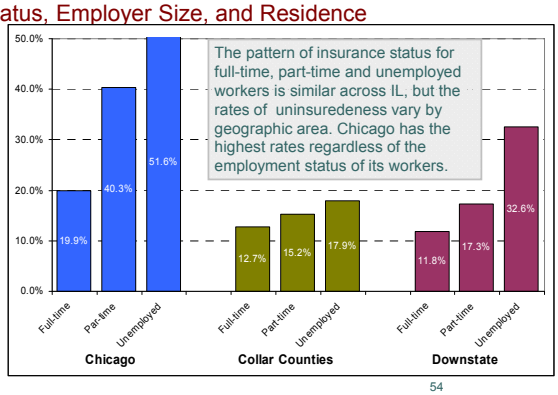
51





53

Insurance Status of Illinois Workers by Employment Status, Employer Size, and Residence



54

Narrating Tables

- Present a series of adjusted ratio measures (OR, RR, HR, etc) in one ***table*** for comparison
- Convey reference groups and significance in a way that is clear to a general audience
- Narrate tables when appropriate to help audience interpret results

55

Narrating Tables

Table 1. Adjusted* Prevalence Ratio (aPR) of factors associated with late or no entry into prenatal care, MA PRAMS, 2007

	aPR	95% CI
Age and education		
< 20 yrs	3.3	1.8, 6.0**
20+ yrs, ≤high school	1.5	1.0, 2.3**
20+ yrs, > high school	Ref	--
Maternal race		
White non-Hispanic	Ref	--
Black non-Hispanic	1.8	1.2, 2.6**
Hispanic	1.4	0.9, 2.1
Other	1.9	1.3, 2.7**
Not married vs. married	1.1	0.7, 1.7
Parity		
No previous live birth	Ref	--
1-2 previous live births	1.2	0.9, 1.7
3+ previous live births	2.6	1.6, 4.3**
Pre-pregnancy insurance		
Private	Ref	--
Medicaid	1.7	1.1, 2.8**
Uninsured	1.8	1.1, .8**

* Adjusted for all other variables at the same time
** Statistically significant at α=0.05 compared to reference group

Tables with Modeling Results: Some Issues

- Titling, labeling
- Reference group display, position, wording
- Confidence interval display, format
- Describing statistical results
- Explanatory text in table

56

Narrating Tables

Table 1. Comparing the percents of Massachusetts women who get into prenatal care late or not at all across various factors, PRAMS, 2007

	Ratio of Percents	95% CI
Age and education		
< 20 yrs	3.3	1.8, 6.0**
20+ yrs, ≤high school	1.5	1.0, 2.3**
20+ yrs, > high school	Ref	--
Maternal race		
White non-Hispanic	Ref	--
Black non-Hispanic	1.8	1.2, 2.6**
Hispanic	1.4	0.9, 2.1
Other	1.9	1.3, 2.7**
Not married vs. married	1.1	0.7, 1.7
Parity		
No previous live birth	Ref	--
1-2 previous live births	1.2	0.9, 1.7
3+ previous live births	2.6	1.6, 4.3**
Pre-pregnancy insurance		
Private	Ref	--
Medicaid	1.7	1.1, 2.8**
Uninsured	1.8	1.1, .8**

* Accounting for all other characteristics simultaneously.
** Significantly different from the reference group (α=0.05).

Tables with Modeling Results: Some Issues

- Titling, labeling

57

Narrating Tables

Table 1. Comparing the percents of Massachusetts women who get into prenatal care late or not at all across various factors, PRAMS, 2007

	Ratio of Percents	95% CI
Age and education		
< 20 yrs	3.3	1.8-6.0**
20+ yrs, ≤high school	1.5	1.0-2.3**
20+ yrs, > high school	Ref	--
Maternal race		
Black non-Hispanic	1.8	1.2-2.6**
Hispanic	1.4	0.9-2.1
Other	1.9	1.3-2.7**
White non-Hispanic	Ref	--
Not married vs. married		
Not Married	1.1	0.7-1.7
Married	Ref	--
Parity		
3+ previous live births	2.6	1.6-4.3**
1-2 previous live births	1.2	0.9-1.7
No previous live birth	Ref	--
Pre-pregnancy insurance		
Medicaid	1.7	1.1-2.8**
Uninsured	1.8	1.1-0.8**
Private	Ref	--

* Accounting for all other characteristics simultaneously.
** Significantly different from the reference group (α=0.05).

Tables with Modeling Results: Some Issues

- Reference groups all the last category
- Confidence intervals alligned and with hyphens

58

Narrating Tables

Table 1. Comparing the percents of Massachusetts women who get into prenatal care late or not at all across various factors, PRAMS, 2007

	Ratio of Percents
Compared to women at least 20 years old with more than than high school	
< 20 yrs	3.3**
20+ yrs & ≤high school	1.5**
Compared to White, non-Hispanic women	
Black non-Hispanic	1.8**
Hispanic	1.4
Other	1.9**
Compared to married women	
Not Married	1.1
Compared to women giving birth for the first time	
3+ previous live births	2.6**
1-2 previous live births	1.2
Compared to women with private pre-pregnancy insurance	
Medicaid	1.7**
Uninsured	1.8**

* Accounting for all other characteristics simultaneously.
** Significantly different from the comparison group (α=0.05).

Tables with Modeling Results: Some Issues

- Reference groups displayed as headers
- Confidence intervals not displayed

59

Table 1. Comparing the percents of Massachusetts women who get into prenatal care late or not at all across various factors, PRAMS, 2007

Maternal Characteristic	Ratio of Percents	Interpretation
< 20 yrs	3.3**	***Compared to women at least 20 years old with more than a high school education,*** adolescents were approximately 3 times more likely, and adult women who did not complete high school were 1.5 times more likely to report late or no prenatal care.
20+ yrs & ≤high school	1.5**	
Black non-Hispanic	1.8**	***Compared to white, non-Hispanic women,*** black, non-Hispanic women were almost 2 times more likely to report late or no prenatal care.
Hispanic	1.4	
Other	1.9**	
Not Married	1.1	**Compared to married women,** approximately the same percent of unmarried women said they got late or no prenatal care.
3+ previous live births	2.6**	***Compared to women giving birth for the first time,*** the percent of women who said they got late or no prenatal care was similar for those with 1 or 2 previous births, but was 2.6 times greater for women who had three or more previous births.
1-2 previous live births	1.2	
Medicaid	1.7**	***Compared to women with private insurance before they got pregnant,*** women either on Medicaid or with no health insurance coverage were close to 2 times more likely to say they entered prenatal care late or not at all.
Uninsured	1.8**	

* Accounting for all other characteristics simultaneously.
** Significantly different from the comparison group (α=0.05).

60

Principle 5: Documentation

Thoroughly describe the evidence; important for establishing credibility

- Provide a detailed title
- Indicate authors and sponsors
- Document data sources and years
- Show complete measurement scales
- Acknowledge error (confidence intervals) in estimates when appropriate
- Communicate statistical significance when appropriate

61

Measurement Scales

Always start y-axis at zero for bar charts; use points instead of bars if y-axis must start at a number other than zero to zoom in on relevant data

Proportions can be distorted when scales change across or within charts; for example:

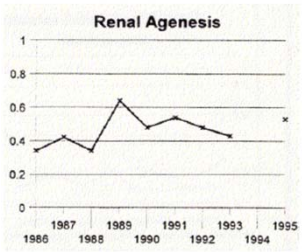
- Two different graphs examining the same outcome, but based on different time periods or different lengths of time
- A bar graph of several time-based groups, where the groups correspond to different lengths of time
- Graphs of statistical functions, such as regression lines, that extend beyond the range of values observed in the data

"Guidelines for Conducting Birth Defects Surveillance Chapter 11 - Data Presentation": http://www.nbdpn.org/docs/Ch11_DataPresentation.pdf

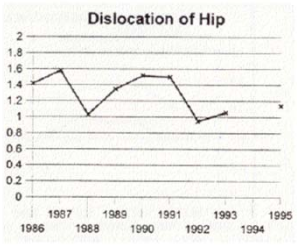
62

Measurement Scales

Cases per 10,000 live births for select birth defects (Muscatello et al, 2006)



Sample Figure 1A. Cases per 10,000 live births 1986–1995



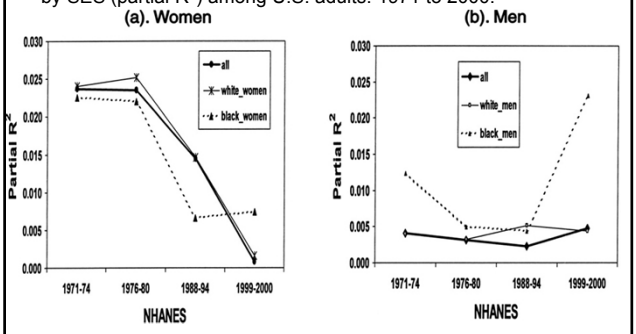
Sample Figure 1B. Cases per 10,000 live births 1986–1995

"Guidelines for Conducting Birth Defects Surveillance Chapter 11 - Data Presentation": http://www.nbdpn.org/docs/Ch11_DataPresentation.pdf

63

Measurement Scales

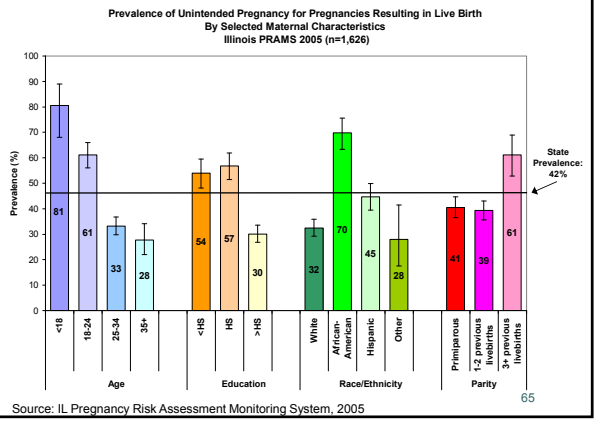
Figure 2: Changes in the variation of BMI explained by SES (partial R^2) among U.S. adults: 1971 to 2000.



Zhang Q and Wang Y (2204). Trends in the Association between Obesity and Socioeconomic Status in U.S. Adults: 1971 to 2000. Obesity Research 12: 1622-1632.

64

Confidence Intervals



Source: IL Pregnancy Risk Assessment Monitoring System, 2005

65

Communicating Statistical Significance

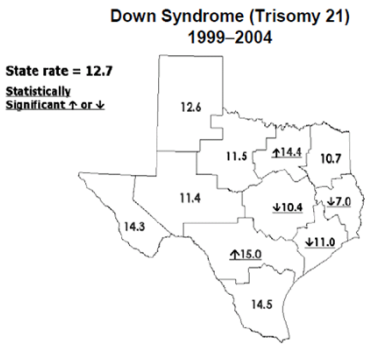


Figure A11.4-7 Area Map

66

Principle 6: Content Counts Most of All

Analytical presentations ultimately stand or fall depending on the quality, relevance and integrity of content

- Charts/tables should be **content focused**, not process focused
- Simple design, rich content
- Eliminate anything that doesn't contribute to content, including boxes, legends, "chart junk"

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Small Multiples

Minimize the time it takes audience to figure out format

- By keeping the quantitative scale consistent, graphic is easier for audience to read
- Audience doesn't need to figure out format again with each new display of information
- Especially useful when there is a fourth dimension that would make a single chart too busy or difficult to interpret

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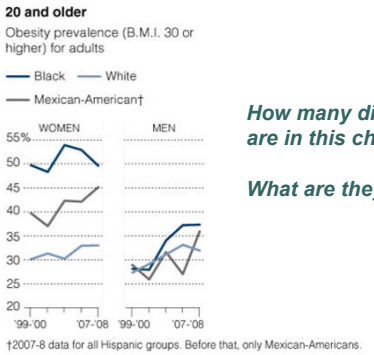
Small Multiples



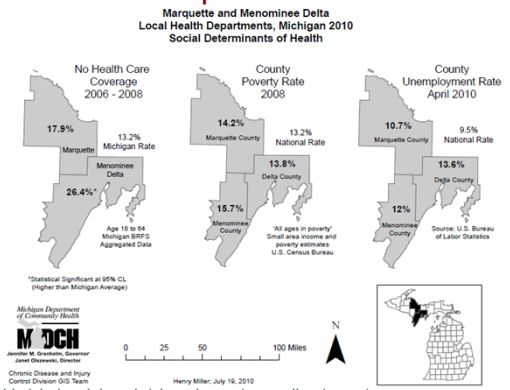
How many dimensions are in this chart?

What are they?

From: "Obesity Rates Hit Plateau in U.S., Data Suggest"
By Pam Belluck
New York Times, Published: January 13, 2010

69

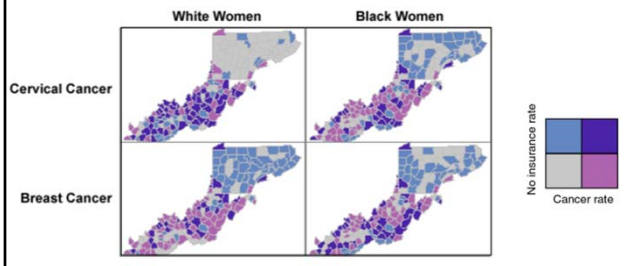
Small Multiples



http://cehi.nicholas.duke.edu/gisexchange/mapgallery/maps/detail/index.html?24#24

70

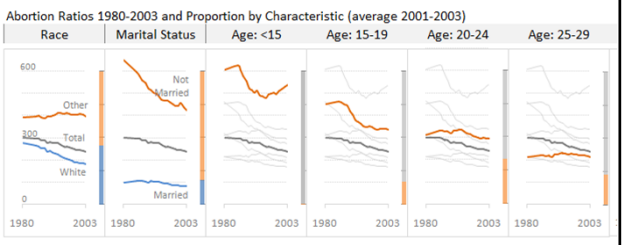
Small Multiples



https://www.e-education.psu.edu/geog486/l8_p5.html

71

Small Multiples



http://www.excelcharts.com/blog/chart-design-abortion-ratios-1980-2003/

Minimize "Ink-to-Data Ratio"

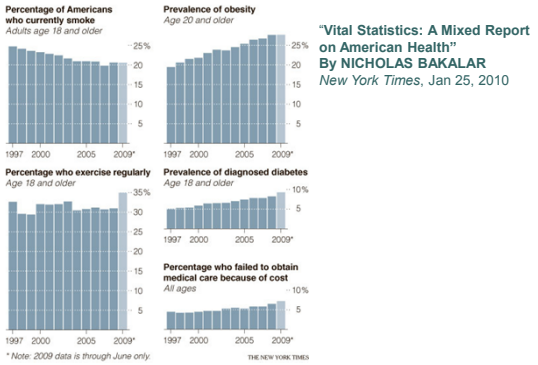
Reduce optical clutter

- Remove boxes around text, legends and figures
- Eliminate gridlines in favor of data labels, or
- De-emphasize gridlines with white breaks in bars
- Minimize axis labels

  Example: Label every other year on x-axis
- Remove tick marks for categorical data

In cases where all of the above is generated by the graphing software by default, do not hesitate to edit it out wherever possible

De-emphasizing Gridlines



"Vital Statistics: A Mixed Report on American Health"
By NICHOLAS BAKALAR
New York Times, Jan 25, 2010

Tricking Excel to do this:
http://peltiertech.com/Excel/Charts/ArbitraryGridlines.html

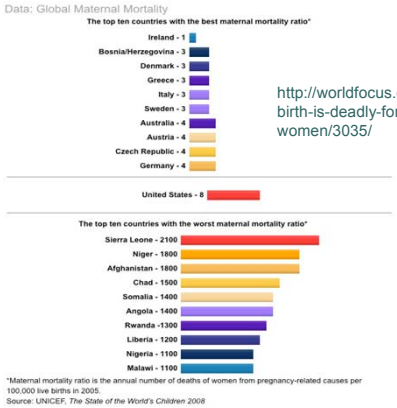
Use of Color

- Color should be used only if it conveys additional information
- In general, use soft colors in graphs and reserve bolder, brighter colors for points that you want to stand out
- If color is used to distinguish two different categories, make sure they are different enough in intensity to be distinguished in black and white and for the color blind
- Gradations of one color should only be used with ordered variables, not nominal variables

http://www.perceptualedge.com/articles/Whitepapers/Communicating_Numbers.pdf

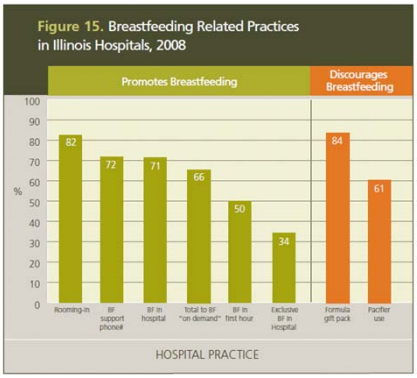
http://www.perceptualedge.com/articles/visual_business_intelligence/rules_for_using_color.pdf

Ineffective Use of Color



http://worldfocus.org/blog/2008/12/02/birth-is-deadly-for-guatemalan-women/3035/

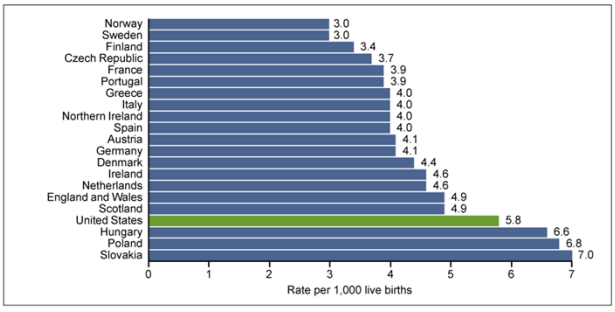
Effective Use of Color



http://www.ilbreastfeedingblueprint.org/

Effective Use of Color

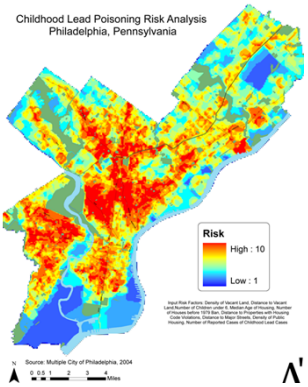
Figure 2. Infant mortality rates, excluding births at less than 22 weeks of gestation, United States and selected European countries, 2004



SOURCE: NCHS linked birth/infant death data set (for U.S. data) and *European Perinatal Health Report* (for European data).

http://www.cdc.gov/nchs/data/databriefs/db23.htm

Effective Use of Color



http://www.cdc.gov/gis/mg_lead_poisoning.htm

Minimize Chartjunk

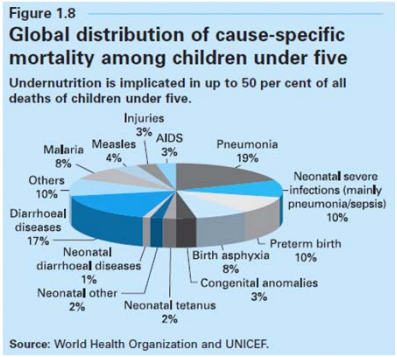
"Chartjunk" = Visual elements in charts that are not necessary to comprehend the information and distract viewer from information

- Background colors or graphics
- Pictures
- Clip art or animations
- 3-D effects – distort images

Tufte, Edward R. (1983). *The Visual Display of Quantitative Information.* Cheshire, CT: Graphics Press.

80

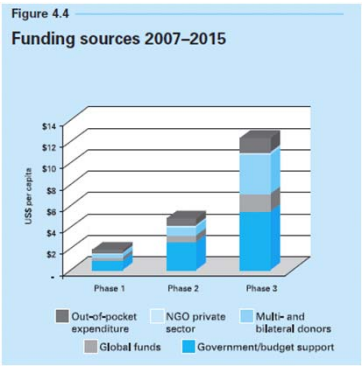
3-D Distortion



http://www.unicef.org/publications/files/The_State_of_the_Worlds_Children_2008.pdf

81

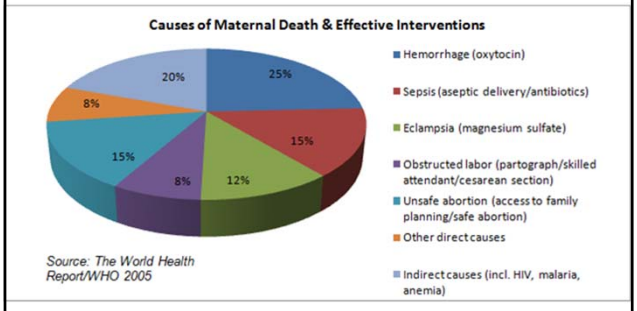
3-D Distortion



http://www.unicef.org/publications/files/The_State_of_the_Worlds_Children_2008.pdf

82

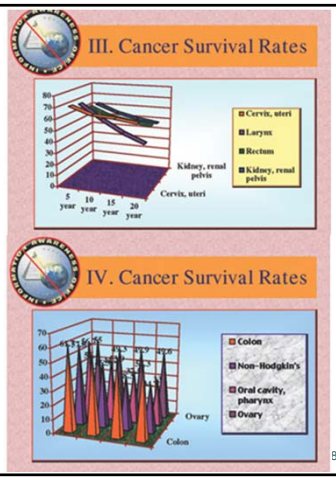
3-D Distortion



http://confutata.com/2010/03/12/safe-birth-is-a-human-rights-issue/

83

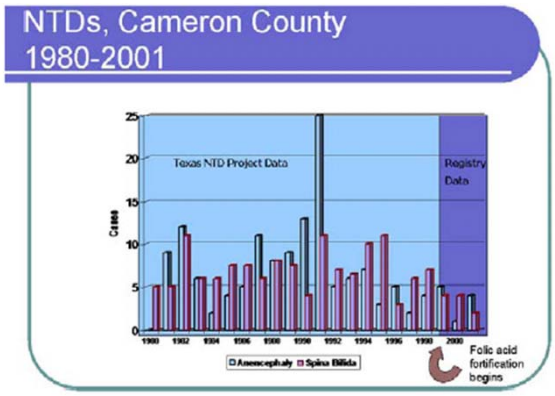
3-D Distortion



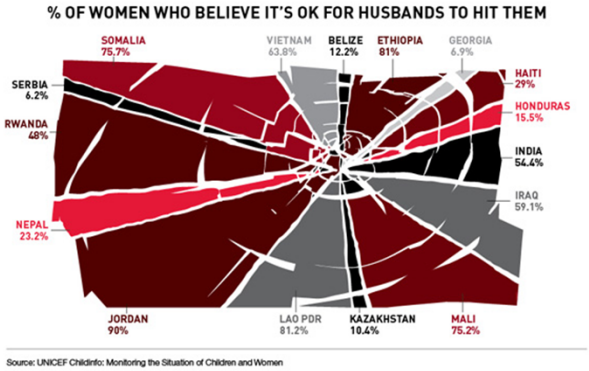
http://www.edwardtufte.com/bboard/q-and-a-fetch-msg?msg_id=0000Jr

84

Chartjunk



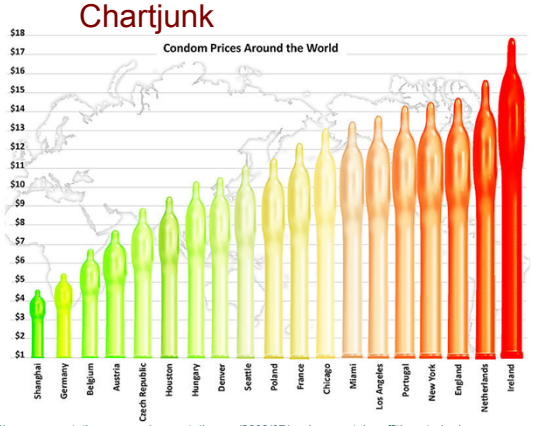
Chartjunk



http://www.globalhealthmagazine.com/screenshots/of_women_who_believe_its_ok_for_husbands_to_hit_them

86

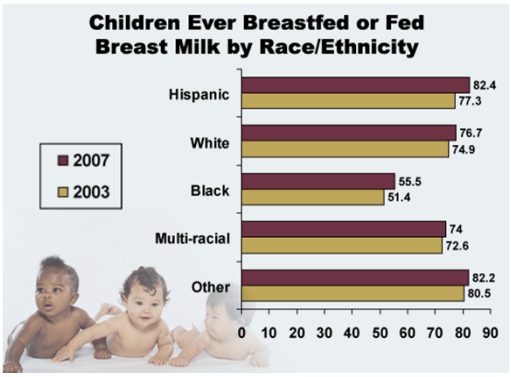
Chartjunk



http://www.presentationzen.com/presentationzen/2008/07/environmental-graffiti-posted-a-bar-chart-suitable-for-entry-into-the-bar-chart-hall-of-shame-i-made-a-list-of-at-least-ten.html

87

Chartjunk?



http://www.cdc.gov/Features/dsBreastfeedingNSCH/

88

CLOSING THOUGHTS

89

Consider Your Audience Means Respect Your Audience

- Don't underestimate audience and "dumb-down" content

Educate as you inform

  - Example: if you never show standard errors because your audience doesn't understand them, your audience will never understand them
- Use "plain language"
  - A plain language document-one in which people can
    - Find what they need
    - Understand what they find
    - Act appropriately on that understanding

PLAIN LANGUAGE: A PROMISING STRATEGY FOR CLEARLY COMMUNICATING HEALTH INFORMATION AND IMPROVING HEALTH LITERACY
http://www.health.gov/communication/literacy/plainlanguage/PlainLanguage.htm

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Consider Your Audience Means Respect Your Audience

Plain language:

- Organize information so the most important behavioral or action points come first
- Break complex information into understandable chunks
- Use simple language or define technical terms
- Provide ample white space so pages look easy to read
- Use short sentences and active voice
- "Plain language is not "dumbing down"…
  - "Plain language is not just about vocabulary or grade level. Writing to a certain grade level does not necessarily ensure that the message is in plain language or understood by the intended audience…"

PLAIN LANGUAGE: A PROMISING STRATEGY FOR CLEARLY COMMUNICATING HEALTH INFORMATION AND IMPROVING HEALTH LITERACY
http://www.health.gov/communication/literacy/plainlanguage/PlainLanguage.htm

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Educate as you Inform

Explaining Confidence Intervals

Question: Outcome #2: CSHCN who receive coordinated, ongoing, comprehensive care within a medical home (derived)

Region		Outcome successfully achieved	Outcome not achieved	Total %
Nationwide	%	47.1	52.9	100.0
	C.I.	(46.3 - 48.0)	(52.0 - 53.7)	
	n	18,977	19,909	
	Est.	4,588,731	5,146,261	
Minnesota	%	51.8	48.2	100.0
	C.I.	(47.7 - 55.9)	(44.1 - 52.3)	
	n	390		
	Est.	88,280		

The 95% confidence interval (C.I.) is a range that contains the true population value 95% of the time. The 95% C.I. is a standard that is widely used among researchers. A smaller C.I. range indicates a more precise estimate.

DATA ALERT: Click here for information compar

For a detailed explanation of the data MOVE your cursor over the text in the table or the bold text below
C.I. = 95% Confidence Interval. Percentages are weighted to population characteristics.
n = Cell size. Use caution in interpreting Cell sizes less than 50.

http://www.cshcndata.org/DataQuery/DataQueryResults.aspx

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Educate as You Inform: Explaining Adjustment

- To more accurately portray relationships between risk factors and health outcomes, we use a statistical approach called "adjustment" to account for characteristics that might distort what we see
  - Example: We adjust for a woman's age and educational level to better understand the relationship between cigarette smoking and infant mortality
- The information about relationships between risk factors and MCH is reported using adjustment. This approach accounts for differences among women that might distort what we see.
  - Example: The relationship between cigarette smoking and infant mortality might be distorted unless we adjust for the differences in women's age and educational level
- The statistics reported are adjusted so that they account for differences between women. With this approach, the comparisons we report, for example between those with and without health insurance, are accurate ***regardless of other factors***

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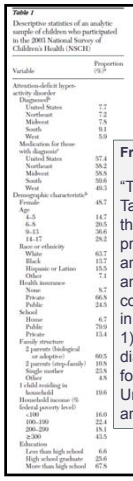
Table 1
Descriptive statistics of an analytic sample of children who participated in the 2003 National Survey of Children's Health (NSCH)

Variable — Proportion (%)[a]

Attention-deficit hyperactivity disorder
Diagnosed[b]
United States 7.7
Northeast 7.2
Midwest 7.8
South 9.1
West 5.9
Medication for those with diagnosis[c]
United States 57.4
Northeast 58.2
Midwest 59.8
South 59.6
West 49.3
Demographic characteristics[b]
Female 48.7
Age
4–5 14.7
6–8 20.5
9–13 36.6
14–17 28.2
Race or ethnicity
White 63.7
Black 13.7
Hispanic or Latino 15.5
Other 7.1
Health insurance
None 8.7
Private 66.8
Public 24.5
School
Home 6.7
Public 79.9
Private 13.4
Family structure
2 parents (biological or adoptive) 60.5
2 parents (step-family) 10.8
Single mother 23.8
Other 4.8
1 child residing in household 19.6
Household income (% federal poverty level)
<100 16.0
100–199 22.4
200–299 18.1
≥300 43.5
Education
Less than high school 6.6
High school graduate 25.6
More than high school 67.8

Educate as you Inform

Fulton, et al 2009, *Psychiatric Services*, NSCH (2003) analysis:

From the Results Section:

"To aid interpretation [of Table 3], we translated the odds ratios into probabilities using a boy and girl between age nine and 13 with the most common characteristics in the sample (see Table 1). The predicted diagnostic prevalence for the boy and girl for the United States was 10.7% and 4.1%, respectively…"

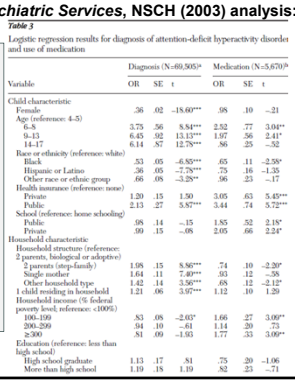
Table 3
Logistic regression results for diagnosis of attention-deficit hyperactivity disorder and use of medication

Variable	Diagnosis (N=69,505)[a] OR	SE	t	Medication (N=5,670)[b] OR	SE	t
Child characteristic						
Female	.56	.02	−18.60***	.98	.10	−.21
Age (reference: 4–5)						
6–8	3.75	.56	8.84***	2.52	.77	3.04**
9–13	6.45	.92	13.13***	1.97	.56	2.41*
14–17	6.14	.87	12.78***	.86	.25	−.52
Race or ethnicity (reference: white)						
Black	.53	.05	−6.85***	.65	.11	−2.58*
Hispanic or Latino	.56	.05	−7.78***	.75	.16	−1.35
Other race or ethnic group	.66	.08	−3.28**	.96	.23	−.17
Health insurance (reference: none)						
Private	1.20	.15	1.50	3.05	.63	5.45***
Public	2.13	.27	5.87***	3.44	.74	5.72***
School (reference: home schooling)						
Public	.98	.14	−.15	1.85	.52	2.18*
Private	.99	.15	−.08	2.05	.66	2.24*
Household characteristic						
Household structure (reference: 2 parents, biological or adoptive)						
2 parents (step-family)	1.98	.15	8.86***	.74	.10	−2.20*
Single mother	1.64	.11	7.40***	.93	.12	−.58
Other household type	1.42	.14	3.56***	.68	.12	−2.12*
1 child residing in household	1.21	.06	3.97***	1.12	.10	1.29
Household income (% federal poverty level, reference: <100%)						
100–199	.83	.08	−2.03*	1.66	.27	3.09**
200–299	.94	.10	−.61	1.14	.20	.73
≥300	.81	.09	−1.93	1.77	.33	3.09**
Education (reference: less than high school)						
High school graduate	1.13	.17	.81	.75	.20	−1.06
More than high school	1.19	.18	1.19	.82	.23	−.71

Balancing Clarity and Detail

Consider a layered approach to presenting results in order to allow audience to drill down from summary points to details:

1. Executive Summary
2. Detailed graphs and charts with annotation and accompanying narrative/pictures
3. Appendix with all underlying tables and statistical results, as well as methods and data source description

Prior to finalizing reports, always pilot materials with a few people who are unfamiliar with the data to make sure your message is getting across as anticipated; Revise as necessary

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Take-Home Message

Analytic methods need not be simplistic in order to deliver a clear, simple message and scientific rigor should be practiced regardless of the audience

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