

Principles of Data Presentation



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Learning Objectives

- Identify **key steps** in effective data presentation
- Determine **when** data are best displayed in **text**, **tables** and **figures**
- Identify **design features** of **effective tables** and **effective figures**

Topics of this presentation

- Purpose of data presentation
- Types of data presentation
- Steps in effective data presentation
- Design features of good tables
- Design features of good graphs (data visualization)

Purpose of data presentation

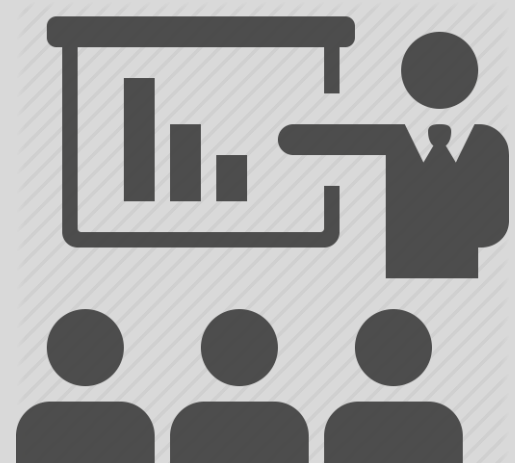
- To communicate data to the audience *effectively*
- To provide evidence for *decision* and *action*

What is effective data presentation?

- Data presentation is effective when it
 - catches the audience 's **attention** quickly
 - is **easily** and **quickly understood**
 - tells a **data story**
 - has **relevance** for the audience
 - encourages the audience to **use your data** appropriately

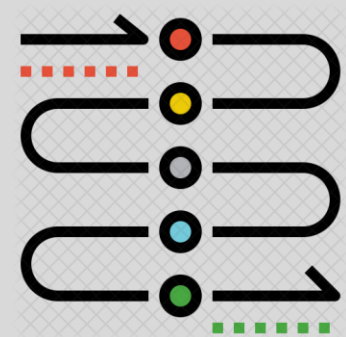
Types of data presentation

- Technical report
- Theses and dissertations
- Research articles
- Poster
- Policy briefs
- Press releases
- Newspaper articles
- Dashboards
- Info graphics
- Oral presentations
- Public talks



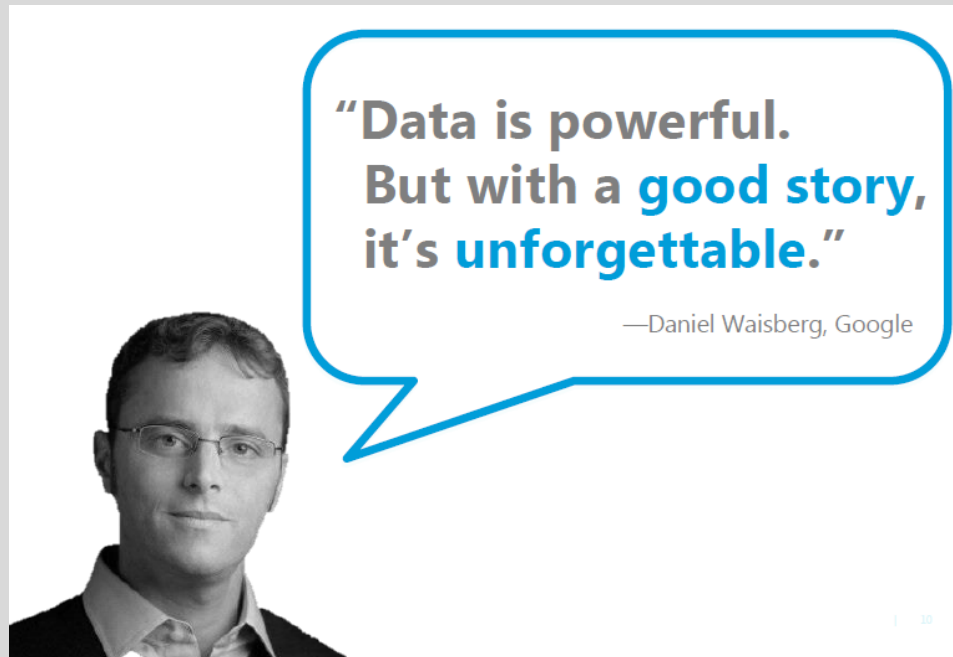
Steps in effective data presentation

1. Determine the **messages**
2. Know your **audience**
3. Choose the **right kind of presentation**
(text, tables, figures)
4. Apply **good design features**
 - Follow standard **formats (style guide)**
 - Eliminate clutter (**declutter**)
 - **Focus** attention where you want
5. Tell a **story**



1. Determine the messages

- (1.1) Find the story in the data



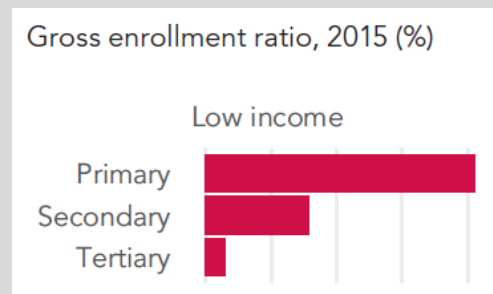
- (1.2) Storyboard
- (1.3) Sketch first

(1.1) Find the story in the data

- Keep your **objectives** in mind
- Exploratory data analysis (**EDA**)
by tables and figures

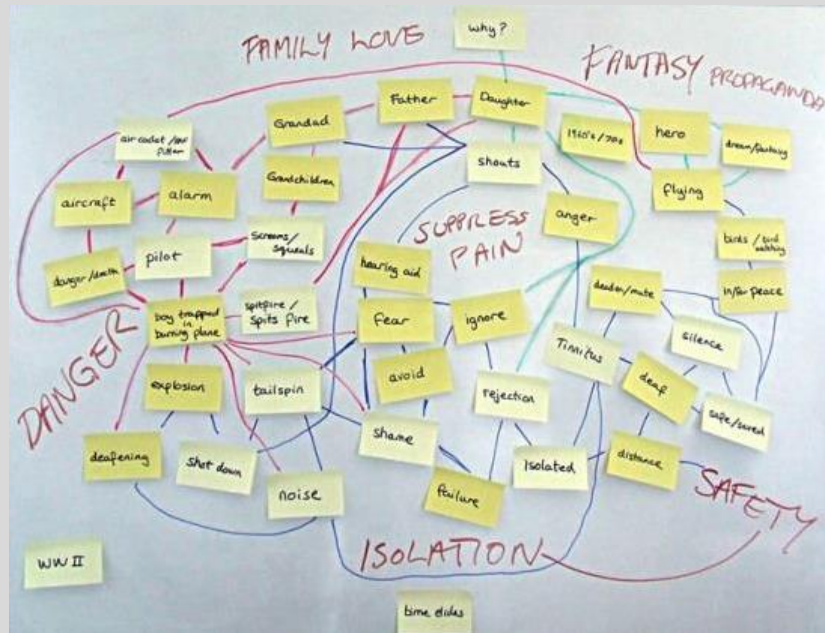
- Trends
- Ranges
- Patterns
- Comparisons
- Surprises

	National		
	Mean	Poverty	Elasticity
2004/05	1450	44.5	
2009/10	1638	37.5	-1.2
2015	1898	26.1	-1.9
2005-2015			-1.3



(1.2) Storyboard

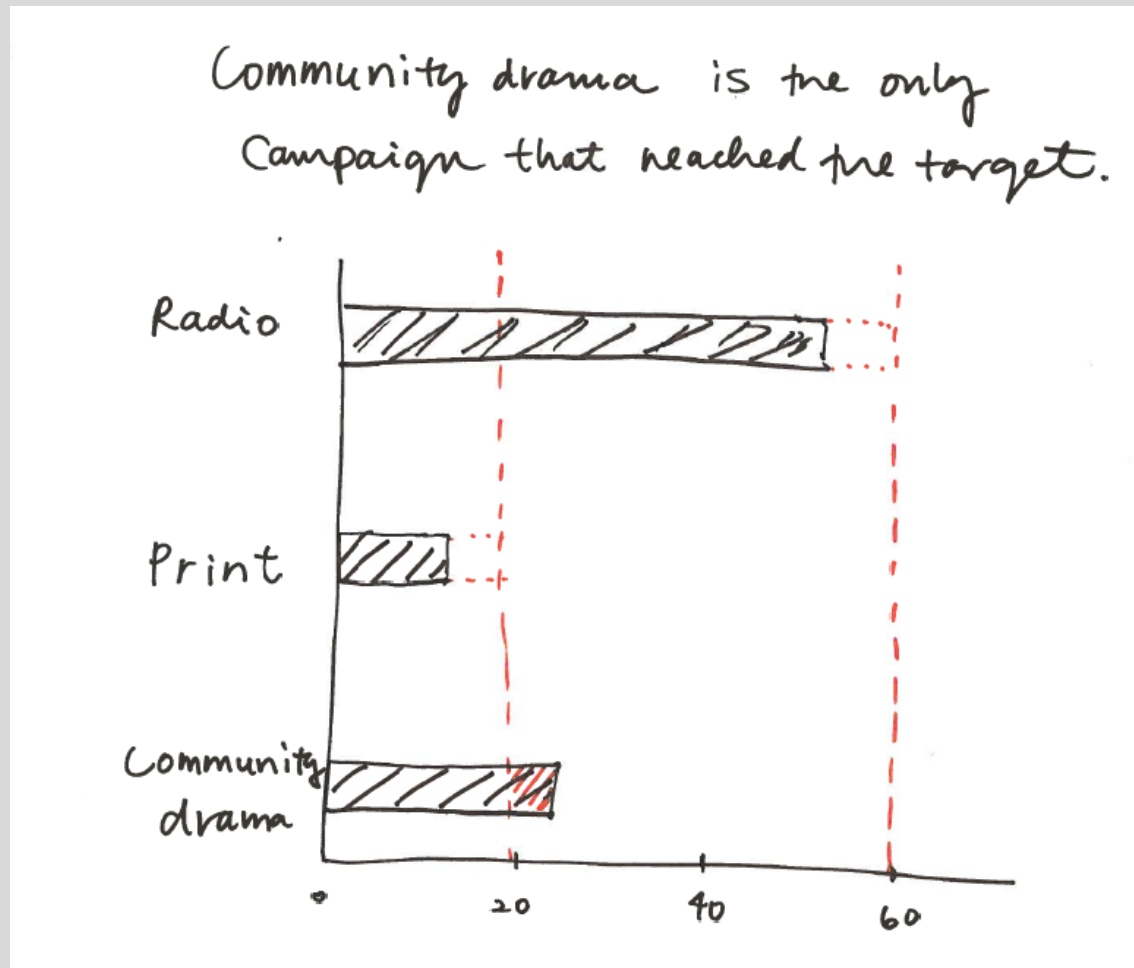
- For a complex story, create a storyboard through collaborative brainstorming



1. **Select the story points** (facts/findings)
2. **Post-its**
3. **Arrange** (group and order)

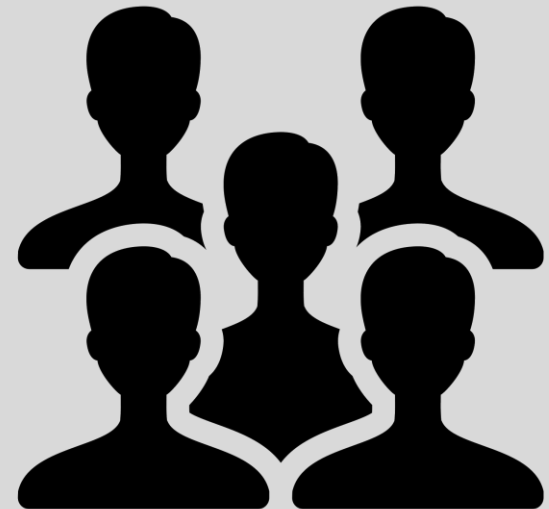
(1.3) Sketch first

- For a simple story, sketching is just ok



2. Know your audience

- Different persons have different data needs.
- Consider your audience's
 - education
 - literacy
 - numeracy/graph literacy
 - what data they need



2. Know your audience

- Think beyond job titles and organizations
- Developing **Audience Personas**



3. Choose the right kind of presentation

- (3.1) Text

- present 2 or 3 pieces of data
- **highlight/summarizes** the main points in tables/figures



- (3.2) Tables

- the **exact values**
- both the **values and derived measures** such as frequency and percentages or total number and means.

WHO region	High quality	Medium quality	Low quality	Very low quality or no data	Total
AFR	1	2	1	43	47
AMR	10	18	4	3	35
SEAR	0	0	3	8	11
EUR	33	12	8	0	53
EMR	0	1	7	13	21
WPR	5	5	3	14	27
Global (percentage)	49 (25%)	38 (20%)	25 (13%)	81 (42%)	194

- (3.3) Figures

- **Patterns, Trends, Comparisons**
- **Complex** relationships
- **Geographic** variation



(3.1) Text

- Present a few numbers

“Overall, 36% of women and 22% of men reported betel chewing.”

- Summarize/highlight the results in tables and figures

“Then mean blood glucose concentration was 50% lower in the 16 patients treated with drug X than in the 14 untreated patients (Table 3). ”

(3.1) Text

- Present a few numbers

“Overall, 36% of women and 22% of men reported betel chewing.”

- Summarize/highlight the results in tables and figures

“Then mean blood glucose concentration was 50% lower in the 16 patients treated with drug X than in the 14 untreated patients (Table 3). ”

Text table

November 2009; 35(4)

103

European Science Editing

Text-table: an underused and undervalued tool for communicating information

Marcin Kozak

*Department of Experimental Design and Bioinformatics, Warsaw University of Life Sciences, Nowoursynowska 159,
02-776 Warsaw, Poland; nyggus@gmail.com*

- something between a sentence and a table.
- a simple table with no graphical elements (such as grid lines, rules, shading, or boxes)
- embedded within a text
- no reference to it (“see Table 1”) is needed.

Text table: *examples*

Sentences:

Causes of death in Myanmar were communicable, maternal and neonatal in 17% of deaths, non-communicable in 72% of deaths and injuries in 11% of deaths.

Text table:

Causes of death in Myanmar are:

Communicable, maternal and neonatal	17% of deaths
Non-communicable	72% of deaths
Injuries	11% of deaths.

Text table: *examples*

Sentences:

Germplasm group dry matter means were 470 g kg⁻¹ for Northern Upland, 436 g kg⁻¹ for Southern Upland, 396 g kg⁻¹ for Northern Lowland, and 378 g kg⁻¹ for Southern Lowland.

Text table:

Germplasm group dry matter means were

Northern Upland	470 g kg ⁻¹
-----------------	-------------------------------

Southern Upland	436 g kg ⁻¹
-----------------	-------------------------------

Northern Lowland	396 g kg ⁻¹
------------------	-------------------------------

Southern Lowland	378 g kg ⁻¹
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(3.2) Table

Minimum requirement is (2 x 2) or (2 x 3) data cells.

Table 20.20 A Table Showing Restoration of Data Integrity*

Variable, units	Control Group (<i>n</i> = 66)	Treatment Group (<i>n</i> = 83)
Women, <i>n</i> (%)	45 (68)	54 (65)
Mean (SD) age, years	36 (7.3)	35 (7.0)
Symptomatic, <i>n</i> (%)	19 (29)	26 (31)

* Data integrity has been restored by moving the restrictive column head to the row head.

(3.2) Table

A table is an arrangement of ***numbers*** or words in columns and rows.

Table: Predicted future population sizes of different countries

Table 2.4 from Samuelson's Economics

<i>Percentages and millions</i>				
	Annual Growth (% per year)	1970	1980	1985
United States	1.3	205.0	226.0	240.0
United Kingdom	0.6	55.1	59.5	61.8
France	0.8	50.8	55.3	57.6
Soviet Union	1.0	243.0	271.0	287.0
Sweden	0.7	8.0	8.6	8.8
Italy	0.8	53.7	57.9	60.0
Japan	1.2	103.0	116.0	121.0

Adapted from Ehrenberg (1977)

Source: United Nations

(3.2) Table

A table is an arrangement of numbers or ***words*** in columns and rows.

<i>Table 1.1.</i> COMPARISON OF THE TYPES OF SCIENTIFIC EVIDENCE			
Characteristic	Type One	Type Two	Type Three
Goal/action	Identify a problem or priority (something should be done)	Identify what works (what should be done)	Identify how to implement (what works for whom, in what context, and why)
Typical data/relationship	Size and strength of preventable risk—disease relationship (measures of burden, descriptive data, etiologic research)	Relative effectiveness of public health intervention	Information on the adaptation and implementation of an effective intervention
Common setting	Clinic or controlled community setting	Socially intact groups or community-wide	Socially intact groups or community-wide
Example 1 questions	Does smoking cause lung cancer?	Will price increases with a targeted media campaign reduce smoking rates?	What are the political challenges of price increases in different geographic settings?
Example 2 questions	Is the density of fast-food outlets linked with obesity?	Do policies that restrict fast-food outlets change caloric intake?	How do community attitudes about fast-food policies influence policy change?
Quantity	Most	Moderate	Least

Source: Brownson, R.C., 2018. Evidence- Based Public Health.

2 types of table by purpose

- **Presentation table**

- (Demonstration table / Analytical table)**

- Extracted from reference tables
 - Concise, well-organized way to support the accompanying analysis.
 - Used in **main body** of the article/report

- **Reference table**

- A large number of entries
 - Different categories (alphabetical/official order).
 - Usu. in an ***appendix*** or an accompanying spreadsheet.

Presentation table

Table1. Age-specific CFR of Covid-19 up to 2021-01-13, Myanmar

Age (years)	Number of positives	Number of deaths	CFR (%)
<15 Years	9299	7	0.1
15-29 Years	45527	35	0.1
30-44 Years	34194	160	0.5
45-60 Years	24186	700	2.9
61-75 Years	14045	1271	9.0
>75 Years	3506	728	20.8
Total	130757	2901	2.2

CFR = Case Fatality Rate

Source: CEU, MOHS, Myanmar

Reference table

Table 2. COVID-19 confirmed cases and deaths reported in the last seven days by countries, territories and areas, and WHO Region, as of 17 January 2021**

Reporting Country/Territory/Area ⁱ	New cases in last 7 days	Cumulative cases	Cumulative cases per 100 thousand population	New deaths in last 7 days	Cumulative deaths	Cumulative deaths per 100 thousand population	Transmission classification ⁱⁱ
Africa	177 252	2 313 130	206.2	5 000	52 905	4.7	
South Africa	111 483	1 325 659	2 235.2	4 027	36 851	62.1	Community transmission
Nigeria	11 465	108 943	52.8	78	1 420	0.7	Community transmission
Zambia	9 507	36 074	196.2	68	532	2.9	Community transmission
Zimbabwe	6 382	26 881	180.9	200	683	4.6	Community transmission
Mozambique	4 501	25 862	82.7	47	234	0.7	Community transmission
Lesotho	3 794	6 371	297.4	47	97	4.5	Community transmission
Malawi	3 479	11 785	61.6	80	300	1.6	Community transmission
Ethiopia	2 980	130 772	113.8	44	2 029	1.8	Community transmission
Namibia	2 475	30 198	1 188.5	29	280	11.0	Community transmission
Senegal	1 738	22 738	135.8	50	509	3.0	Community transmission
Algeria	1 698	103 611	236.3	28	2 831	6.5	Community transmission
Democratic Republic of the Congo	1 658	20 625	23.0	19	629	0.7	Community transmission
Côte d'Ivoire	1 602	24 856	94.2	3	141	0.5	Community transmission
Eswatini	1 556	12 736	1 097.8	69	360	31.0	Community transmission
Rwanda	1 389	10 850	83.8	22	140	1.1	Clusters of cases
Ghana	1 209	56 981	183.4	5	341	1.1	Community transmission
Burkina Faso	1 134	9 000	43.1	12	101	0.5	Community transmission
Kenya	898	99 082	184.3	24	1 728	3.2	Community transmission
Niger	810	4 132	17.1	34	138	0.6	Community transmission
Mauritania	679	15 893	341.8	18	396	8.5	Community transmission
Cabo Verde	664	12 901	2 320.4	5	119	21.4	Community transmission
Angola	609	18 765	57.1	15	431	1.3	Community transmission
Congo	549	7 709	139.7	14	114	2.1	Community transmission
Uganda	531	38 085	83.3	3	304	0.7	Community transmission
Cameroon	488	27 336	103.0	3	451	1.7	Community transmission

Source: WHO. Weekly epidemiological update - 19 January 2021

3 types of table by structure

- **1-way table (a single explanatory variable)**
- **2- way table (2 explanatory variables)**
- **multi-way table (3 or more explanatory variables)**

1-way table (a single explanatory variable)

Table 20.2 A One-Way Table Shows One Explanatory Variable*

Response Variable	Control Group (<i>n</i> = 118)	Treatment Group (<i>n</i> = 123)
Variable 1, mg	1	2
Variable 2, kg	3	4
Variable 3, mg/dL	5	6

* Group, with values of treatment and control. Also called a 2×3 table because the data field contains 6 cells.

2- way table (2 explanatory variables)

Table 20.3 A Two-Way Table Shows Two Explanatory Variables*

Response Variable	Control Group (<i>n</i> = 118)		Treatment Group (<i>n</i> = 123)	
	Men (<i>n</i> = 57)	Women (<i>n</i> = 61)	Men (<i>n</i> = 55)	Women (<i>n</i> = 63)
Variable 1, mg	1	2	3	4
Variable 2, kg	5	6	7	8
Variable 3, mg/dL	9	10	11	12

* Group, with values of treatment and control, and sex of patients in each group. Also called a 4×3 table because the data field contains 12 cells. The column headings of control and treatment group are now spanner headings that cover the subgroups of men and women.

multi-way table (3 or more explanatory variables)

Table 20.4 A Three-Way Table Shows Three Explanatory Variables*

Response Variable	Control Group (<i>n</i> = 118)				Treatment Group (<i>n</i> = 123)			
	Men (<i>n</i> = 57)		Women (<i>n</i> = 61)		Men (<i>n</i> = 57)		Women (<i>n</i> = 66)	
	Right	Left	Right	Left	Right	Left	Right	Left
	(<i>n</i> = 45)	(<i>n</i> = 12)	(<i>n</i> = 48)	(<i>n</i> = 13)	(<i>n</i> = 47)	(<i>n</i> = 10)	(<i>n</i> = 51)	(<i>n</i> = 15)
Variable 1, mg	1	2	3	4	5	6	7	8
Variable 2, kg	9	10	11	12	13	14	15	16
Variable 3, mg/dL	17	18	19	20	21	22	23	24

* Group, with values of treatment and control; sex of patients in each group; and handedness, with values of right and left. Also called an 8×3 table because the data field contains 24 cells. The column headings of men and women are now themselves spanner headings that cover the subgroups of right- and left-handedness.

(3.3) Figures

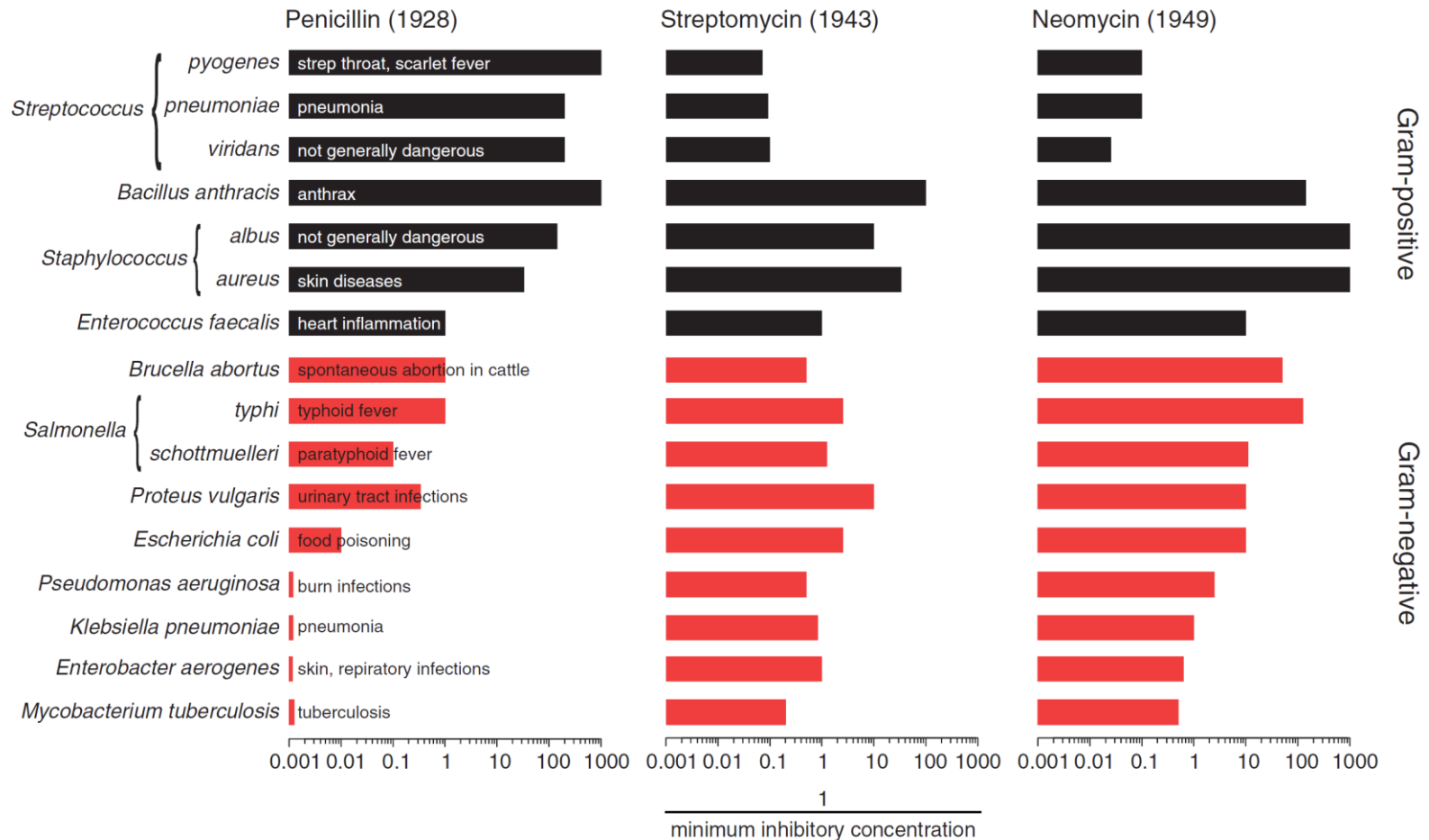
- **Figure** is any type of illustration other than a table.
 - graph
 - chart
 - maps,
 - photograph
 - a drawing
 - any other illustration or non-textual depiction

Figures: some terms

- **Figure**: a drawing or diagram conveying information
- **Graph**: a diagram showing numerical relationship along a pair of axes at right angles.
- **Chart**: visual representation of data. May be used interchangeably with “graph”. But charts may also represent non-numeric data such as flow chart or organization chart.
- **Diagram**: a simplified drawing showing the appearance, structure, or workings of something.
- **Plot**: a graph showing the relation b/t two variables
- **Data visualization (dataviz)**: the representation of information in the form of a chart, diagram, picture, etc.

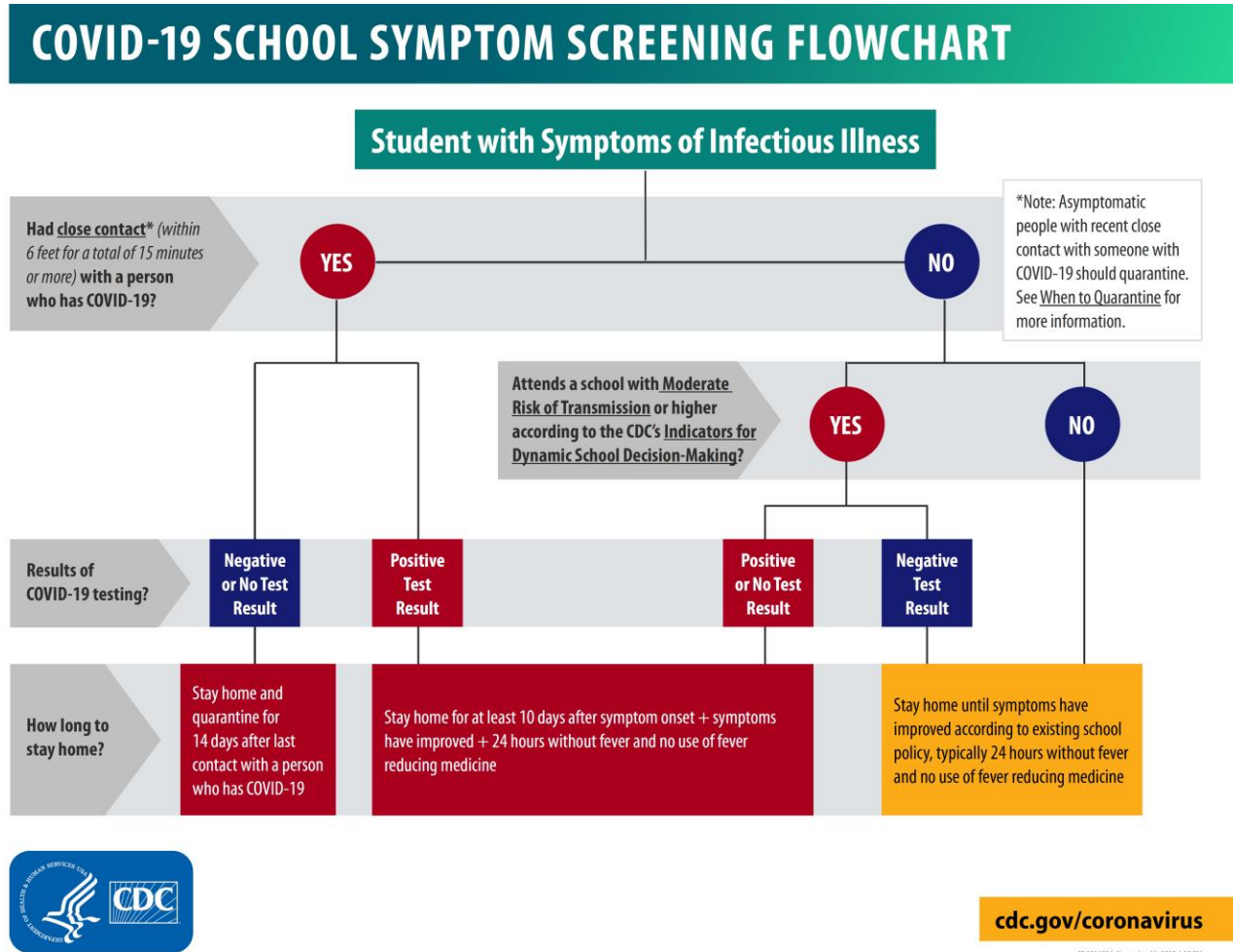
(3.3) Figures: *graph*

Effectiveness of three antibiotics against a variety of bacteria.



Source: Wainer, H., 2014. Medical illuminations: Using evidence, visualization and statistical thinking to improve healthcare. Oxford University Press.

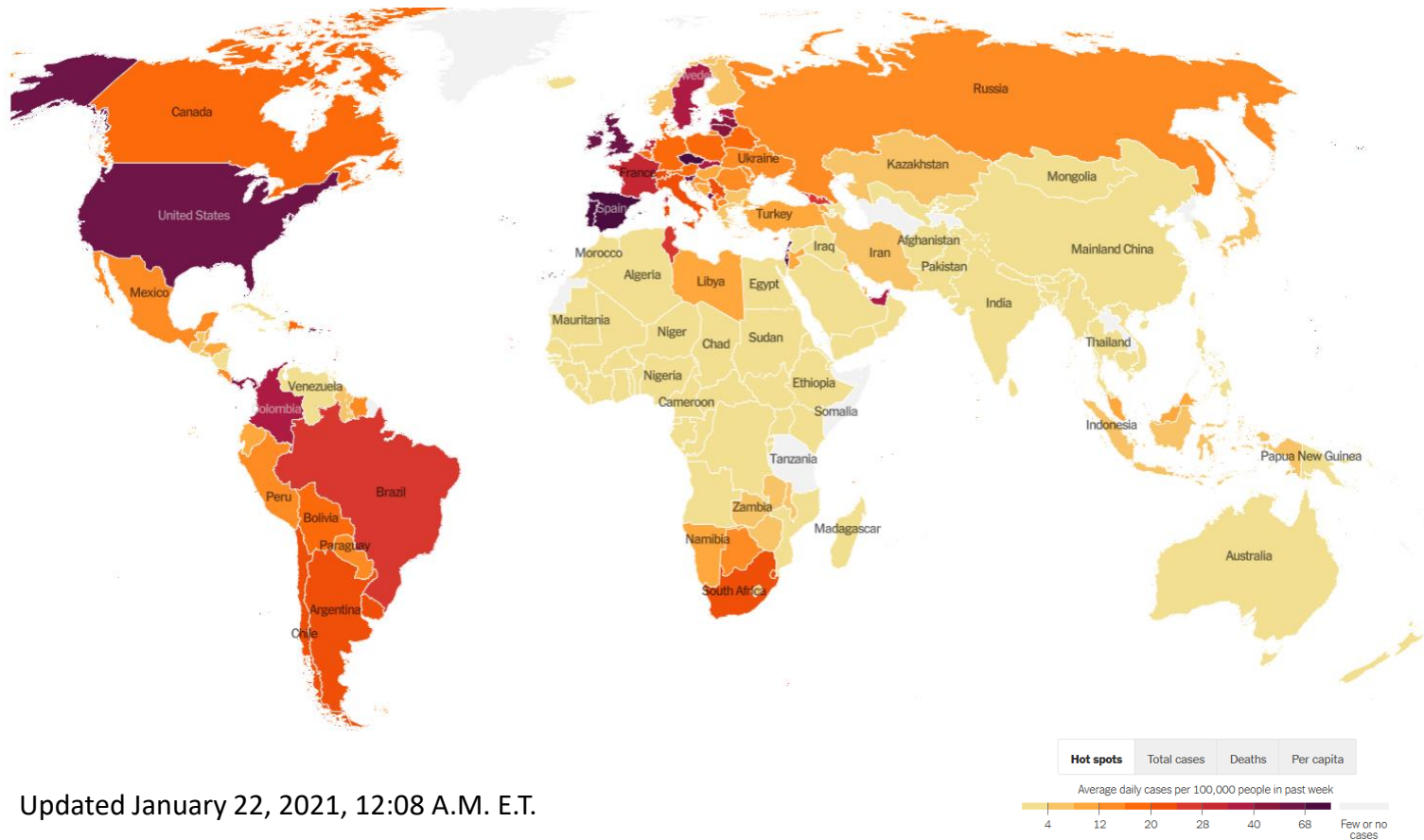
(3.3) Figures: *chart*



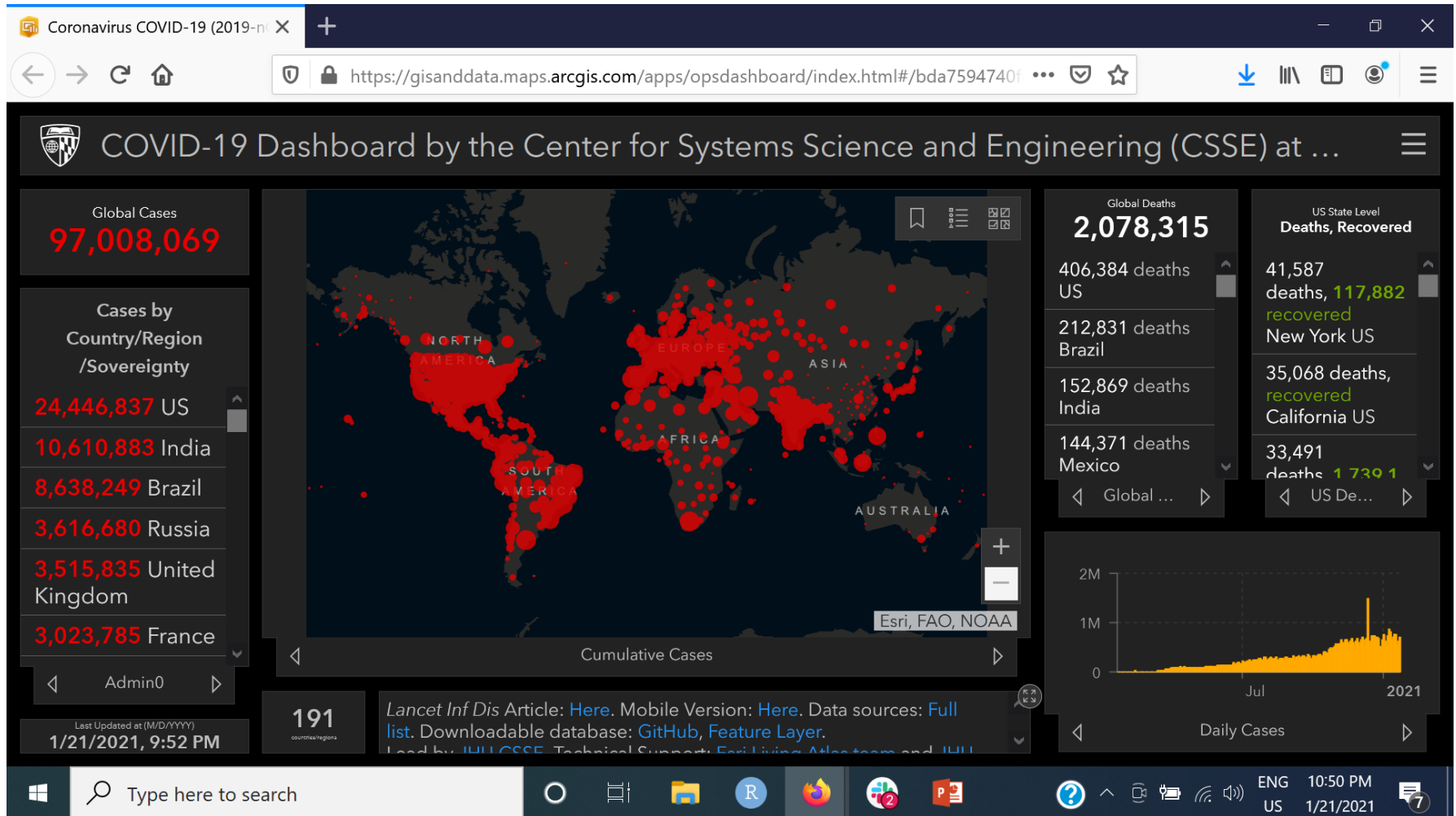
Source: US CDC <https://www.cdc.gov/coronavirus/2019-ncov/downloads/school-screening-flowchrt-print.pdf>

(3.3) Figures: *map*

Fig 1. Tracking the global Covid-19 outbreak



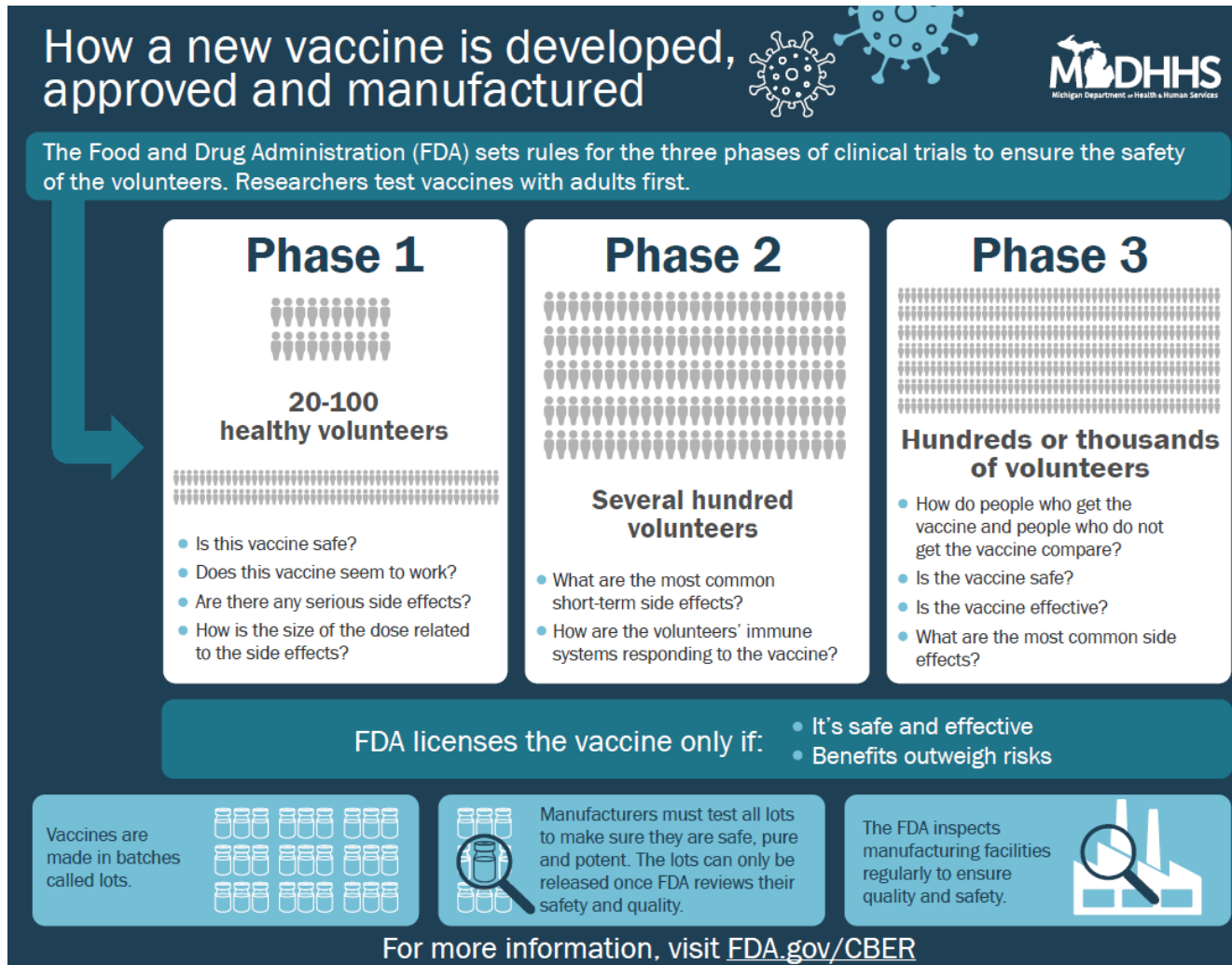
(3.3) Figures: *dashboard*



Source: The Center for Systems Science and Engineering (CSSE) at JHU

<https://gisanddata.maps.arcgis.com/apps/opsdashboard/index.html#/bda7594740fd40299423467b48e9ecf6>

(3.3) Figures: *infographic*

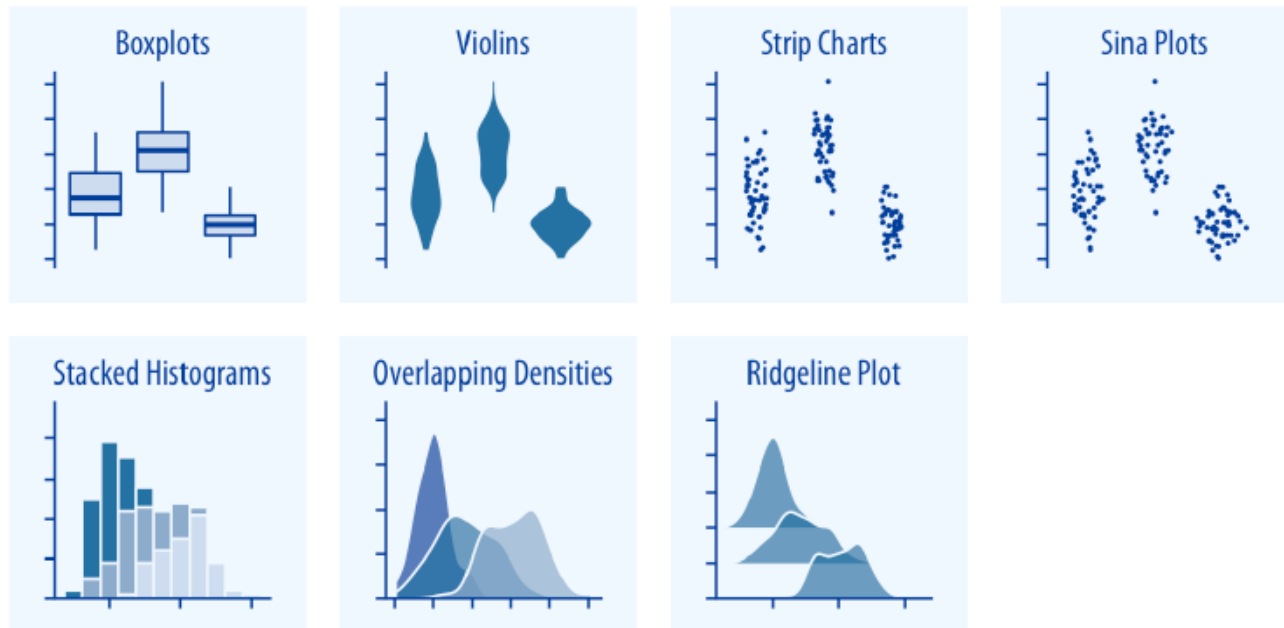
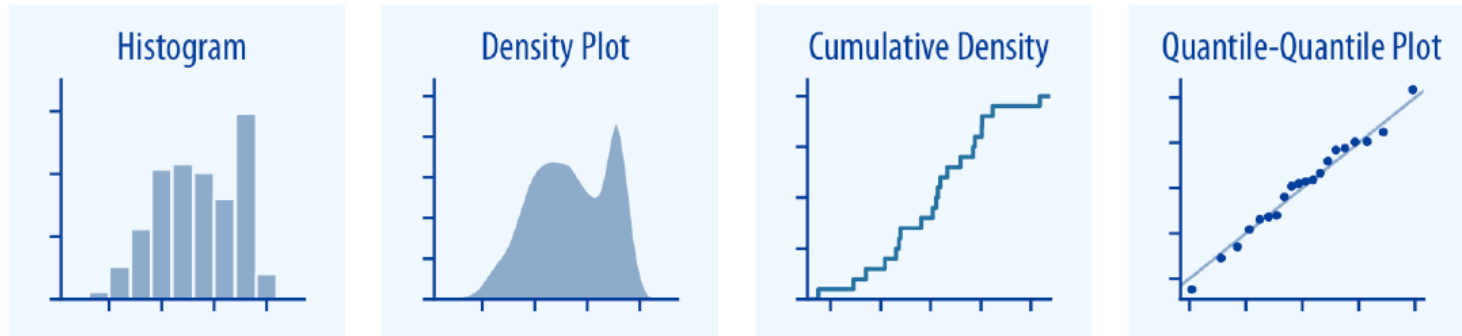


Source: FDA, USA

https://www.michigan.gov/documents/coronavirus/Vaccine_infographic_v2_710069_7.pdf

Type of graphs by purpose

Distributions



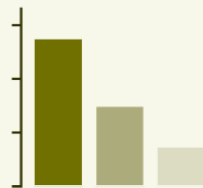
Type of graphs by purpose

Proportions

Pie Chart



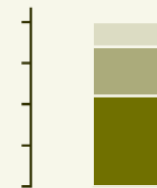
Bars



Bars



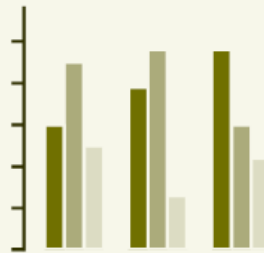
Stacked Bars



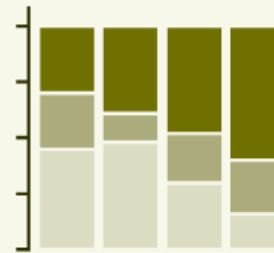
Multiple Pie Charts



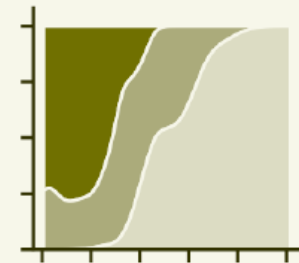
Grouped Bars



Stacked Bars



Stacked Densities



Mosaic Plot



Treemap



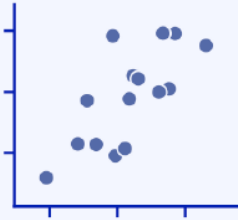
Parallel Sets



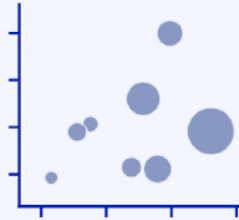
Type of graphs by purpose

x-y relationships

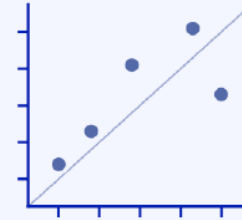
Scatterplot



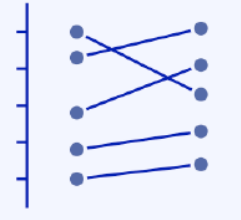
Bubble Chart



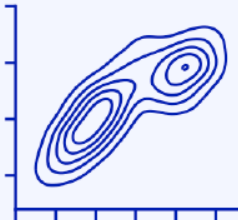
Paired Scatterplot



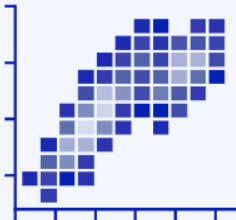
Slopegraph



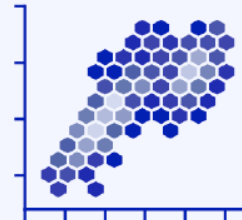
Density Contours



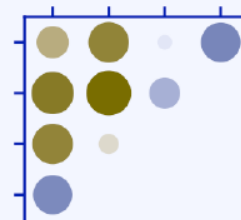
2D Bins



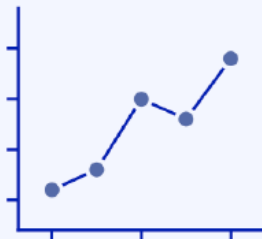
Hex Bins



Correlogram



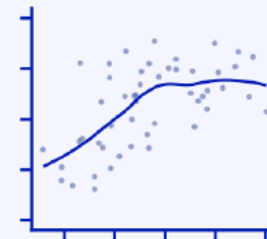
Line Graph



Connected Scatterplot

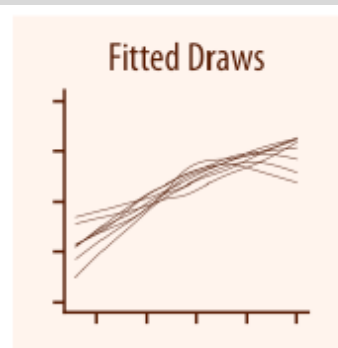
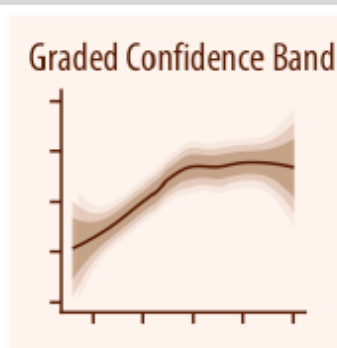
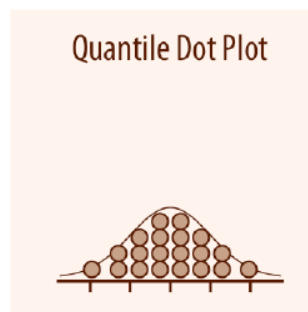
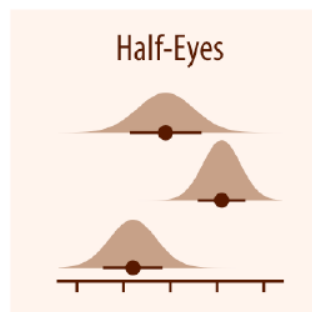
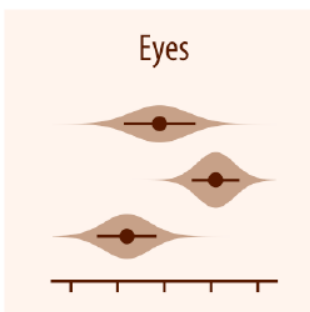
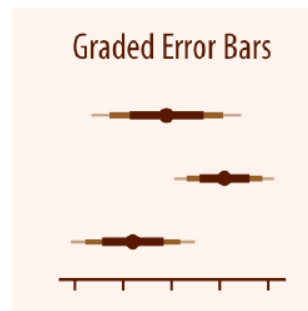
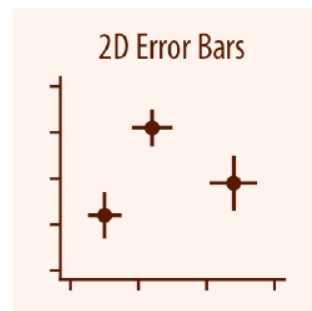


Smooth Line Graph

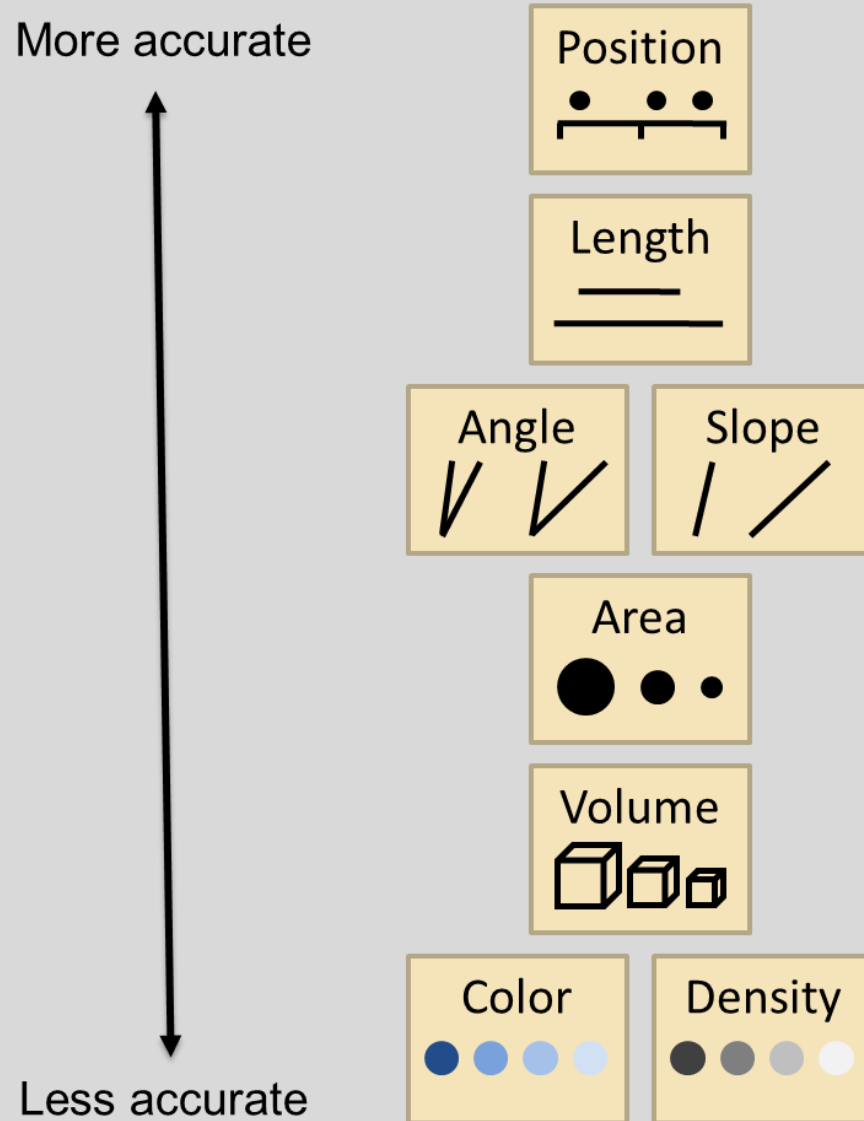


Choose the appropriate dataviz

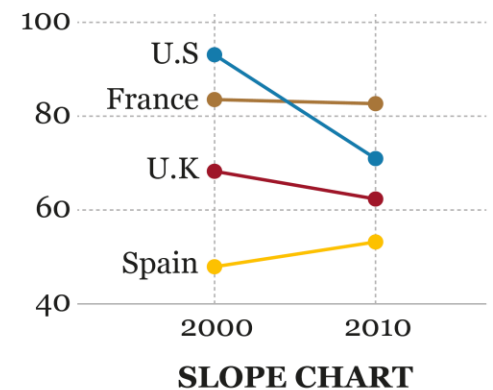
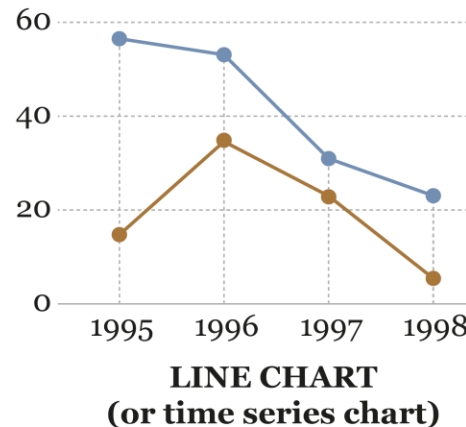
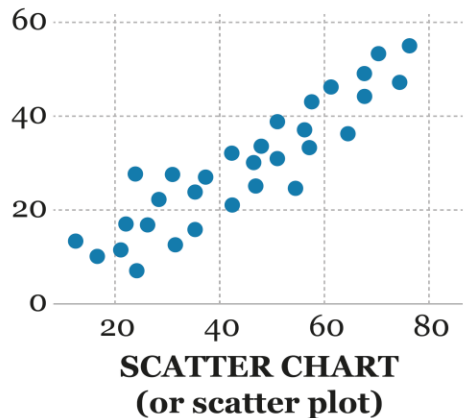
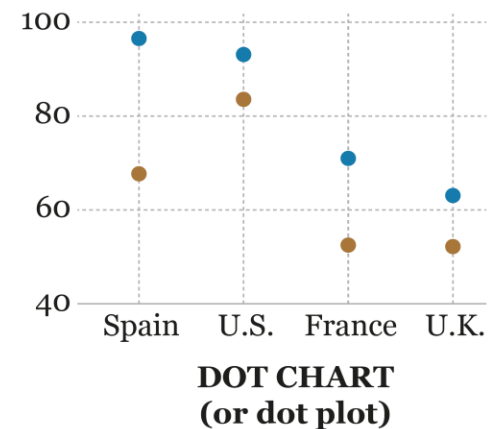
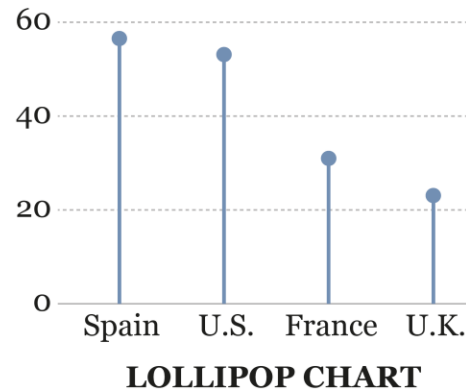
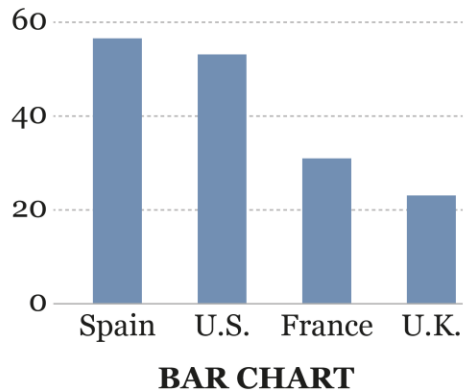
Uncertainty



Accurate perception of quantitative values by geometric objects



Accurate perception of quantitative values by geometric objects (length and position)

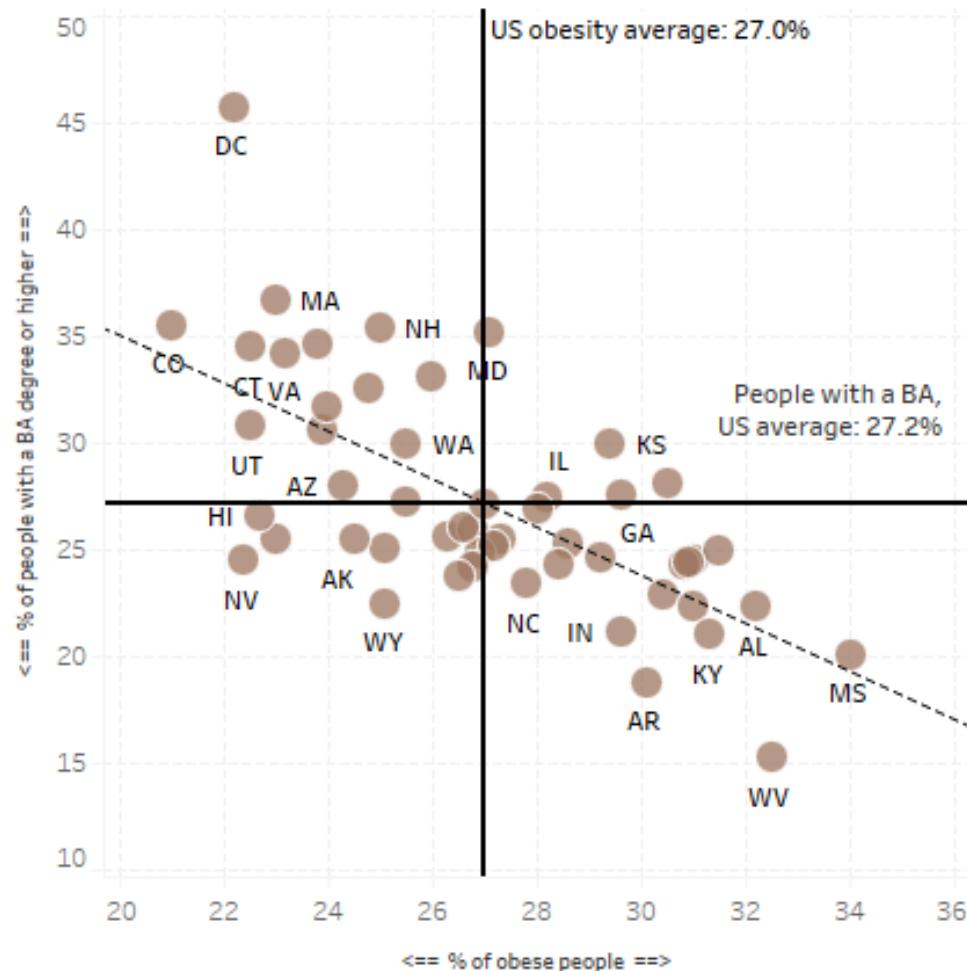


Height, length, position are appropriate encodings to enable accurate judgments: Comparisons, relationships, change over time, etc.

Accurate perception of quantitative values by geometric objects (position)

Scatterplot

The standard way to show the relationship between two continuous variables, each of which has its own axis.

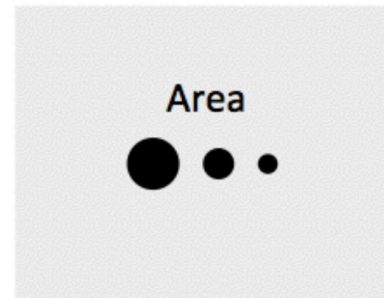
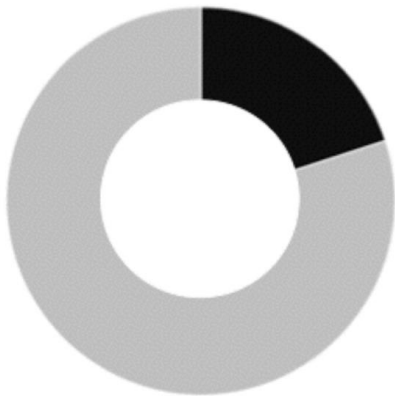
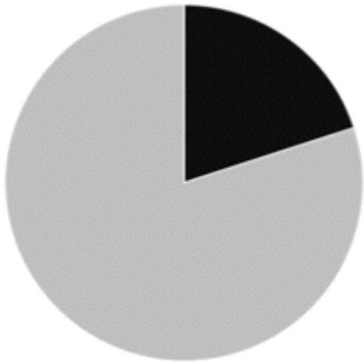


Sum of OBESITY % vs. sum of BA OR HIGHER. The marks are labeled by State Abbr. Details are shown for State.

Accurate perception of quantitative values by geometric objects (area/angle)

Less Effective

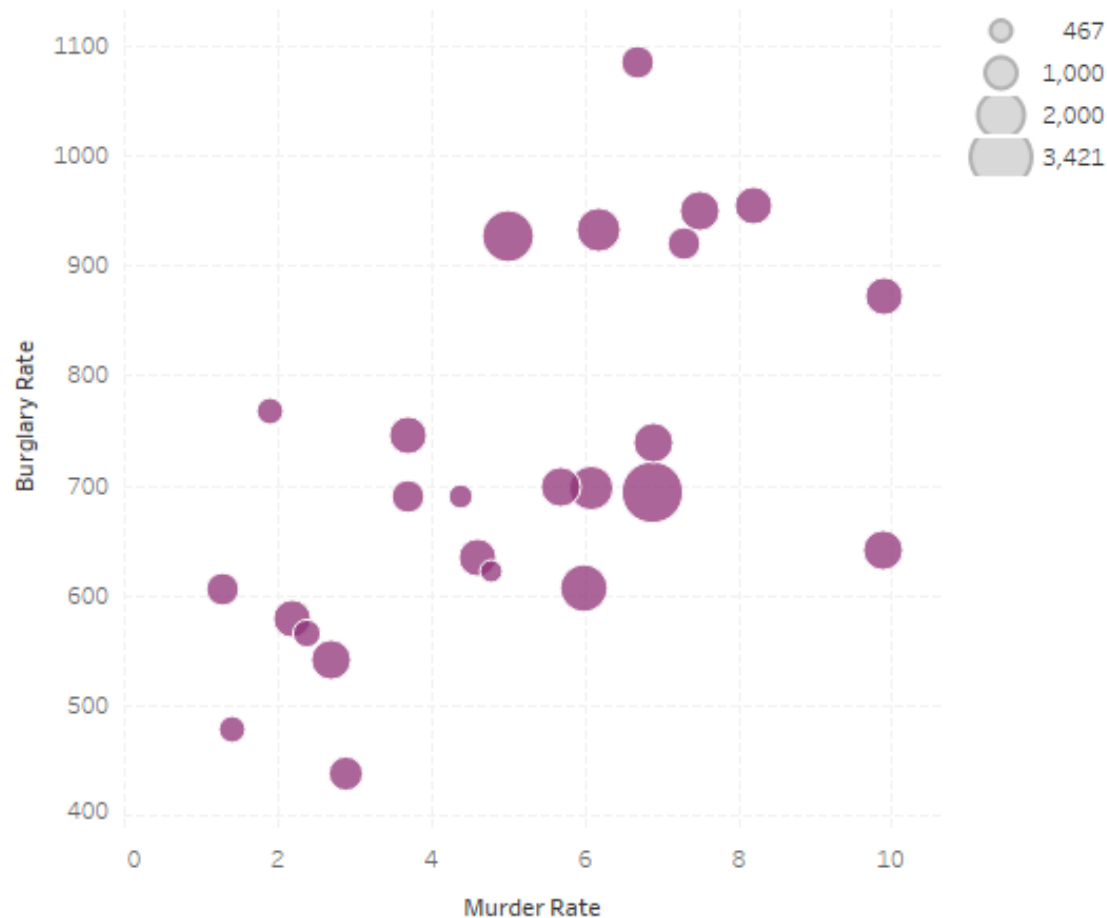
For Quantitative/Ordinal Data



Accurate perception of quantitative values by geometric objects (area)

Proportional Symbol

Use when there are big variations between values and/or seeing fine differences between data is not so important.



Sum of Murder Rate vs. sum of Burglary Rate. Size shows sum of Population Size.
Details are shown for State. The view is filtered on State, which keeps 25 of 50 members.

4. Apply good design features

Motto: **Show the data**

Key design features

1. Make a table/graph self-contained
2. Eliminate clutter (declutter)
3. Focus attention where you want

(4.1) Design features of effective tables

Effective Tables

Key design features

1. **Make a table self-contained**
2. Eliminate clutter (declutter)
3. Focus attention where you want

SELF-CONTAINED table

- You understand what the table (or figure) telling you without having to look into the narration/other information.
- The table (or figure) should include all **essential components**.

Self-contained tables

Self-contained tables have 5-7 components

1. Table number
- 2. Table title**
- 3. Column heads**
- 4. Row heads**
- 5. Data**
- 6. Horizontal lines (rules)**
7. Footnotes

[Table Number] **Table 20.1** [Title] **Components and Nomenclature of Tables**

Row Head	Spanner Head				Column Head
	Column subhead: Group size (units)	Column subhead: Group size (units)	Column subhead: Group size (units)	Column subhead: Group size (units)	Group size (units)
“Cut-in” Head					
Row head	Data Field				
Row subhead					
Row subhead					
Row head					
“Cut-in” Head					
Row head	Data Field				
Row subhead					
Row subhead					
Total					

ABC = expanded abbreviation

★ (asterisk)

† (dagger)

‡ (double dagger)

§ (section mark)

|| (parallel mark)

¶ (paragraph mark)

★★ (double asterisk)

^a superscript lowercase letter

^b superscript lowercase letter

^c superscript lowercase letter

[Table Number] **Table 20.1**

[Title] **Components and Nomenclature of Tables**

Row Head

Spanner Head

Column Head

Column subhead:
Group size
(units)

Column subhead:
Group size
(units)

Column subhead:
Group size
(units)

Column subhead:
Group size
(units)

Group size
(units)

“Cut-in” Head

Row head

Row subhead

Row subhead

Row head

Data Field

“Cut-in” Head

Row head

Row subhead

Row subhead

Data Field

Total

ABC = expanded abbreviation

* (asterisk)

† (dagger)

‡ (double dagger)

§ (section mark)

|| (parallel mark)

¶ (paragraph mark)

** (double asterisk)

^a superscript lowercase letter

^b superscript lowercase letter

^c superscript lowercase letter

Table 4.3 Age at first marriage

Percentage of women and men age 15-49 who were first married, by specific exact ages, and median age at first marriage, according to current age, Myanmar DHS 2015-16

Current age	Percentage first married by exact age:					Percentage never married	Number of respondents	Median age at first marriage
	15	18	20	22	25			
WOMEN								
15-19	1.1	na	na	na	na	86.4	1,810	a
20-24	1.9	16.0	30.5	na	na	51.9	1,867	a
25-29	3.5	18.3	33.2	47.9	64.2	27.5	1,867	22.3
30-34	4.4	18.6	33.9	49.0	62.6	20.9	2,037	22.2
35-39	2.9	19.2	34.7	47.2	62.2	16.9	1,954	22.5
40-44	2.8	20.7	36.8	52.0	66.2	14.7	1,733	a
45-49	3.1	19.2	37.6	52.3	64.6	13.5	1,617	21.6
20-49	3.1	18.6	34.3	na	na	24.5	11,075	a
25-49	3.4	19.2	35.1	49.5	63.9	18.9	9,208	22.1
MEN								
15-19	0.0	na	na	na	na	94.7	731	a
20-24	0.0	5.0	14.8	na	na	65.2	692	a
25-29	0.0	5.8	15.5	31.7	52.7	31.5	677	24.6
30-34	0.0	7.6	18.4	32.1	52.5	18.3	698	24.7
35-39	0.0	8.1	18.3	33.1	52.4	10.5	679	24.6
40-44	0.0	7.8	21.2	39.3	54.9	8.8	689	a
45-49	0.0	6.0	17.1	36.0	54.8	5.2	571	24.3
20-49	0.0	6.7	17.6	na	na	23.8	4,006	a
25-49	0.0	7.1	18.1	34.4	53.4	15.2	3,314	24.5

Note: The age at first marriage is defined as the age at which the respondent began living with her/his first spouse.

na = Not applicable due to censoring

a = Omitted because less than 50% of the women or men began living with their spouse for the first time before reaching the beginning of the age group

Source: MOHS & ICF: Myanmar DHS 2015-2016

Components of a self-contained table

1. Table No.

- Number tables sequentially (after the number of the chapters and sections)

e.g. **Table 1, Table 2**

e.g. **Table 1.1, Table 1.2**

2. Table title

- Answer “**what**”, “**where**” and “**when**”.
- “What” include
 - Variables (characteristics/items)
 - Population (may not be necessary)
- Brief but clear and precise
- Avoid repetition of headings of columns and rows
- Usu. above the table
- No full stop at the end

Examples of table titles

Table 5.1 Cancer incidence in China, 2000 through 2010, by age group and sex

Table 5.2 Healthcare resource information of the participating hospitals in 10 provinces in China

Table 5.3 Relationship between effective predictors and mortality of cancer patients analyzed using the multiple logistic regression model

(defines the independent variable “effective predictors” and the dependent variable “mortality.”)

Examples of table titles

Table 5.1 Cancer incidence in China, 2000 through 2010, by age group and sex

Table 5.2 Healthcare resource information of the participating hospitals in 10 provinces in China

Table 5.3 Relationship between effective predictors and mortality of cancer patients analyzed using the multiple logistic regression model

Examples of table titles

Table 5.1 Cancer incidence in China, 2000 through 2010, by age group and sex

Table 5.2 Healthcare resource information of the participating hospitals in 10 provinces in China

Table 5.3 Relationship between effective predictors and mortality of cancer patients analyzed using the multiple logistic regression model

Descriptive vs. declarative titles

- A **descriptive title** describes the study but not the results.
 - In theses & dissertations
 - In traditional technical reports
 - in most journals
- A **declarative title** declares the results of the study.
 - in oral presentation and posters
 - In modern technical reports
 - in some journals (eg., social sciences journals)

Example of descriptive title

Table 5: Hospitalisation for COVID-19 and severe COVID-19 in the safety population

	ChAdOx1 nCoV-19 (n=12 021)	MenACWY or saline control (n=11 724)
Hospitalisation (WHO clinical progression score ≥ 4)		
≤ 21 days after the first dose	2*	6
> 21 days after the first dose and ≤ 14 days after the second dose	0	5
> 14 days after the second dose	0	5
Severe COVID-19 (WHO clinical progression score ≥ 6)		
≤ 21 days after the first dose	0	0
> 21 days after the first dose and ≤ 14 days after the second dose	0	1
> 14 days after the second dose	0	1

Source: Voysey, M., Clemens, S.A.C., Madhi, S.A., Weckx, L.Y., Folegatti, P.M., Aley, P.K., Angus, B., Baillie, V.L., Barnabas, S.L., Bhorat, Q.E. and Bibi, S., 2020. Safety and efficacy of the ChAdOx1 nCoV-19 vaccine (AZD1222) against SARS-CoV-2: an interim analysis of four randomised controlled trials in Brazil, South Africa, and the UK. *The Lancet*, 397(10269), pp.99-111.

Example of declarative title

TABLE 1.1 In 2017, low-income countries had the lowest percentage of people covered by essential health services, while lower-middle-income countries had the most people who still lacked coverage

World Bank income group	% covered in 2017	Number of people (billions) in 2017		
		Covered	Not covered	Total population*
World	33–49%	2.5–3.7	3.8–5.0	7.5 billion
High-income	59–72%	0.7–0.9	0.3–0.5	1.2 billion
Upper-middle income	42–57%	1.1–1.5	1.1–1.5	2.6 billion
Lower-middle income	21–38%	0.6–1.1	1.9–2.4	3.0 billion
Low-income	12–27%	0.1–0.2	0.5–0.6	0.7 billion

* All population estimates are based on the UN World Population Prospects 2019 (23).

3 & 4. Column and Row headings

- should identify the variables being presented
- Heading of the first column identifies the row heads below
- Put **units of measurements** if necessary
- Put **group size (sample size)** if necessary
- Put column/row total if necessary
- Put groups in columns for comparison
(like male/female, urban/rural, control/cases,
non-non-exposed/exposed, placebo/treatment)

TABLE 12–8 Numbers of Men and Women by BMI Category

BMI* Category	Men (<i>n</i> = 1868)	Women (<i>n</i> = 1994)	Total (<i>n</i> = 3862)
Normal weight	631	1289	1920
Overweight	925	452	1377
Obese	312	253	565

* BMI is body mass index = $\text{weight}_{\text{kg}} / \text{height}_{\text{m}}^2$; normal weight ($\text{BMI} \leq 25.0$), overweight ($25.0 < \text{BMI} < 30.0$), and obese ($\text{BMI} \geq 30.0$).

TABLE 12–7 Background Characteristics of Study Participants by Intervention Group

Characteristic*	Intervention Group		
	Self-Help (<i>n</i> = 100)	Group Therapy (<i>n</i> = 90)	Individual Therapy (<i>n</i> = 80)
Age, years	78.2 (6.2)	79.6 (5.9)	81.4 (5.7)
Male sex, <i>n</i> (%)	46 (46%)	38 (42%)	28 (35%)
Education, years	9.3 (4.2)	10.7 (3.9)	8.6 (4.1)
Marital status			
Single, never married, <i>n</i> (%)	9 (9%)	11 (12%)	5 (6%)
Married or domestic partnership, <i>n</i> (%)	36 (36%)	36 (40%)	23 (29%)
Widowed, <i>n</i> (%)	43 (43%)	33 (37%)	43 (54%)
Divorced or separated, <i>n</i> (%)	12 (12%)	10 (11%)	9 (11%)

* Means (standard deviations) are shown for continuous measures and *n* (%) is shown for categorical measures.

3&4. Column and Row headings

- **Spanner headings**, which apply to two or more columns, allow data to be presented for subgroups
- When several row subheads are needed,
 - they can be indented under a stub heading or
 - they can be introduced with a “**cut-in**” heading that crosses the entire data field
- Align the **spanner heading** and **cut-in heading central**

Table 4.1 Current marital status

Percent distribution of women and men age 15-49 by current marital status, according to age, Myanmar DHS 2015-16

Age	Marital status					Total	Percentage of respondents currently in union	Number of respondents
	Never married	Married	Divorced	Separated	Widowed			
WOMEN								
15-19	86.4	12.6	0.8	0.1	0.1	100.0	12.6	1,810
20-24	51.9	44.6	2.8	0.4	0.3	100.0	44.6	1,867
25-29	27.5	67.4	3.5	0.4	1.2	100.0	67.4	1,867
30-34	20.9	73.9	3.0	0.2	1.9	100.0	73.9	2,037
35-39	16.9	75.9	3.5	0.3	3.4	100.0	75.9	1,954
40-44	14.7	74.0	4.2	0.5	6.5	100.0	74.0	1,733
45-49	13.5	72.3	3.3	0.5	10.4	100.0	72.3	1,617
Total	33.2	60.2	3.0	0.3	3.2	100.0	60.2	12,885
MEN								
15-19	94.7	5.0	0.3	0.0	0.0	100.0	5.0	731
20-24	65.2	33.0	1.4	0.4	0.1	100.0	33.0	692
25-29	31.5	66.0	2.1	0.1	0.3	100.0	66.0	677
30-34	18.3	78.6	2.5	0.0	0.5	100.0	78.6	698
35-39	10.5	86.5	2.4	0.3	0.3	100.0	86.5	679
40-44	8.8	86.2	2.8	0.2	2.0	100.0	86.2	689
45-49	5.2	90.3	1.8	0.5	2.1	100.0	90.3	571
Total	34.7	62.4	1.9	0.2	0.7	100.0	62.4	4,737

Source: MOHS & ICF: Myanmar DHS 2015-2016

5. Data

- Missing values should be identified as “NA”, “-”, “...”
- Parenthesis“()” should be used to identify negative values e.g. (-12)
- When displaying percentages, it is best to always include the percentage sign (%)

6. Gridlines (rules)

- Gridlines should be kept to the minimum
 - Remove vertical gridlines (rules)
 - Reduce horizontal gridlines to the 3 horizontal lines
- Other appropriate lines (above totals, above “cut-in” headings) can be included.

7. Footnotes

- Three kinds of footnotes
- They should appear in the following order:
 1. explanations of abbreviations & notes on levels of statistical significance
 2. notes on specific parts of the content
 3. source information

Table [Arabic numeral]. Concise descriptive title^a

Column heading ^c	Main column heading ^b	
	Extremely long subheading (unit) ^d	Subheading (unit)
Row heading	–	–
indented on second and subsequent lines	10.3 ± 1.1	ND
Second row heading	–	–
Subheading	9.1 ± 3.2	ND
Subheading	2.3 ± 0.2*	362 ^e
Third row heading	6.8 ± 2.5	ND
Fourth row heading	3.0 ± 0.9	490
	17.6 ± 4.4**	51

ND: not determined; *: $P < 0.05$; **: $P < 0.01$ (with appropriate details of the statistical test).

- ^a Explanatory note, for example concerning experimental design and method, or source of data.
- ^b Column headings may be set left or centred over the columns as appropriate (usually centred when the columns contain figures).
- ^c The first column heading is normally set left and aligned with the bottom line of column headings.
- ^d Explanatory note, for example, concerning presentation of data (mean ± standard deviation (SD), etc.).
- ^e Align columns of figures on the decimal point.

Source: reproduced by permission of the publisher from Bloggs & Grundy (16).

8. Footnotes 1. Explanations of abbreviations & notes on levels of statistical significance

- Statistical convention

* : $P < 0.05$

** : $P < 0.01$,

*** $P < 0.001$

8. Footnotes 2. notes on specific parts of the content

- Instead of using lower-case letters (a, b, c, d, e),
you can use symbols (*, †, ‡, §, ||, ¶, **, ††, ‡‡, etc.)
- Avoid using either regular or superscript numerals, which can be mistaken for exponents.

Effective Tables

Key design features

1. Make a table self-contained
2. **Eliminate clutter (declutter)**
3. Focus attention where you want

Example table 1 : Cluttered version

Table1. Age-specific CFR of Covid-19 up to 2021-01-13, Myanmar

Age (years)	Positives	Number of deaths	CFR (%)
<15	9299	7	0.07527
15-29	45527	35	0.076
30-44	34194	160	0.467
45-60	24186	700	2.89
61-75	14045	1271	9.0049
>75	3506	728	20.76
Total	130757	2901	2.218

CFR = Case Fatality Rate

Source: CEU, MOHS, Myanmar

Example table 1 : Cluttered version

Table1. Age-specific CFR of Covid-19 up to 2021-01-13, Myanmar

Age	Number of cases	Number of deaths	CFR
<15			0.07527
15-29			0.076
30-44			0.467
45-60	241	700	2.89
61-75	14	1271	9.0049
>75			20.76
Total			2.218

CFR = Case Fatality Rate

Source: CEU, MOHS, Myanmar

Bad design features

Example table 1 : Decluttered version 1

Table1. Age-specific CFR of Covid-19 up to 2021-01-13, Myanmar

Age (years)	Number of positives	Number of deaths	CFR (%)
<15	9,299	7	0.08
15-29	45,527	35	0.08
30-44	34,194	160	0.47
45-60	24,186	700	2.89
61-75	14,045	1,271	9.00
>75	3,506	728	20.76
Total	130,757	2,901	2.22

CFR = Case Fatality Rate

Source: CEU, MOHS, Myanmar

Example table 1 : Decluttered version 2

Table1. Age-specific CFR of Covid-19 up to 2021-01-13, Myanmar

Age (years)	Number of positives	Number of deaths	CFR (%)
<15	9,299	7	0.08
15-29	45,527	35	0.08
30-44	34,194	160	0.47
45-60	24,186	700	2.89
61-75	14,045	1,271	9.00
>75	3,506	728	20.76
Total	130,757	2,901	2.22

CFR = Case Fatality Rate

Source: CEU, MOHS, Myanmar

Example table 1 : Revised version 3

Table1. Age-specific CFR of Covid-19 up to 2021-01-13, Myanmar

Age (years)	Number of positives	Number of deaths	CFR (%)
<15	9,299	7	0.08
15-29	45,527	35	0.08
30-44	34,194	160	0.47
45-60	24,186	700	2.89
61-75	14,045	1,271	9.00
>75	3,506	728	20.76
Total	130,757	2,901	2.22

CFR = Case Fatality Rate

Source: CEU, MOHS, Myanmar

Example table 1 : Decluttered version 4

Table1. Age-specific CFR of Covid-19 up to 2021-01-13, Myanmar

Age (years)	Number of positives	Number of deaths	CFR (%)
<15	9,299	7	0.08
15-29	45,527	35	0.08
30-44	34,194	160	0.47
45-60	24,186	700	2.89
61-75	14,045	1,271	9.00
>75	3,506	728	20.76
Total	130,757	2,901	2.22

CFR = Case Fatality Rate

Source: CEU, MOHS, Myanmar

Tables: *declutter*

- Remove/mute(soften) **background colour**
- Remove **vertical gridlines** (rules)
- Minimize **horizontal gridlines** (rules)
- Use **white space** between rows to make them distinct
- (text height : white space height=1:1)
- (Or) Use **thin muted line** between rows with normal space to make them distinct

Tables: *declutter*

- **Text** should be **left-aligned**.
- **Numbers** are **right-aligned**.
- Align **dates** to the left, right, or center but should be consistent
- Use **thousand separators** in numbers (e.g. 1,346,200)
- **Round** the numbers to appropriate levels

Tables: *declutter*

- Use a minimum of **equal decimal places** (usu. 2 significant figures)
 - **Presentation tables** should suitably rounded numbers
 - **Reference tables** usually retain most or all of the precision.
- When units are included in column or row heads, don't repeat them in data cells.

Effective Tables

Key design features

1. Make a table self-contained
2. Eliminate clutter (declutter)
3. **Focus attention where you want**

Tables: focus

- Data in a table is not equally important.
- Focus the audience's attention to where you want

Example table 2 : De-emphasized version

Table1. Age-specific CFR of Covid-19 up to 2021-01-13, Myanmar

Age (years)	Number of positives	Number of deaths	CFR (%)
<15	9,299	7	0.08
15-29	45,527	35	0.08
30-44	34,194	160	0.47
45-60	24,186	700	2.89
61-75	14,045	1,271	9.00
>75	3,506	728	20.76
Total	130,757	2,901	2.22

CFR = Case Fatality Rate

Source: CEU, MOHS, Myanmar

Example table 2: Emphasized version 1

Table1. Age-specific CFR of Covid-19 up to 2021-01-13, Myanmar

Age (years)	Number of positives	Number of deaths	CFR (%)
<15	9,299	7	0.08
15-29	45,527	35	0.08
30-44	34,194	160	0.47
45-60	24,186	700	2.89
61-75	14,045	1,271	9.00
>75	3,506	728	20.76
Total	130,757	2,901	2.22

CFR = Case Fatality Rate

Source: CEU, MOHS, Myanmar

Example table 2 : Emphasized version 2 (heat map)

Table1. Age-specific CFR of Covid-19 up to 2021-01-13, Myanmar

Age (years)	Number of positives	Number of deaths	CFR (%)
<15 Years	9299	7	0.1
15-29 Years	45527	35	0.1
30-44 Years	34194	160	0.5
45-60 Years	24186	700	2.9
61-75 Years	14045	1271	9
>75 Years	3506	728	20.8
Total	130757	2901	2.2

CFR = Case Fatality Rate

Source: CEU, MOHS, Myanmar

Example table 2 : Emphasized version 3 (data bar)

Table1. Age-specific CFR of Covid-19 up to 2021-01-13, Myanmar

Age (years)	Number of positives	Number of deaths	CFR (%)
<15 Years	9299	7	0.1
15-29 Years	45527	35	0.1
30-44 Years	34194	160	0.5
45-60 Years	24186	700	2.9
61-75 Years	14045	1271	9
>75 Years	3506	728	20.8
Total	130757	2901	2.2

CFR = Case Fatality Rate

Source: CEU, MOHS, Myanmar

Example table 2 : Emphasized version 4

Table1. Age-specific CFR of Covid-19 up to 2021-01-13, Myanmar

Age (years)	Number of positives	Number of deaths	CFR (%)
<15	9,299	7	0.08
15-29	45,527	35	0.08
30-44	34,194	160	0.47
45-60	24,186	700	2.89
61-75	14,045	1,271	9.00
>75	3,506	728	20.76
Total	130,757	2,901	2.22

CFR = Case Fatality Rate

Source: CEU, MOHS, Myanmar

Example table 2 : Emphasized version 5

Table1. Age-specific CFR of Covid-19 up to 2021-01-13, Myanmar

Age (years)	Number of positives	Number of deaths	CFR (%)
<15	9,299	7	0.08
15-29	45,527	35	0.08
30-44	34,194	160	0.47
45-60	24,186	700	2.89
61-75	14,045	1,271	9.00
>75	3,506	728	20.76
Total	130,757	2,901	2.22

CFR = Case Fatality Rate

Source: CEU, MOHS, Myanmar

Example table 3 : De-emphasized version 5 (Unranked data)

Table 20.6 **Leading Causes of Cancer Death
in the United States, 1998,
Organized to Help Readers
Find Information**

Type of Cancer	Number of Deaths
Breast	44,000
Cervical	5,000
Colorectal	57,000
Lung	160,000
Prostate	39,000

Example table 3 : Emphasized version 1 (Ranked data)

**Table 20.5 Leading Causes of Cancer Death
in the United States, 1998,
Organized to Show Patterns
in the Data**

Type of Cancer	Number of Deaths
Lung	160,000
Colorectal	57,000
Breast	44,000
Prostate	39,000
Cervical	5,000

Tables: focus

- You can use color, bold or italic fonts, border or fill color.
- You can use conditional formatting (heat map or data bar)
- Change unranked data to ranked data

Tables: good examples

TABLE 2—Annual Sexually Transmitted Infection and HIV Positivity Rates per 100 000 Individuals of Offenders Recently Released and Nonoffenders: Marion County, Indiana, 2003–2008

Characteristic	Offenders Recently Released				Nonoffender Population			
	Chlamydia	Gonorrhea	Syphilis	HIV	Chlamydia	Gonorrhea	Syphilis	HIV
Total	2 968	2 305	278	61	759**	350**	77**	13**
Race								
White	1 421	846	70	32	394**	126**	44*	9**
Black	4 331	3 678	482	86	1 635**	969**	152**	57
Gender								
Male	1 984	1 788	182	50	342**	302**	86**	23**
Female	5 393	3 227	512	74	1 124**	396**	69**	5**
Age, y								
≤ 14	3 128	1 579	89	30	69**	20**	2**	0**
15–19	7 019	4 079	146	30	3 629**	463**	44**	9
20–24	4 531	3 231	142	64	5 613**	2 189**	141	37
25–34	2 277	2 017	259	64	1 373**	740**	128**	25**
35–44	850	1 153	361	65	251**	258**	124**	28*
45–54	414	595	366	34	75**	121**	85**	15
55–100	145	248	280	10	13**	24**	80**	4
Gender-age (y) group								
Male 15–19	5 414	3 609	97	27	750**	391**	27*	9
Female 15–19	12 130	5 608	305	38	6 683**	2 077**	64**	10
Male 20–24	3 426	2 795	106	73	2 745**	1 845**	117	72
Female 20–24	8 602	4 837	275	33	8 232	2 703**	175	20

* $P < .05$; ** $P < .01$; P values for difference between offenders and nonoffenders.

AJPH

Tables: good examples

TABLE 2—Association Between Inadequate Food Quantity, Inadequate Food Quality, and Health Conditions Among American Indians From 2 Tribal Nations: Oklahoma, 2015

Variable	Diabetes	Obesity	Hypertension
Food quantity			
Adequate food quantity, unadjusted prevalence, % (95% CI)	18.4 (13.3, 23.5)	48.3 (41.7, 55.0)	41.6 (35.1, 48.1)
Inadequate food quantity, unadjusted prevalence, % (95% CI)	28.4 (23.2, 33.7)	60.0 (54.3, 65.8)	54.1 (48.3, 59.9)
Regression results, PR (95% CI)			
Inadequate food quantity	1.40 (1.00, 1.99)	1.15 (0.96, 1.38)	1.20 (1.00, 1.44)
Age	1.04 (1.03, 1.05)	1.01 (1.00, 1.01)	1.03 (1.02, 1.03)
Male	0.89 (0.63, 1.28)	0.93 (0.76, 1.12)	1.28 (1.08, 1.53)
Study site	1.02 (0.76, 1.37)	0.93 (0.79, 1.09)	1.06 (0.90, 1.24)
Education	0.96 (0.83, 1.13)	0.96 (0.89, 1.04)	0.93 (0.86, 1.01)
Income	0.94 (0.77, 1.16)	0.94 (0.85, 1.04)	0.95 (0.86, 1.06)
Food quality			
Adequate food quality, unadjusted prevalence, % (95% CI)	18.8 (13.3, 24.3)	45.8 (38.7, 52.8)	42.5 (35.6, 49.5)
Inadequate food quality: unadjusted prevalence, % (95% CI)	27.3 (22.4, 32.3)	60.7 (55.2, 66.2)	52.5 (46.9, 58.0)
Regression results, PR (95% CI)			
Inadequate food quality	1.48 (1.04, 2.11)	1.28 (1.07, 1.54)	1.25 (1.04, 1.51)
Age	1.04 (1.03, 1.05)	1.01 (1.00, 1.01)	1.03 (1.02, 1.03)
Male	0.90 (0.63, 1.29)	0.94 (0.78, 1.14)	1.29 (1.08, 1.53)
Study site	1.01 (0.75, 1.35)	0.92 (0.79, 1.07)	1.05 (0.89, 1.23)
Education	0.96 (0.82, 1.12)	0.96 (0.89, 1.04)	0.93 (0.86, 1.01)
Income	0.93 (0.76, 1.14)	0.94 (0.86, 1.04)	0.95 (0.86, 1.05)

Note. CI = confidence interval; PR = prevalence ratio. The sample size was n = 513.

AJPH

Tables: good examples

Table 2. Risk distribution of sample at follow-up visits among participants in a clinical trial of the World Health Organization risk management package for cardiovascular disease, China and Nigeria, 2005–2006

Characteristic	Site A ^a				Site B ^b			
	Intervention (<i>n</i> = 603)		Control (<i>n</i> = 606)		Intervention (<i>n</i> = 588)		Control (<i>n</i> = 600)	
	No.	%	No.	%	No.	%	No.	%
4 month follow-up								
Attended visit	601	99.7	605	99.8	588	100.0	598	99.7
Low risk ^c	104	17.3	80	13.2	136	23.1	96	16.1
Medium risk ^d	484	80.5	516	85.3	444	75.5	483	80.8
SBP > 179 mmHg ^e	13	2.2	7	1.2	8	1.4	15	2.5
Missing data	0	0.0	2	0.3	0	0.0	4	0.7
8 month follow-up								
Attended visit	597	99.0	605	99.8	588	100.0	596	99.3
Low risk ^f	459	76.9	505	83.5	382	65.0	280	47.0
Medium risk ^g	138	23.1	99	16.4	206	35.0	315	52.9
Missing data	0	0.0	1	0.2	0	0.0	1	0.2
12 month follow-up								
Attended visit	584	96.8	605	99.8	530	90.1	447	74.5

mmHg, millimetres of mercury; SBP, systolic blood pressure.

^a China.

^b Nigeria.

^c SBP < 150 mmHg, and age ≤ 50, and non-smoker.

^d SBP 150–179 mmHg; or SBP < 150 mmHg and age > 50; or SBP < 150 mmHg and smoker; or SBP < 150 mmHg and age > 50 and smoker.

^e Referred to higher level of care.

^f SBP < 150 mmHg.

^g SBP ≥ 150 mmHg.

Tables: good examples

Table 3 Multivariable-adjusted odds ratios for diabetes by gender*

Variable	Male		Female	
	OR (95% CI ^{&})	<i>P</i> value	OR (95% CI ^{&})	<i>P</i> value
Age, per 10-yr increment	1.70 (1.52 - 1.89)	0.004	1.71 (1.47 - 1.95)	0.002
Less than junior middle school	1.21 (1.16 - 1.27)	0.001	1.23 (1.17 - 1.28)	<0.001
Family history of diabetes [#]	1.51 (1.27 - 1.89)	0.002	1.53 (1.41 - 1.65)	0.001
Central obesity [#]	2.15 (1.98 - 2.32)	<0.001	2.20 (2.03 - 2.38)	<0.001
Hypertension [#]	1.74 (1.56 - 1.92)	0.002	1.48 (1.31 - 1.65)	0.021
Smoking [#]	1.17 (1.04 - 1.30)	0.035	—	

*Odds ratios were calculated with the use of multinomial logit models. All covariables were included in the model.

[#]References were participants without family history of diabetes, not central obesity, not hypertension and no smoking.

[&]Abbreviation: *CI* confidence intervals, *OR* odds ratio.

BMC Public Health

Tables: good examples

Table 12.7 Use of mosquito nets by pregnant women

Percentage of pregnant women age 15-49 who, the night before the survey, slept under a mosquito net (treated or untreated), under an insecticide-treated net (ITN), and under a long-lasting insecticidal net (LLIN), and among pregnant women age 15-49 in households with at least one ITN, the percentage who slept under an ITN the night before the survey, by background characteristics, Myanmar DHS 2015-16

Background characteristic	Among pregnant women age 15-49 in all households				Among pregnant women age 15-49 in households with at least one ITN ¹	
	Percentage who slept under any mosquito net last night	Percentage who slept under an ITN ¹ last night	Percentage who slept under an LLIN last night	Number of women	Percentage who slept under an ITN ¹ last night	Number of women
Residence						
Urban	95.2	10.4	6.7	105	*	15
Rural	81.1	20.7	19.6	367	60.5	125
Education						
No education	59.8	23.4	23.4	63	(56.3)	26
Primary	84.8	19.4	18.5	207	61.6	65
Secondary	89.2	19.3	15.5	160	65.6	47
More than secondary	(99.4)	(2.3)	(2.3)	41	*	2
Wealth quintile						
Lowest	74.1	20.7	19.1	141	62.6	47
Second	86.6	24.6	24.6	95	60.5	39
Middle	89.0	23.1	22.9	78	71.3	25
Fourth	86.5	12.2	8.5	76	(46.2)	20
Highest	92.2	8.5	5.1	82	*	10
Total	84.2	18.4	16.7	472	61.9	140

(4.2) Design features of figures

Effective figure (dataviz)

Key design features

1. **Make a figure self-contained**
2. Eliminate clutter (declutter)
3. Focus attention where you want

SELF-CONTAINED figure

- You understand what the figure telling you without having to look into the narration/other information.
- The figure should include all **essential components**.

Self-contained figures

Self-contained figures have 6-9 components.

1. Figure number
2. **Figure caption/title** (below/above the figure)
3. **Data field**
4. **Vertical scale**
5. **Horizontal scale**
6. **Labels for each scale**
7. **Data**
8. Reference lines
9. Keys or legends

Components of a dataviz

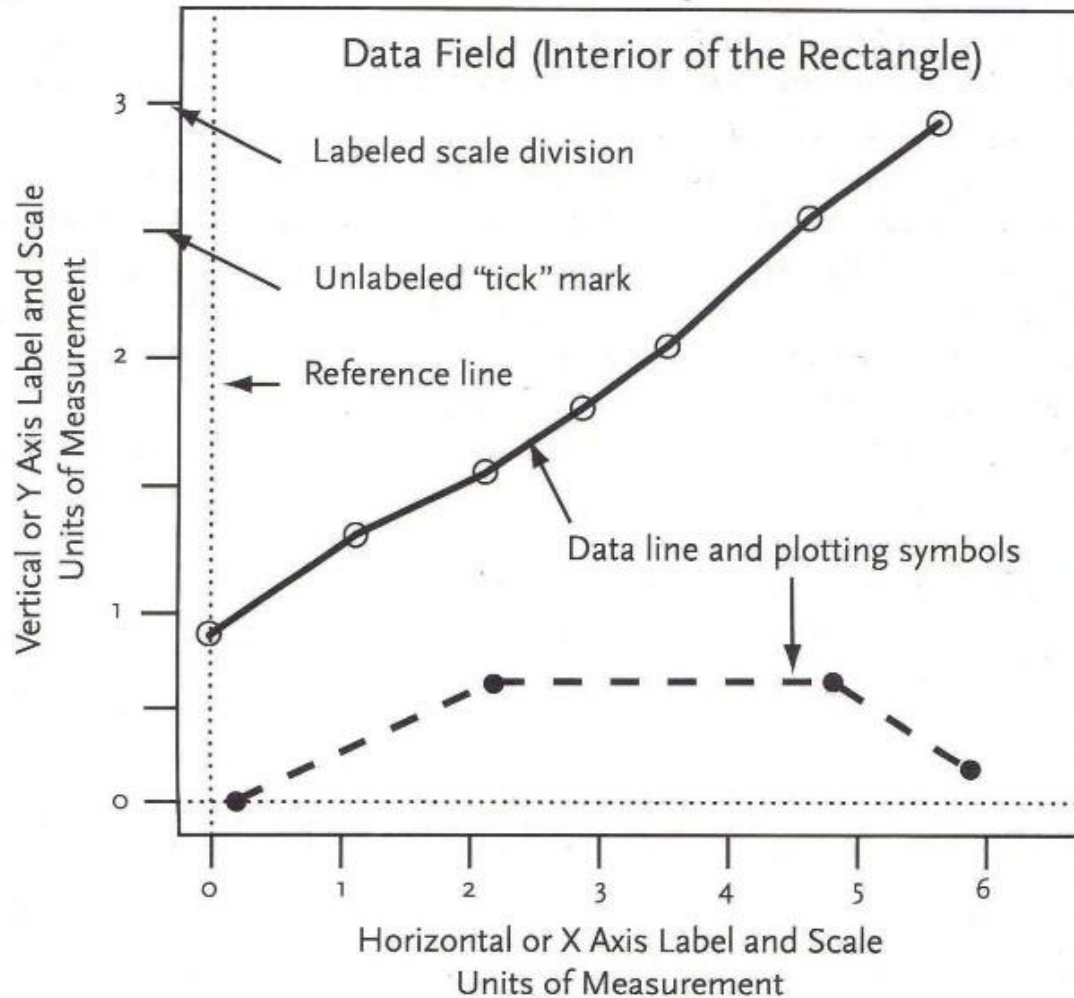
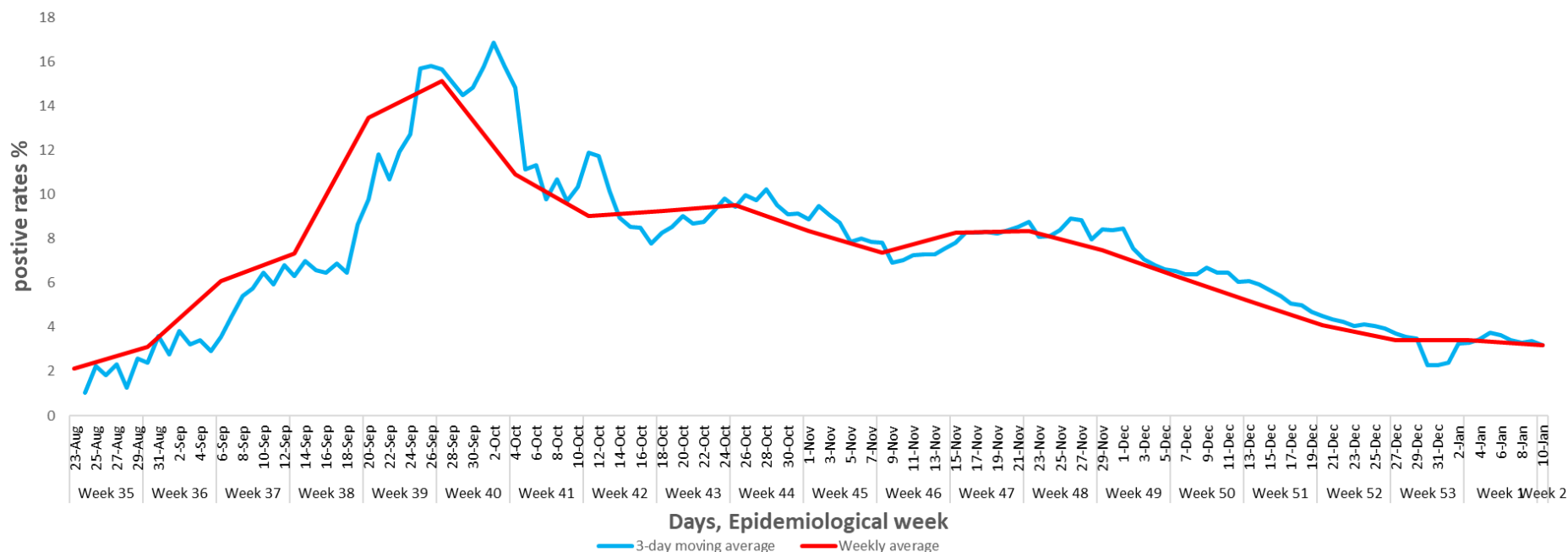


Fig 5. 3-day moving average and weekly average of overall positive rates of COVID-19, Myanmar
(Epi week 35, 2020 to week 1, 2021, as of 11-1-2021)



Source: CEU, Department of Public Health, MOHS, Myanmar

Components of a dataviz

1. Figure number

- Number figures sequentially (after the number of the chapters and sections).
- e.g. **Fig. 1, Fig. 2**
- e.g. **Fig. 1.1, Fig. 1.2**

Components of a dataviz

2. Figure caption/title

- Place figure **caption below the figure.**
- Place figure **title above the figure.**
- It should identify the data displayed in the table and the context (“**what**”, “**where**” and “**when**”) in which they should be interpreted.
- It should be brief but clear and explanatory.
- No full stop at the end.
- Avoid repetition of x-axis and y-axis titles

Components of a dataviz

3. Data field

- A rectangular space in which the data are presented, usually bordered on the left and bottom by the X and Y axes and sometimes enclosed by a rectangle drawn with a thin line

4. Vertical scale

- On a Cartesian graph, Y axis with its labeled divisions and unlabeled “**tick marks**”; on a chart either a scale or category labels

Components of a dataviz

5. Horizontal scale

- On a Cartesian graph, X axis with its labeled divisions and unlabeled “tick marks”; on a chart, either a scale or category labels

6. Labels for each scale

- Identifying the variable graphed and the units of measurement represented on the scale

Components of a dataviz

7. Data

- Plotting symbols, lines, shaded bars, on so on

8. Reference lines

- In the data field to help orient readers

9. Keys or legends

- In the data field or caption that identify data

Effective figure (dataviz)

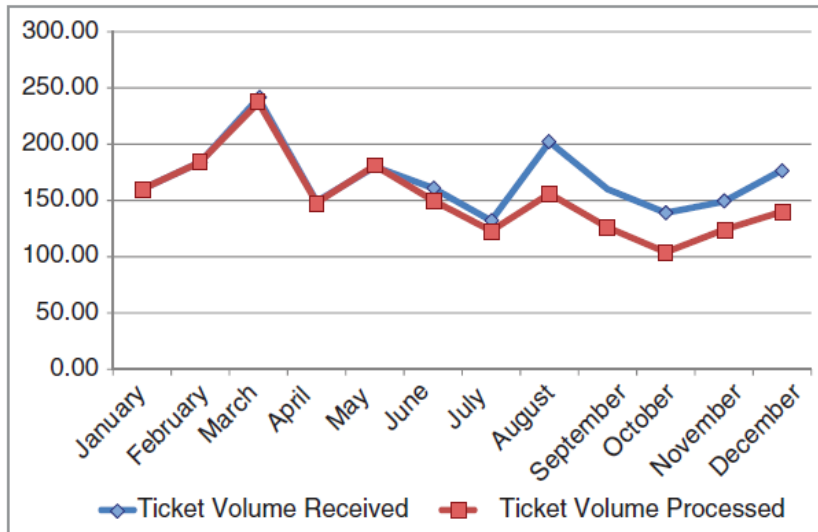
Key design features

1. Make a figure self-contained
2. **Eliminate clutter (declutter)**
3. Focus attention where you want

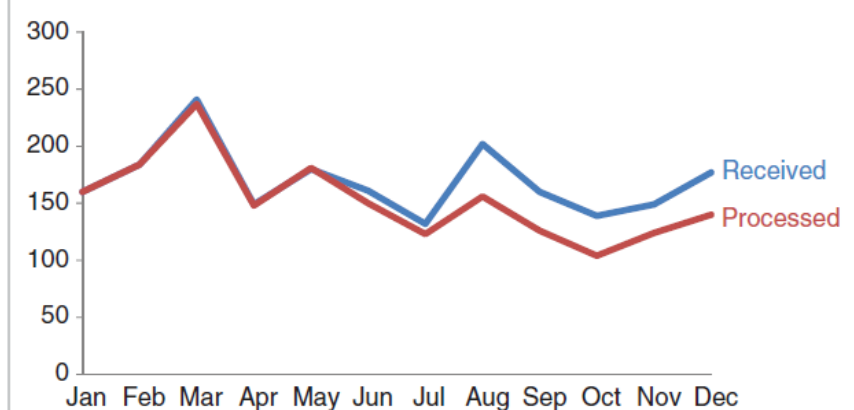
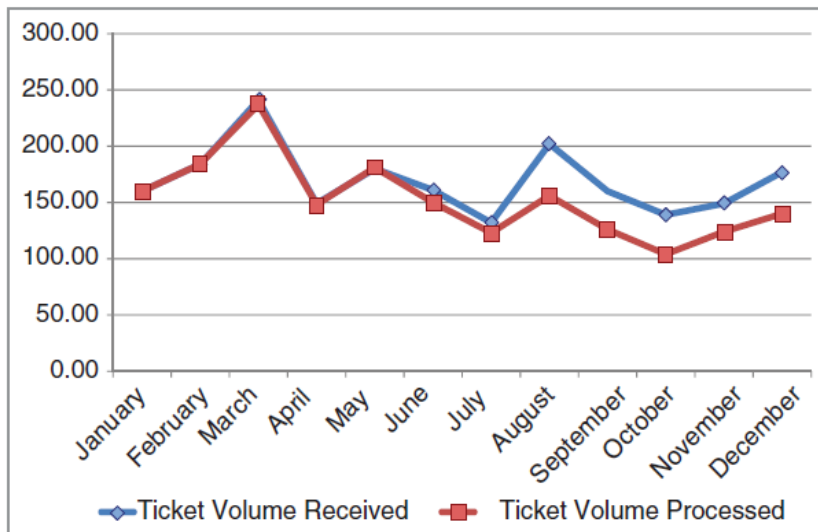
Declutter the graph

- Remove clutter (chart junk) by
 - Removing unnecessary non-data
 - De-emphasize necessary non-data
- Decluttering improves **data-ink ratio (signal-noise ratio)**

Cluttered graph 1

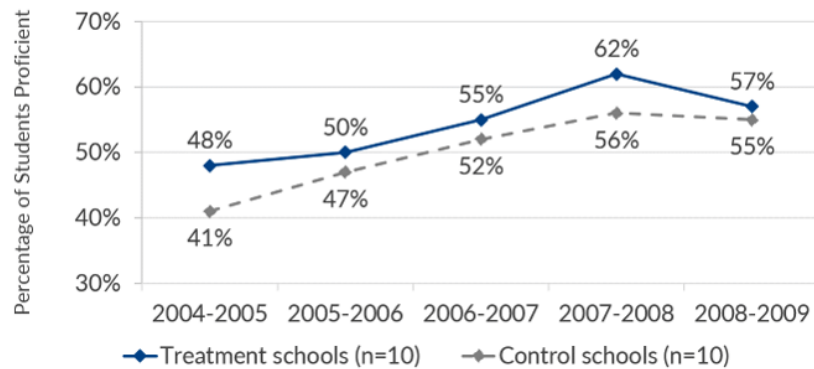


Cluttered to decluttered graph 1



Cluttered 2

Figure 1: Percentage of Students Passing the Third Grade Reading Assessment in Years 1 thru 5



Cluttered to decluttered graph 2



Figure 1: Percentage of Students Passing the Third Grade Reading Assessment in Years 1 thru 5

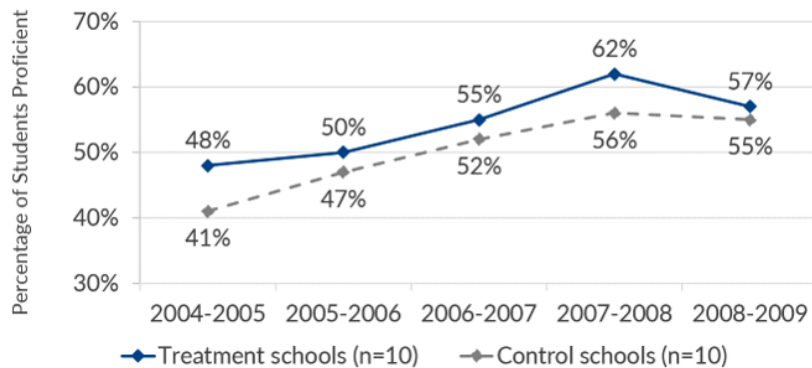
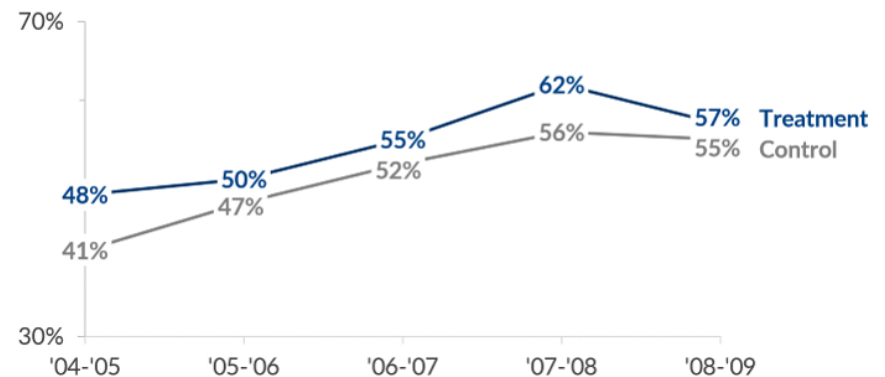
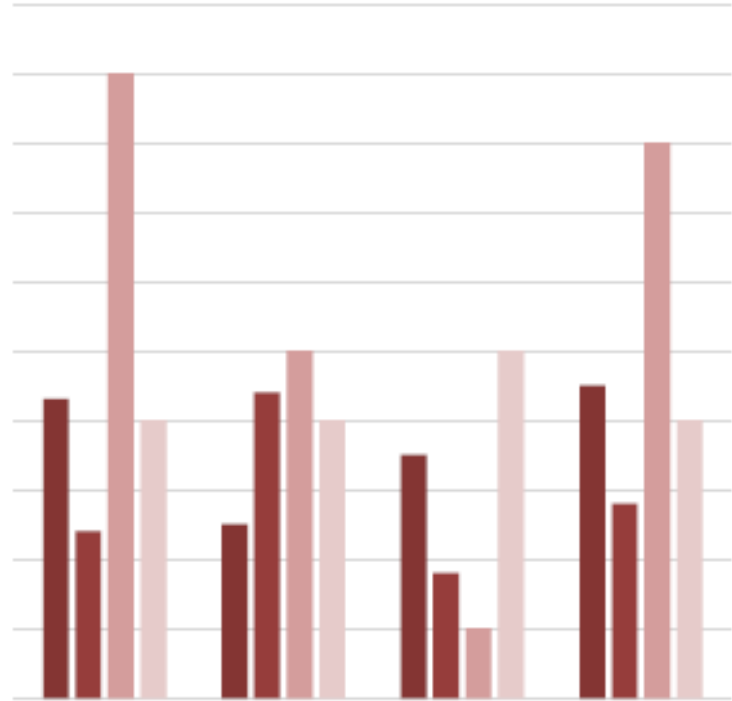
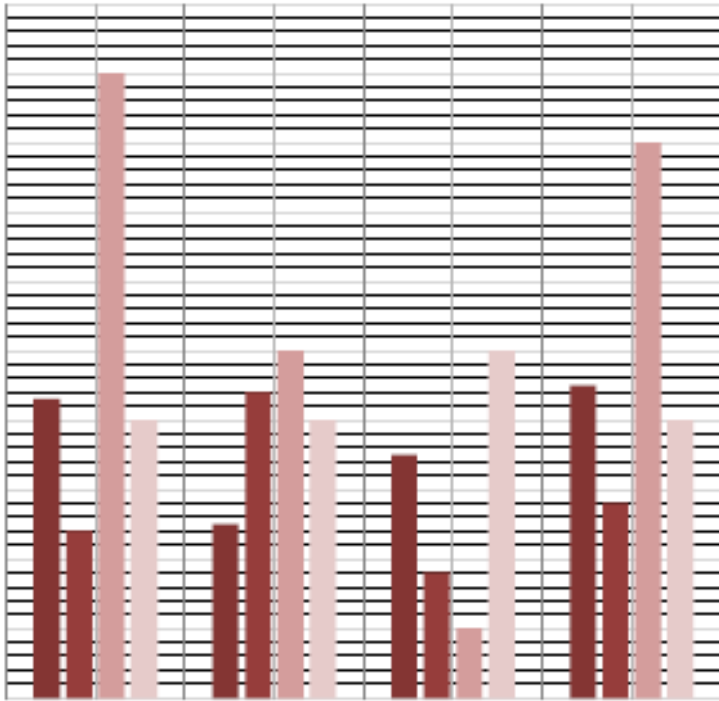


Figure 1: Percentage of Students Passing the Third Grade Reading Assessment in Years 1 thru 5

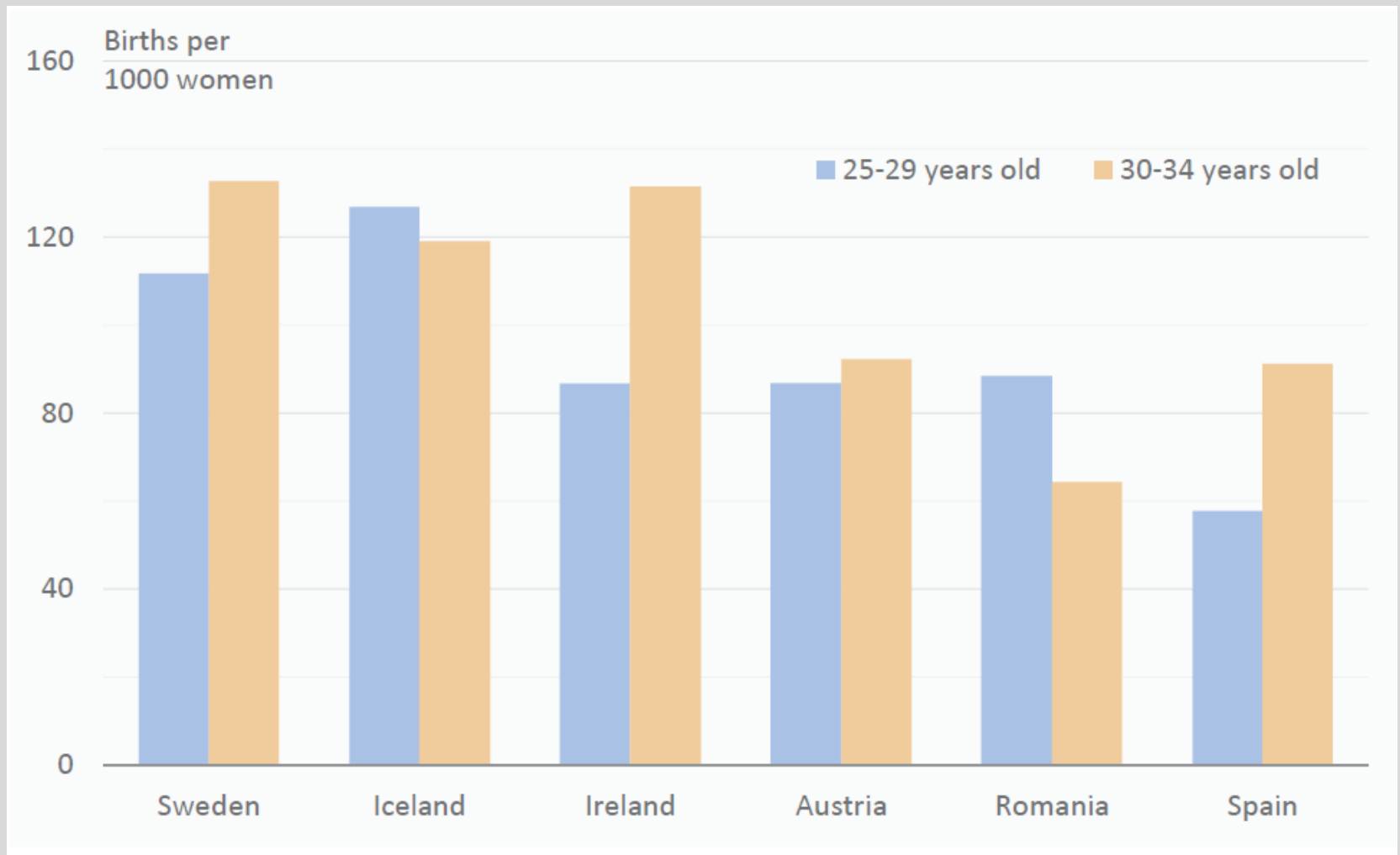


Declutter



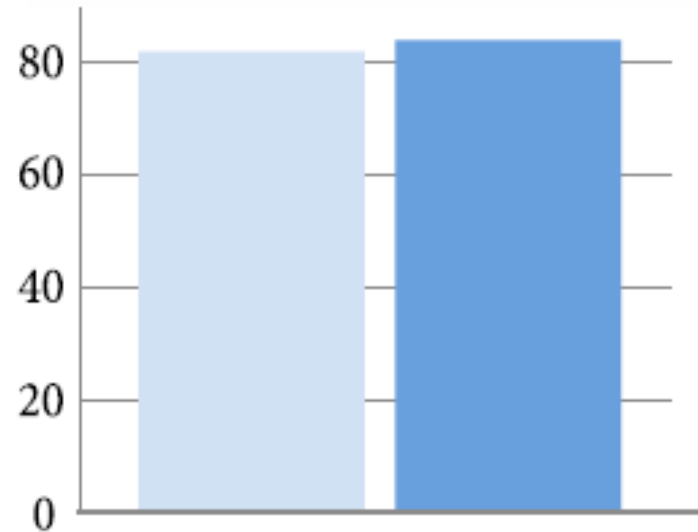
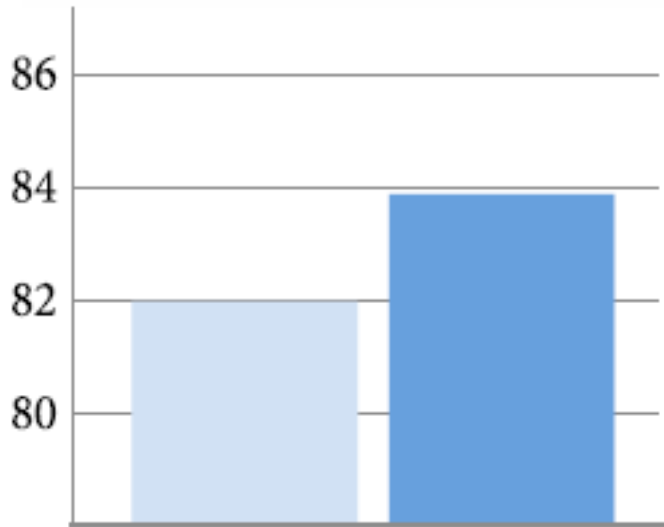
Muted gridlines

Declutter



Grid lines must help reading the chart without interfering.

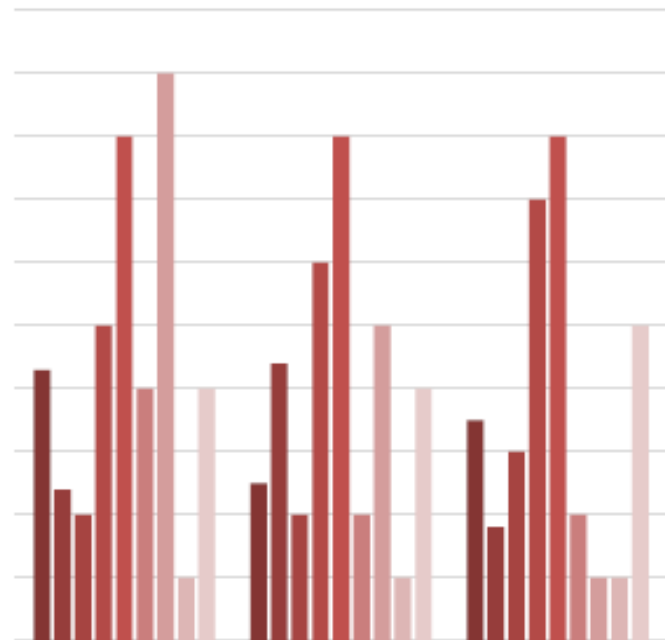
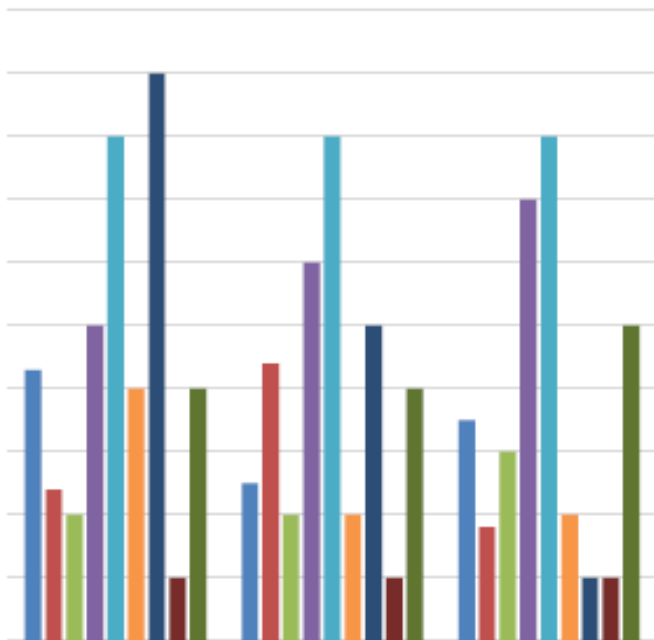
Declutter



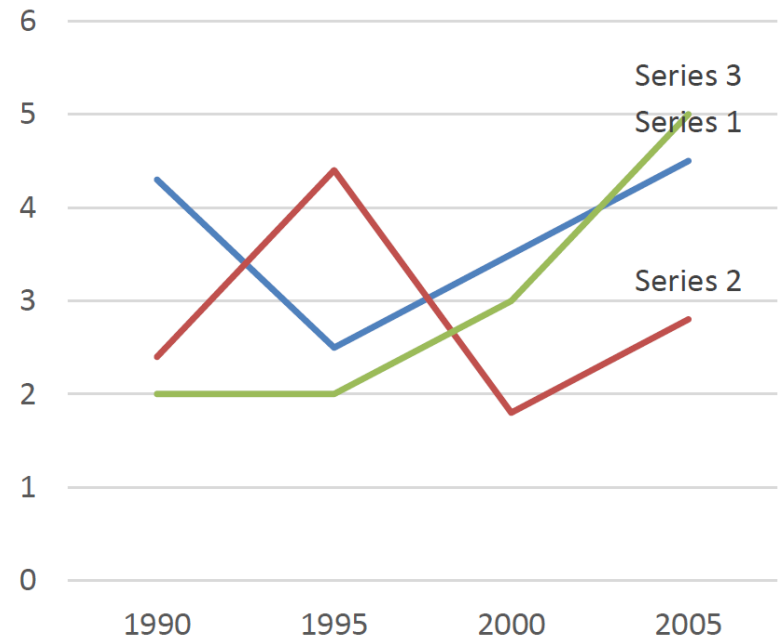
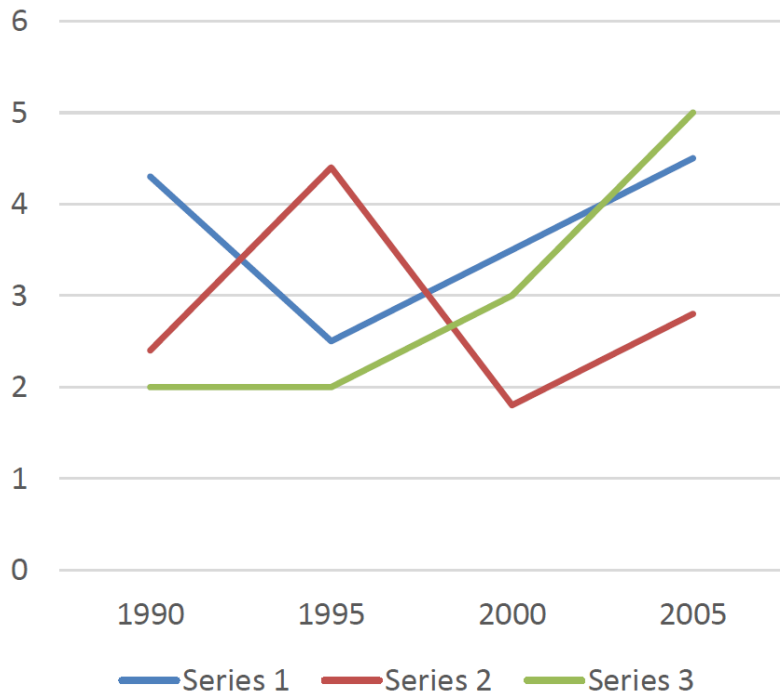
- Always scale to zero for bar chart

Declutter

Use a limited colour palette



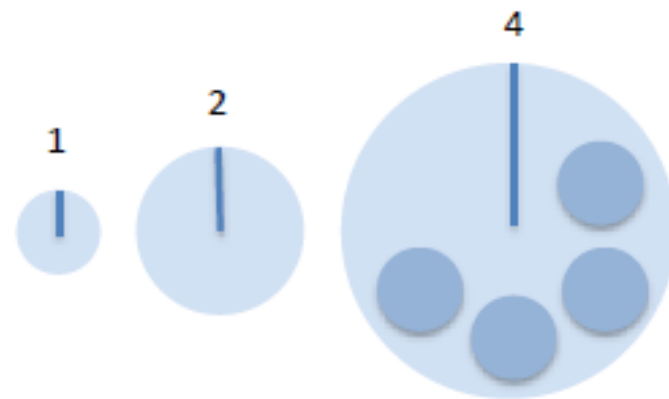
Declutter



Direct labelling

Circle size by area, not radius

Size by radius

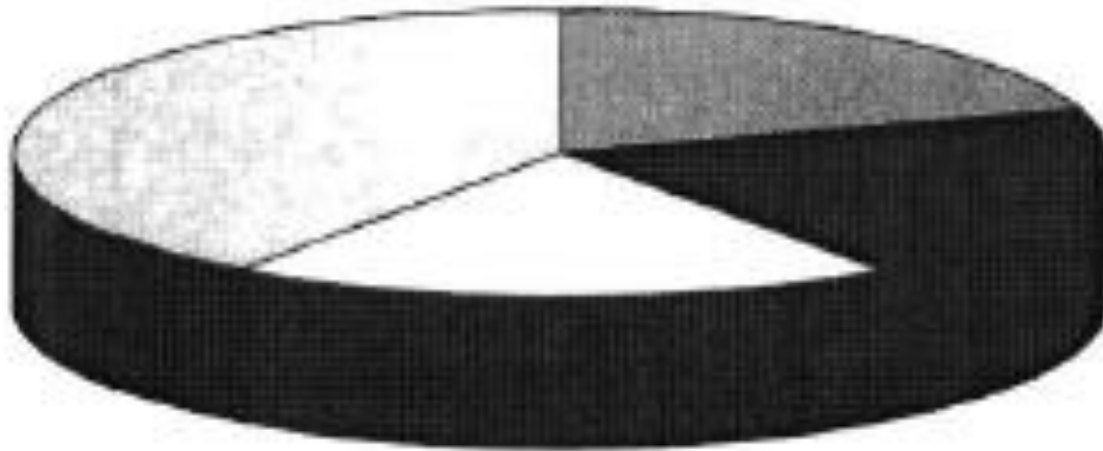


Size by area



Cluttered pie

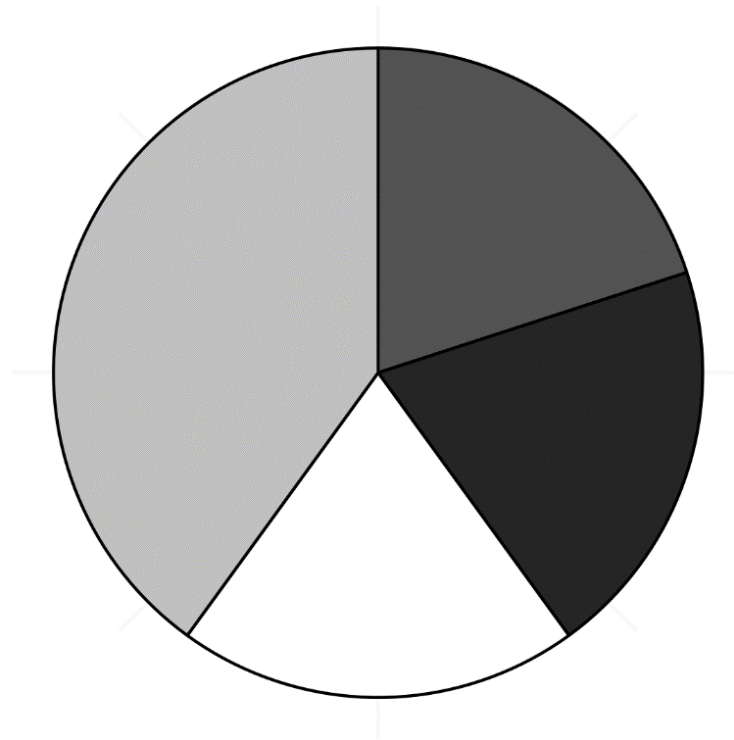
Fig. 2.3 Three-Dimensional Pie Data



Not recommended

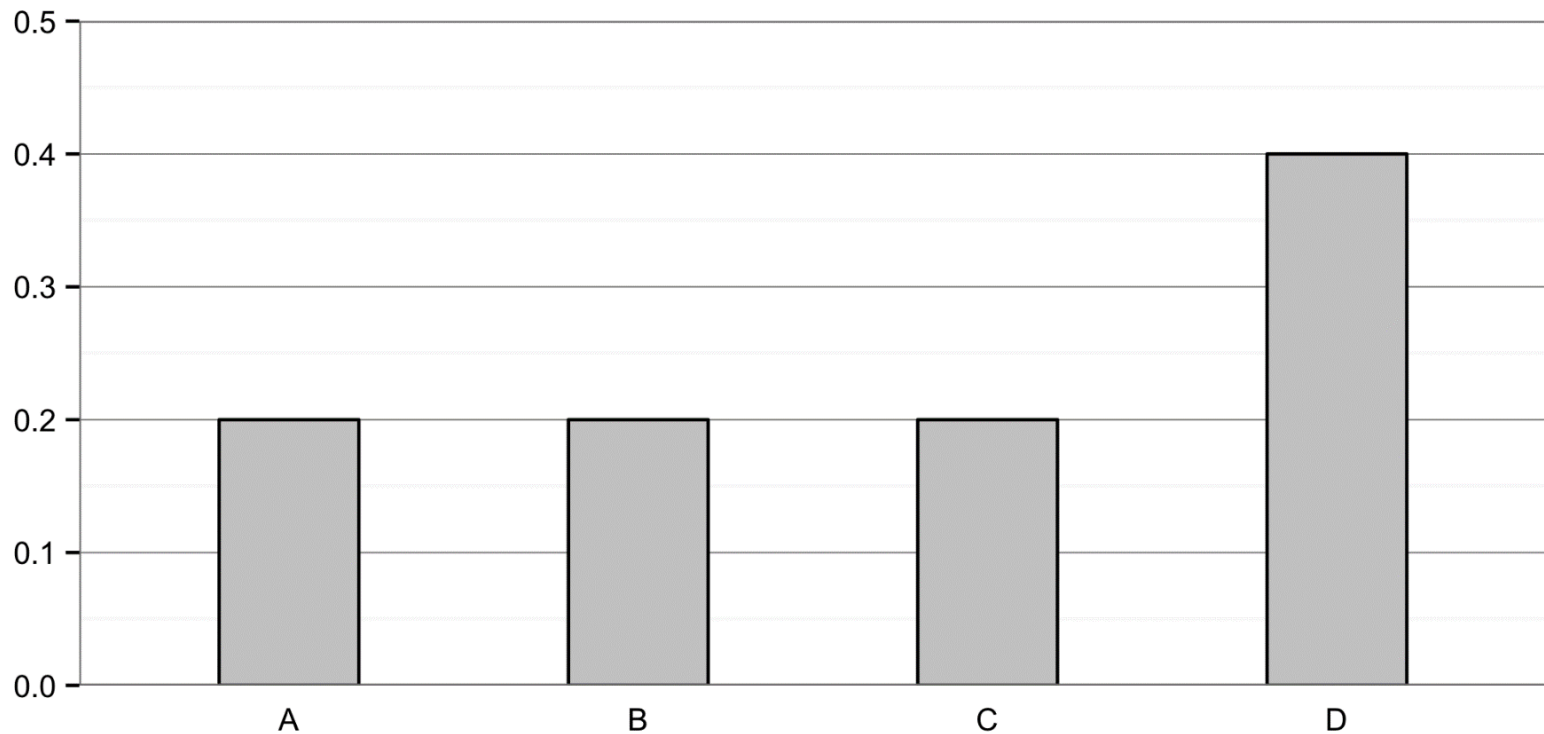
Decluttered pie

**Fig 2.5 Three-Dimensional Pie Data:
Two Dimensional Pie Chart**



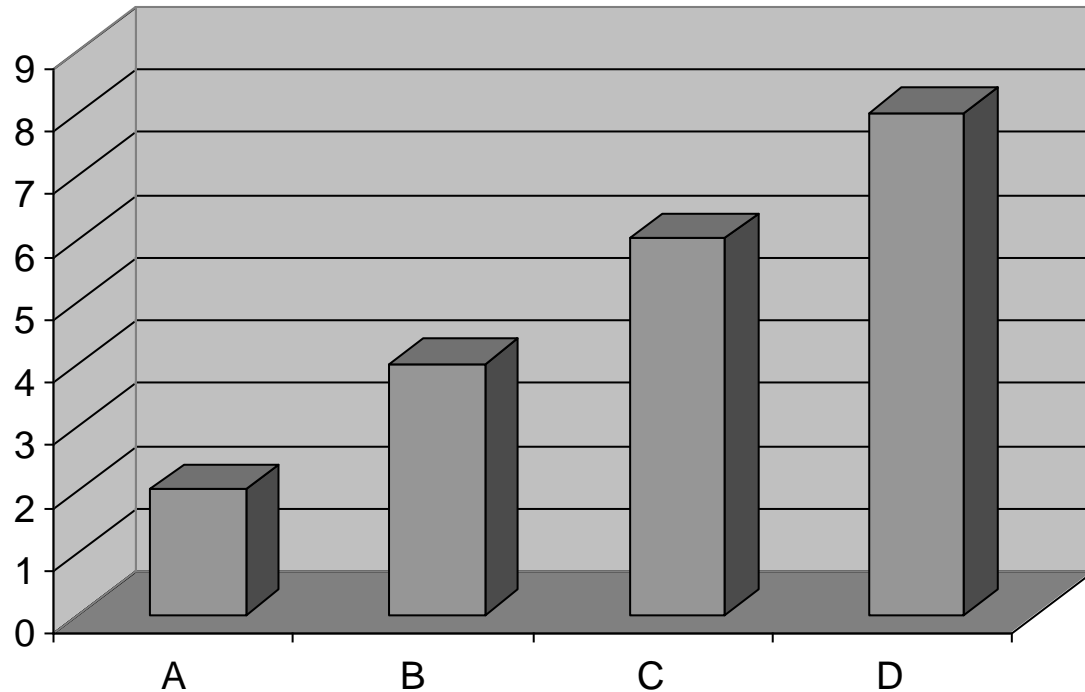
Alternative (bar chart) to pie

**Fig 2.4 Three-Dimensional Pie Data:
Two Dimensional Bar Chart**



Cluttered bar chart

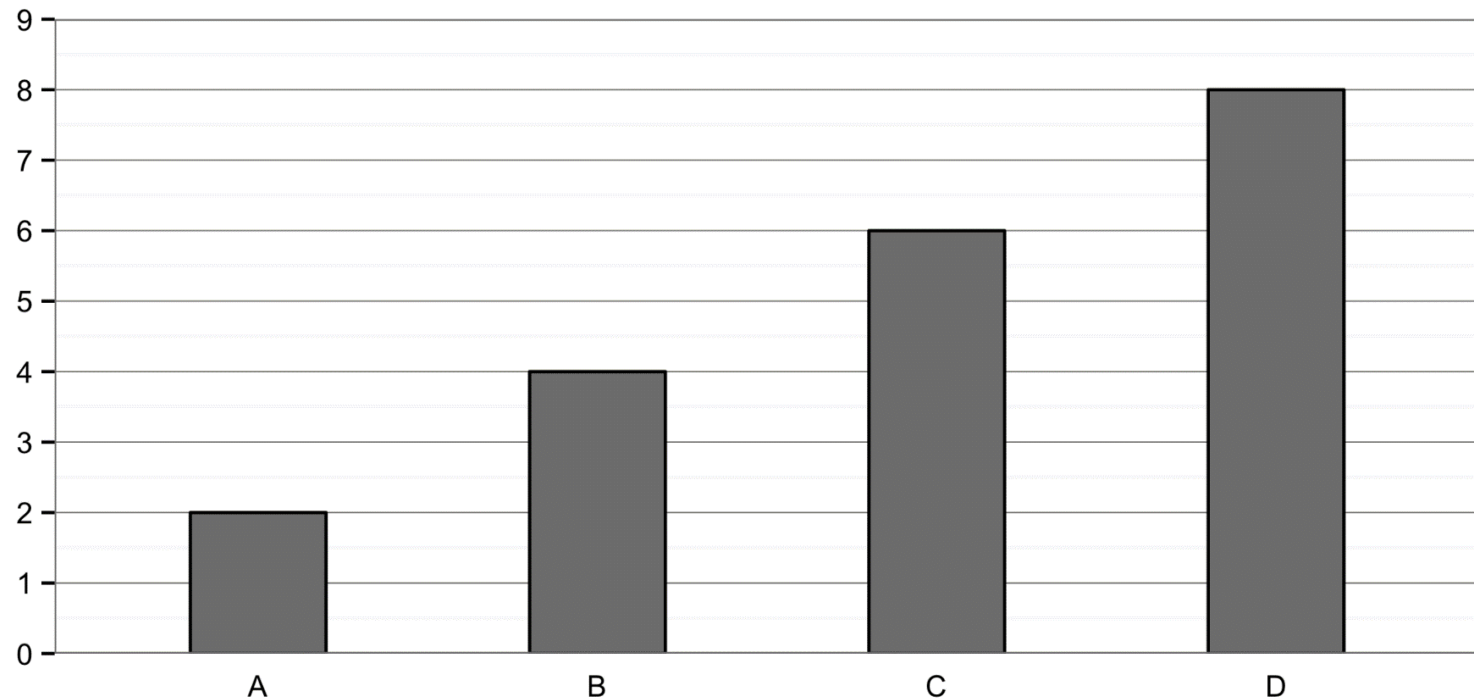
Not recommended



- Pseudo-three-dimensional pie charts and exploded pie charts distort the data even more

Decluttered bar chart

**Fig 2.7 Three Dimensional Bar Data:
Two-Dimensional Bar Chart**



Declutter the graph

- Remove/mute (soften) the background color
- Remove chart border
- Remove/mute gridlines
- Remove data markers
- Clean up axis labels
 - abbreviate labels if necessary
 - remove trailing zeros
 - make axis tick marks align with the data points.
- Push the x- and y-axis lines and labels to the background
- Do not use 3-D
- Don't fill with patterns
- Start your axis at zero for bar chart

Effective figure (dataviz)

Key design features

1. Make a figure self-contained
2. Eliminate clutter (declutter)
3. **Focus attention where you want**

Focus attention where you want

- Data are not equally important.
- Pay more emphasis to the main data.

“It is easy to spot a hawk in a sky full pigeons.”

Focus attention where you want

It's easy to spot a hawk in a sky full of pigeons



Focus attention where you want

It's easy to spot a hawk in a sky full of pigeons



Focus attention where you want

It's easy to spot a hawk in a sky full of pigeons

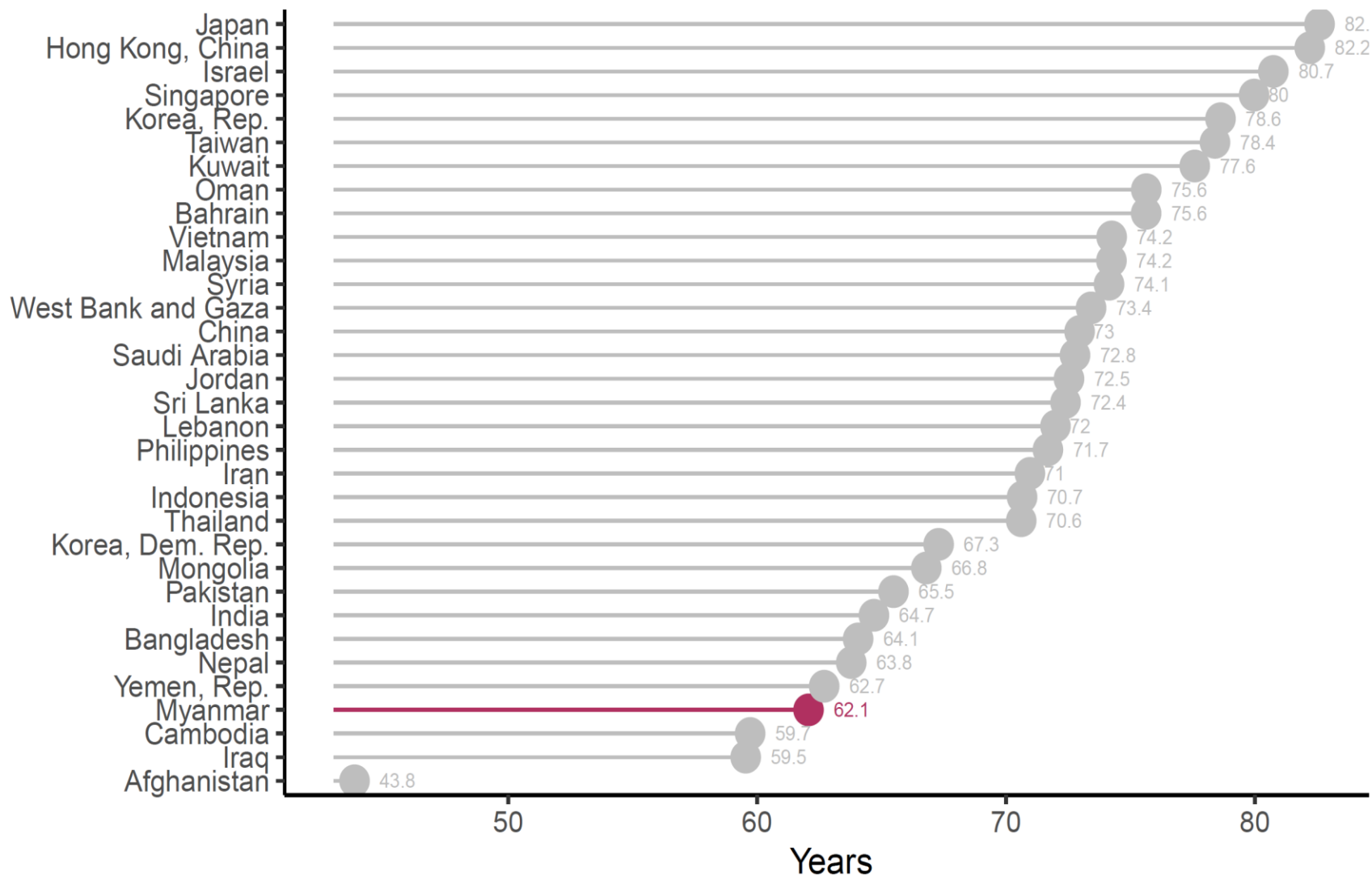


Focus attention where you want

- Focus attention by
 - Size
 - Color
 - Position on page
 - Small multiples
 - Sub-title
 - Annotation

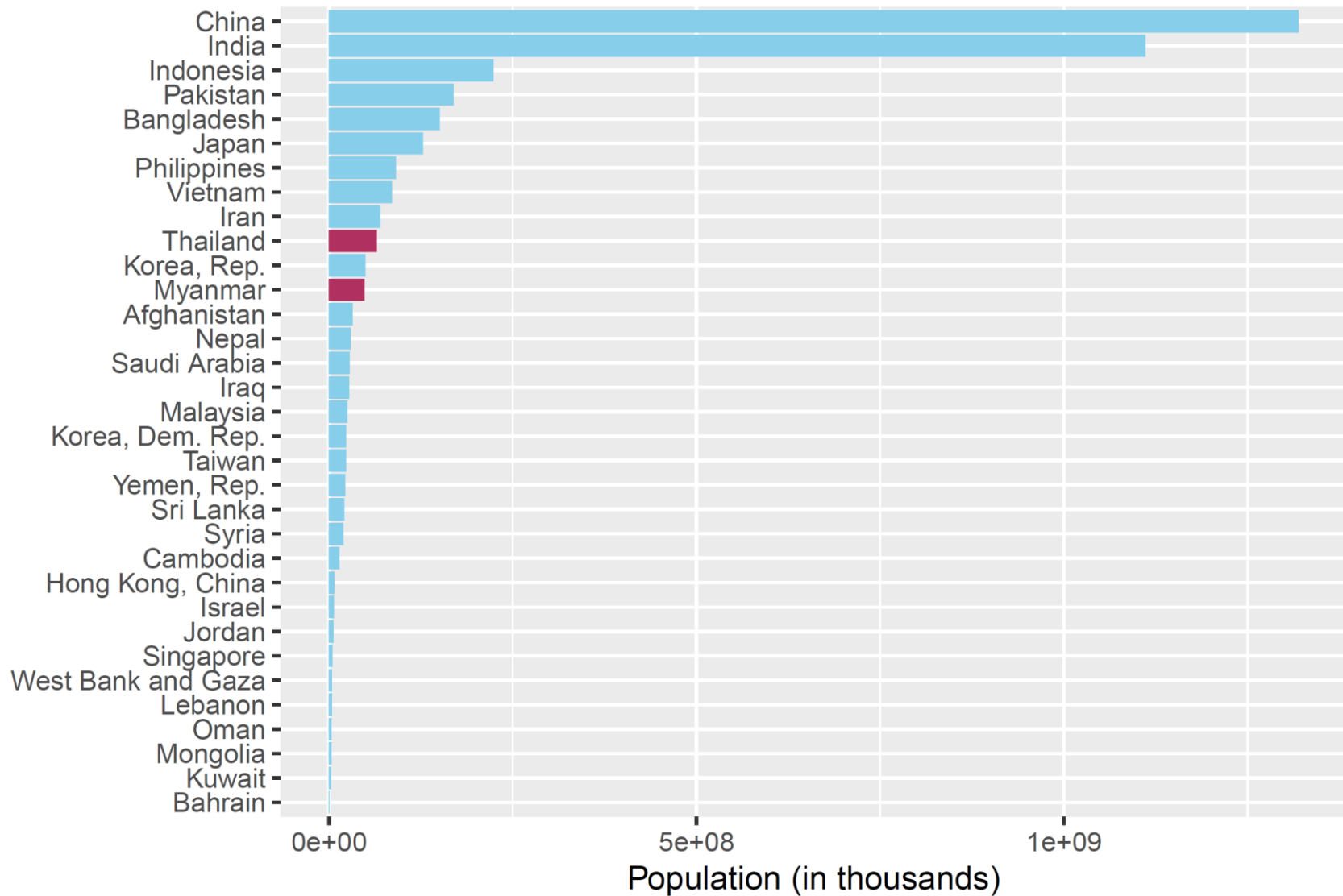
Life expectancy in Asia

2007

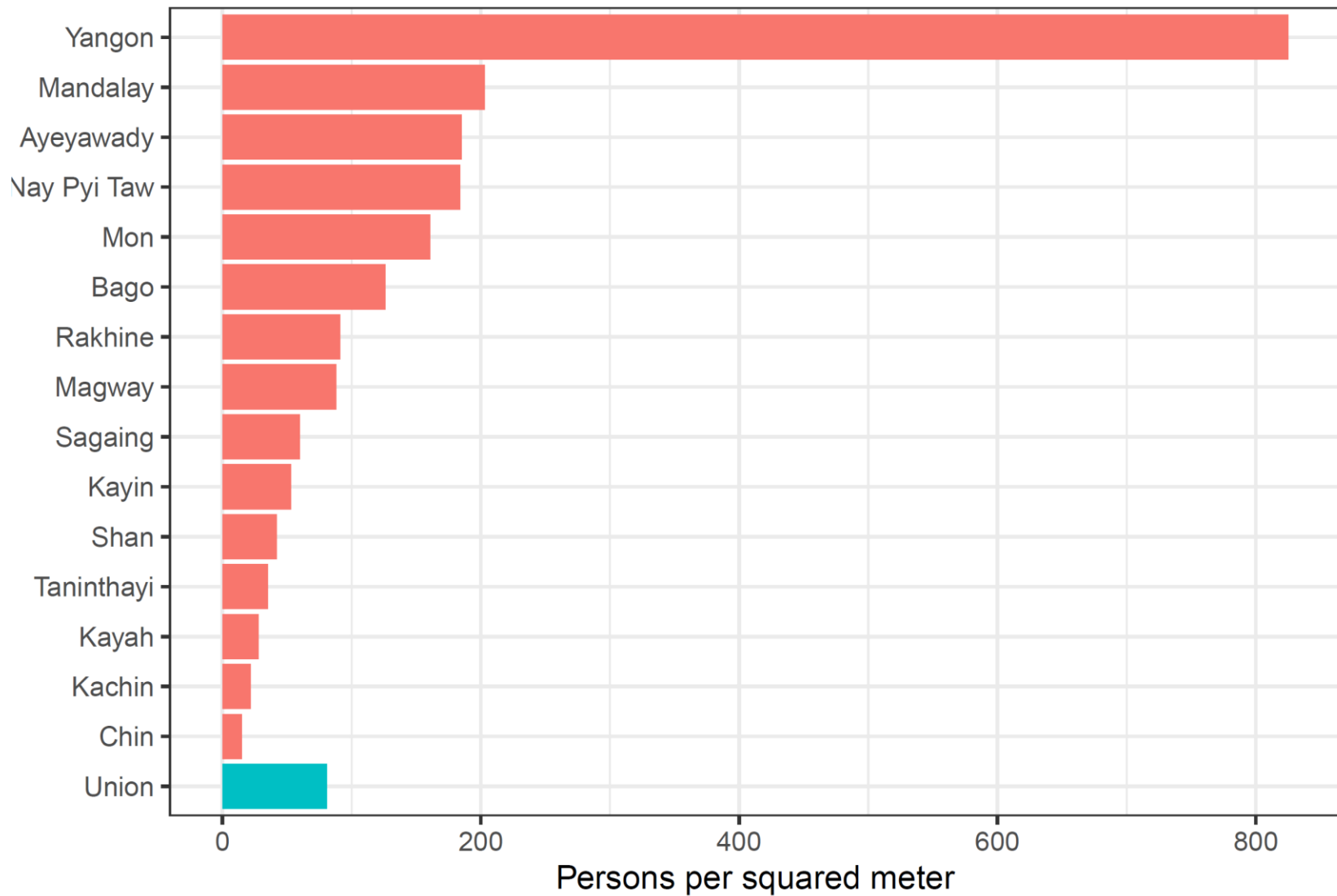


Source: 'gapminder' package

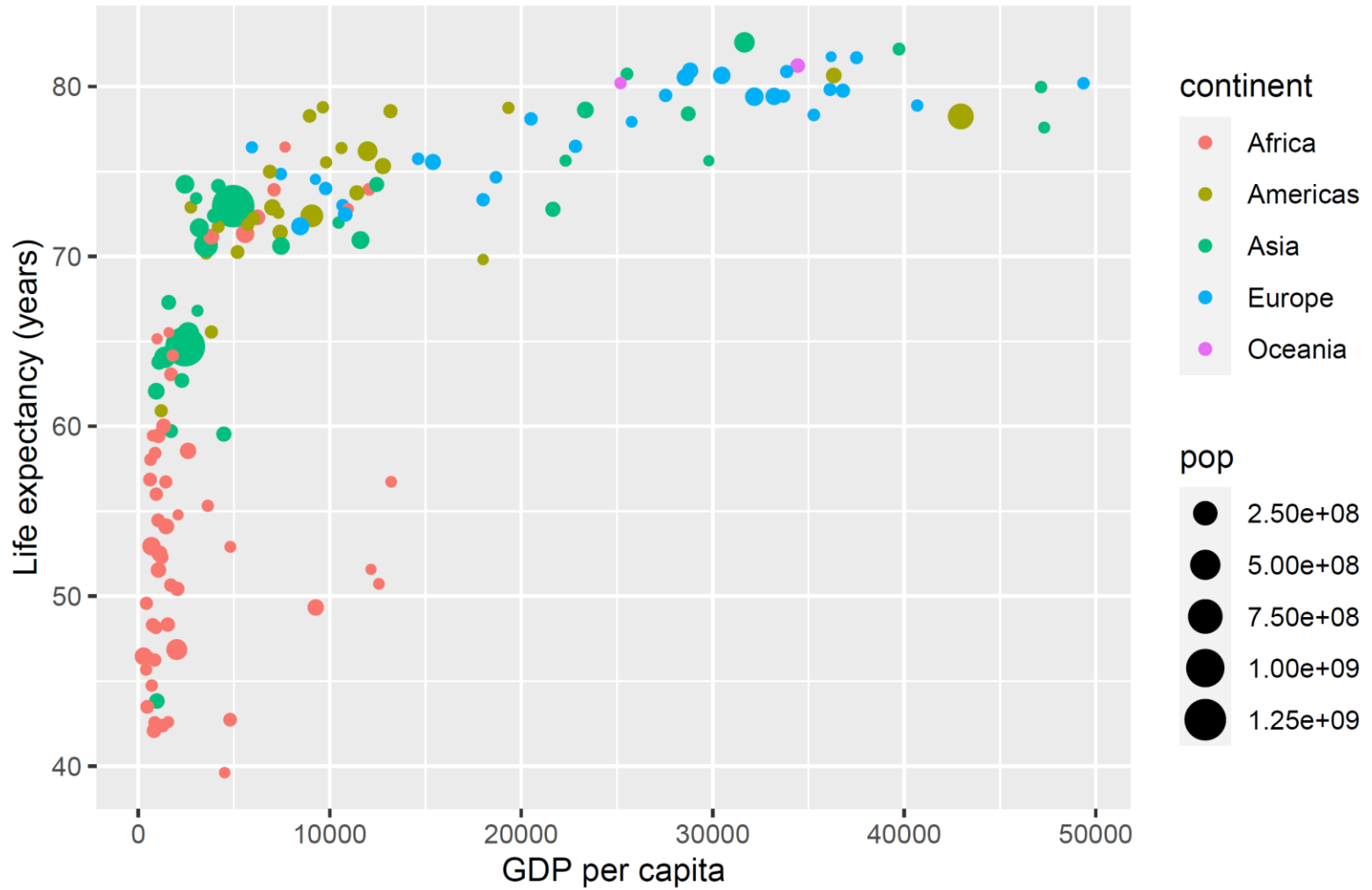
Population in Asian countries,2007



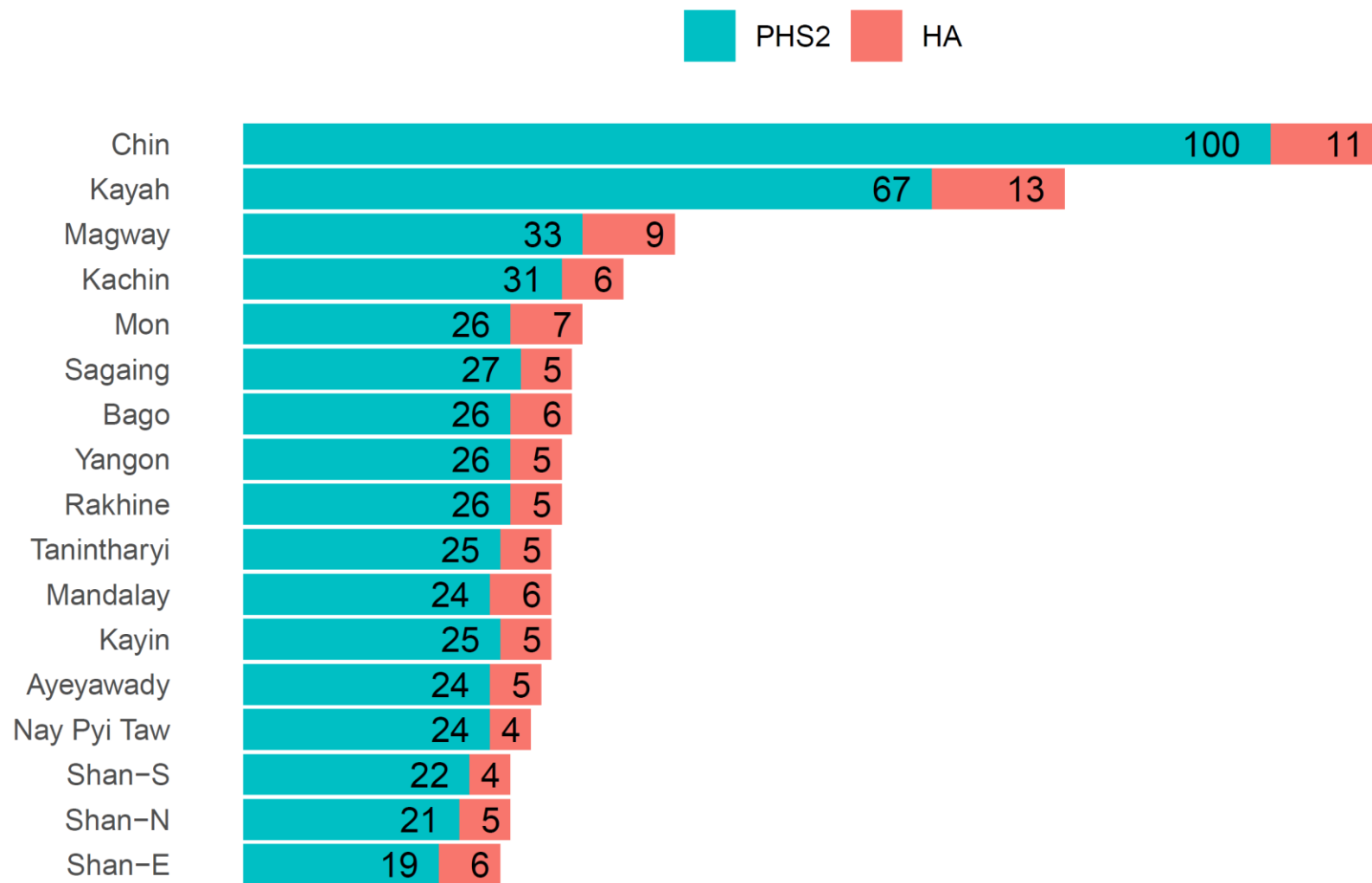
Population Density in Myanmar, 2020



GDP per capita and Life expectancy in 2007



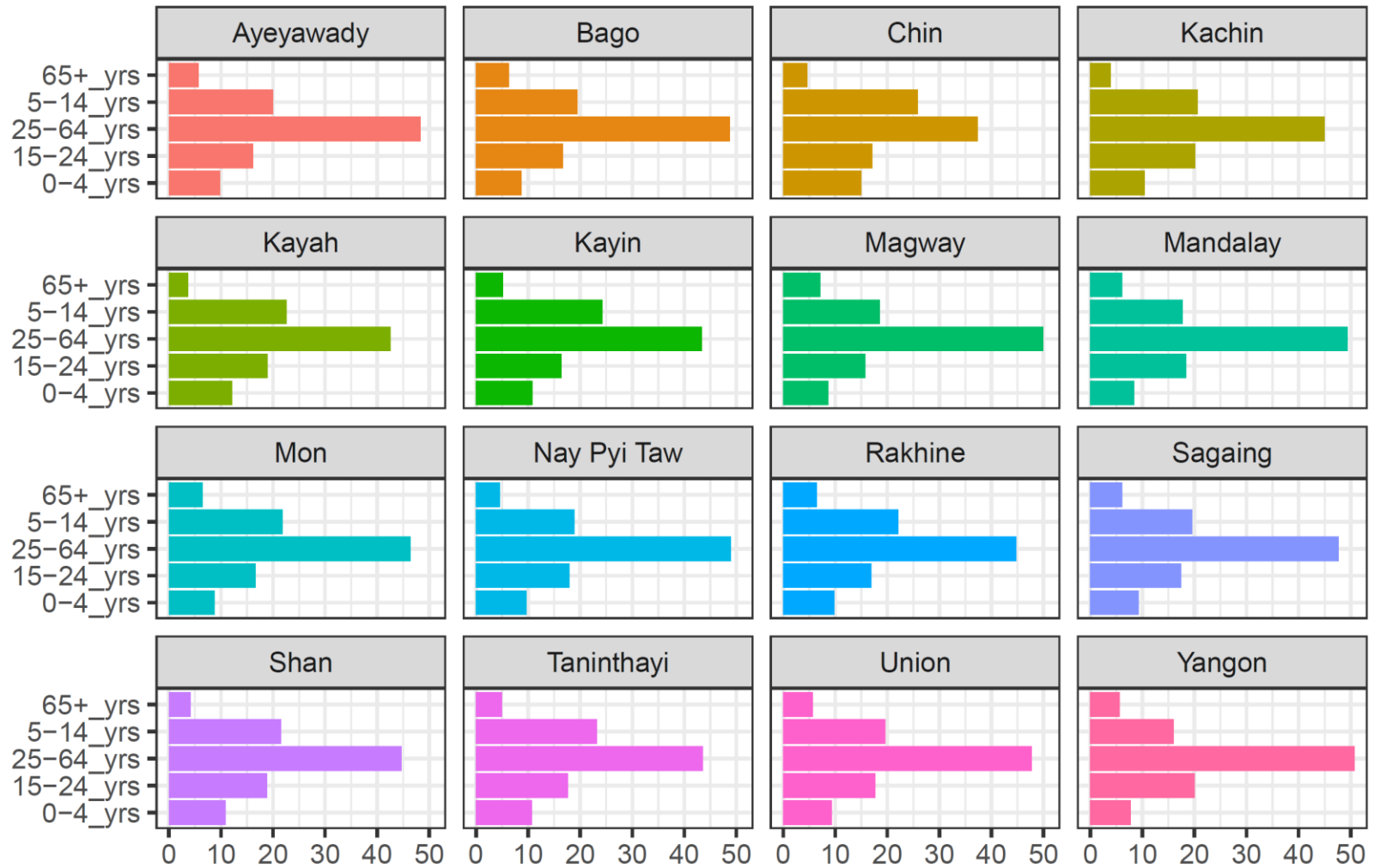
Public health professionals in Myanmar

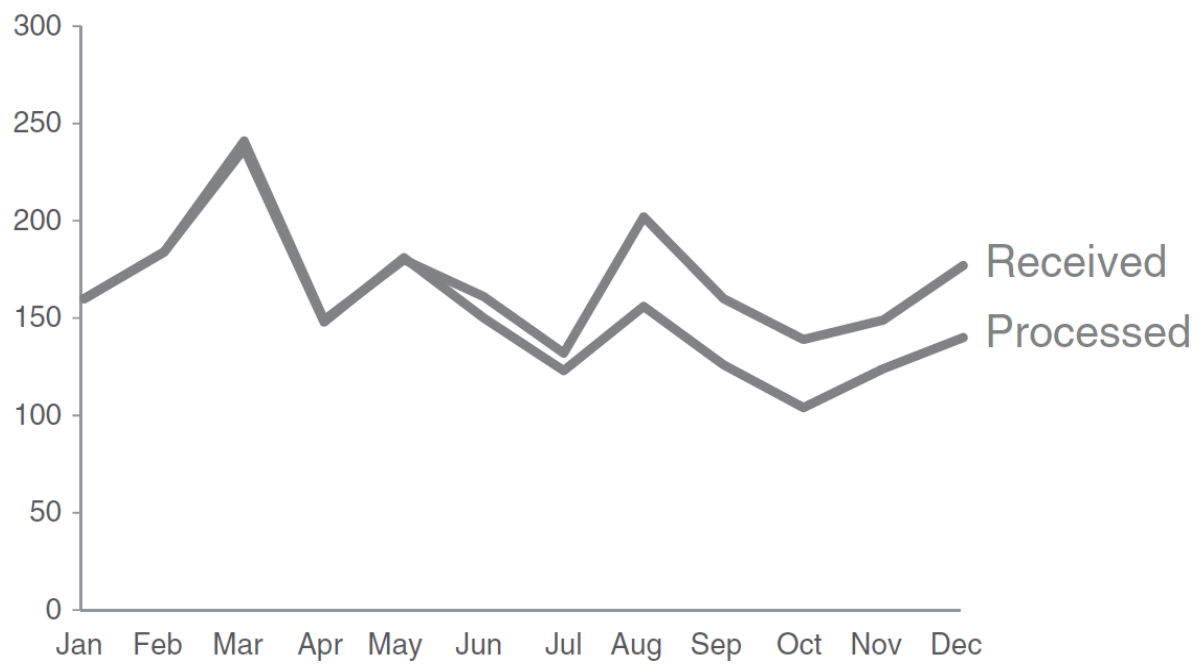


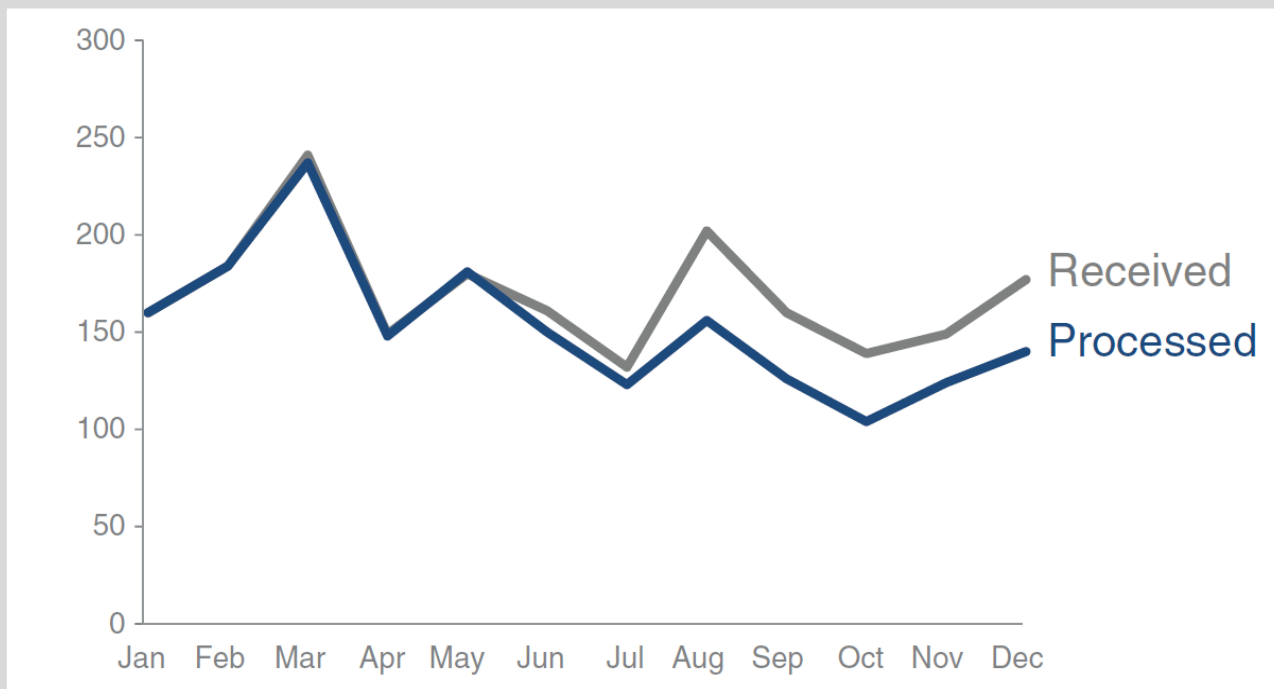
Per 1000 pop.

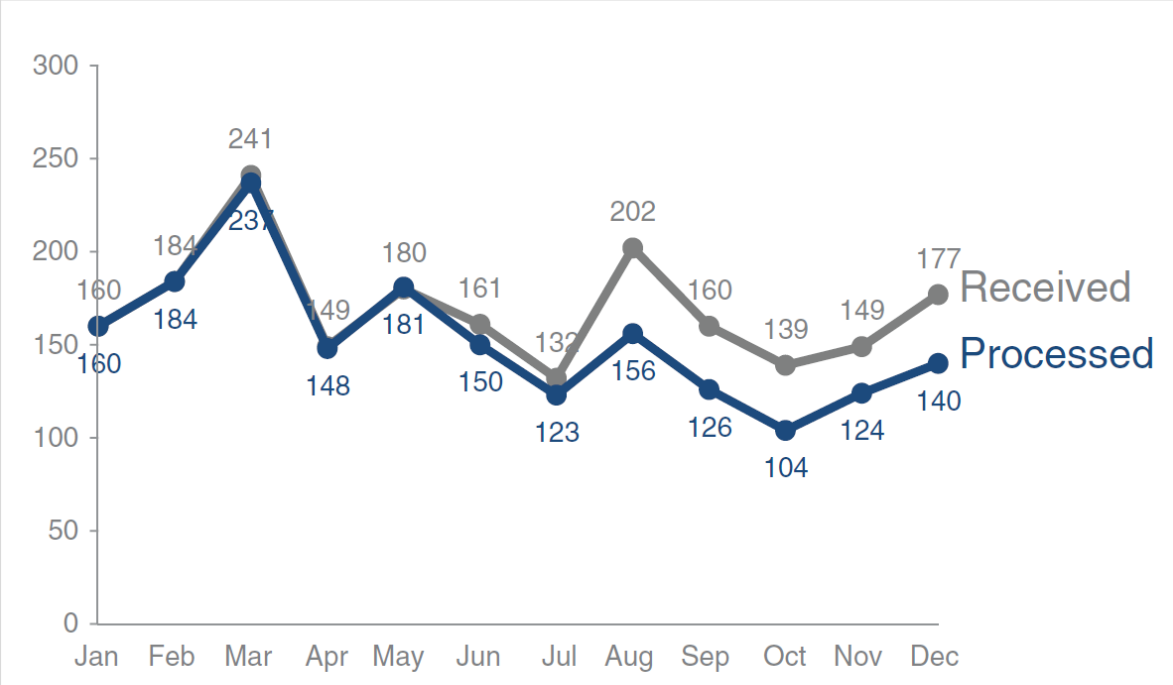
Small multiples

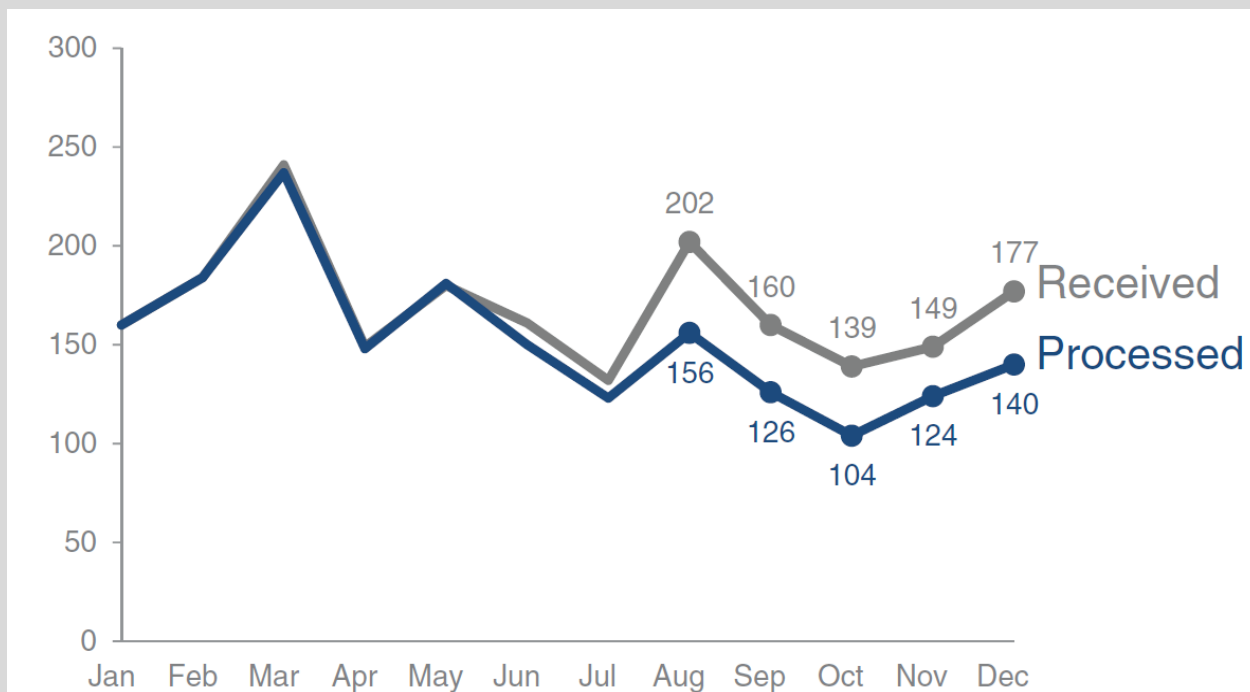
Age distribution in Myanmar by States and Regions







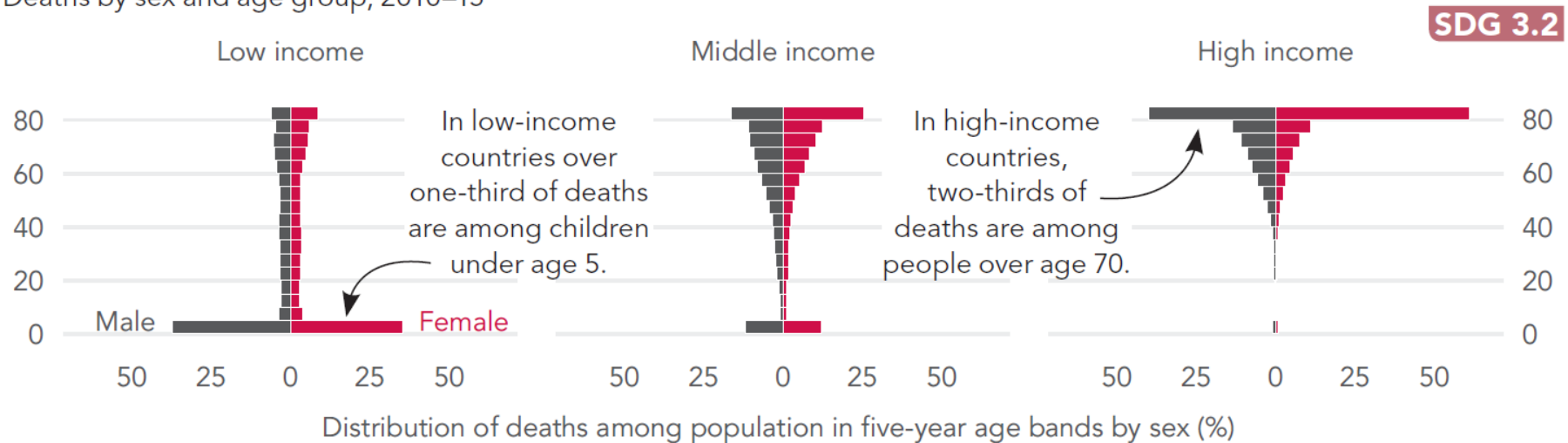




Focus by annotation

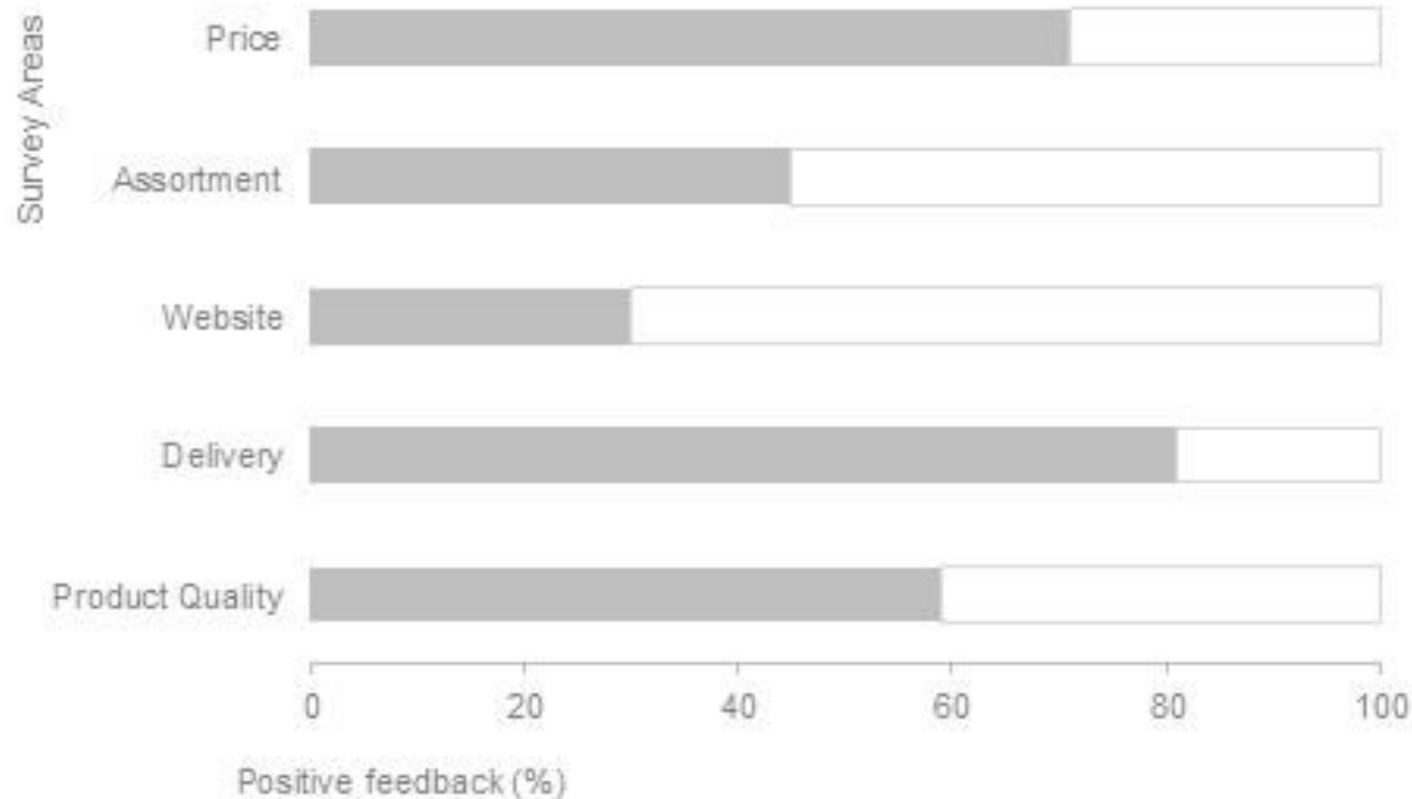
In high-income countries the majority of people who die are old. But in low-income countries children under age 5 account for one in three deaths.

Deaths by sex and age group, 2010–15

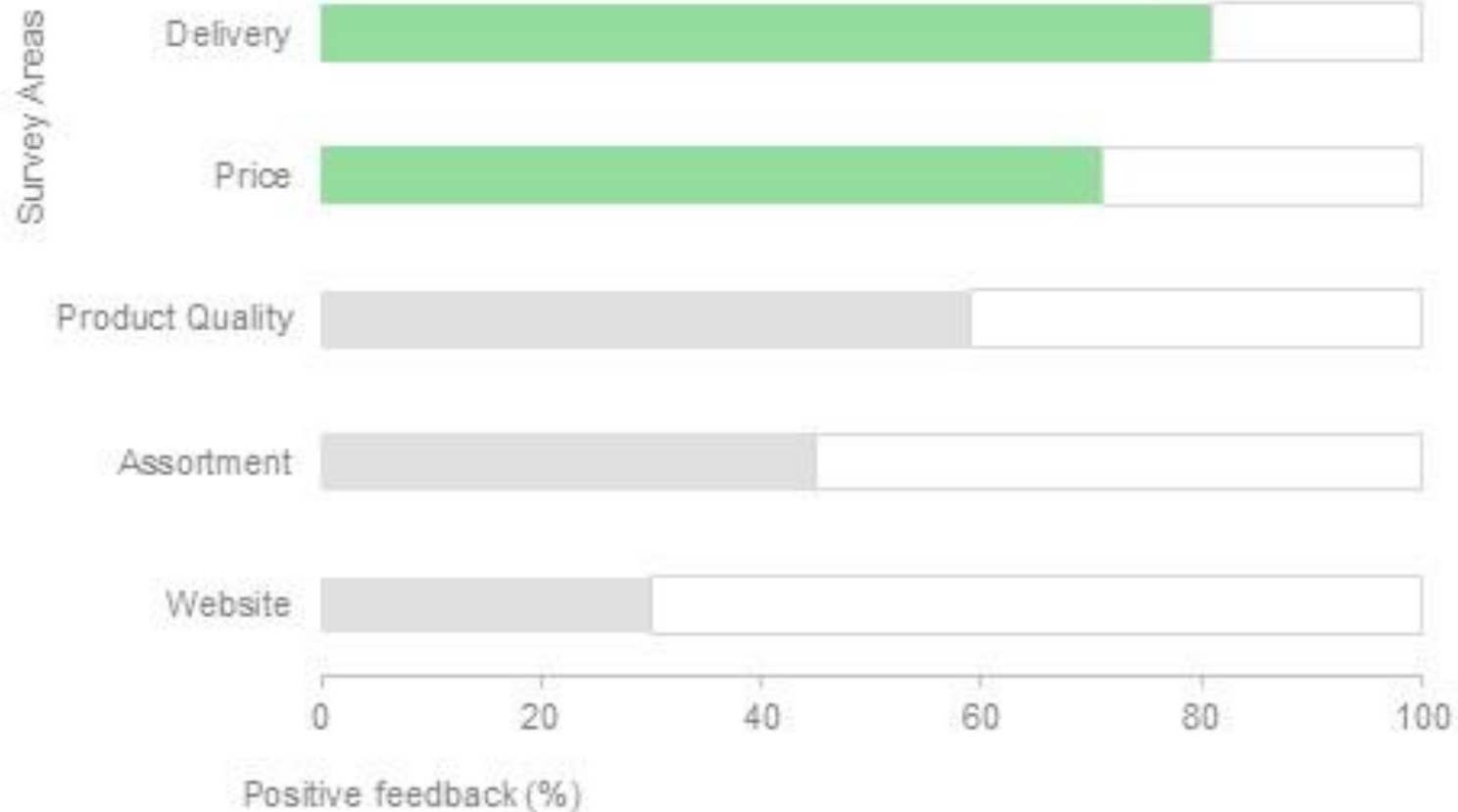


Source: WB. Atlas of SDGs 2018.

Focus attention where you want: examples



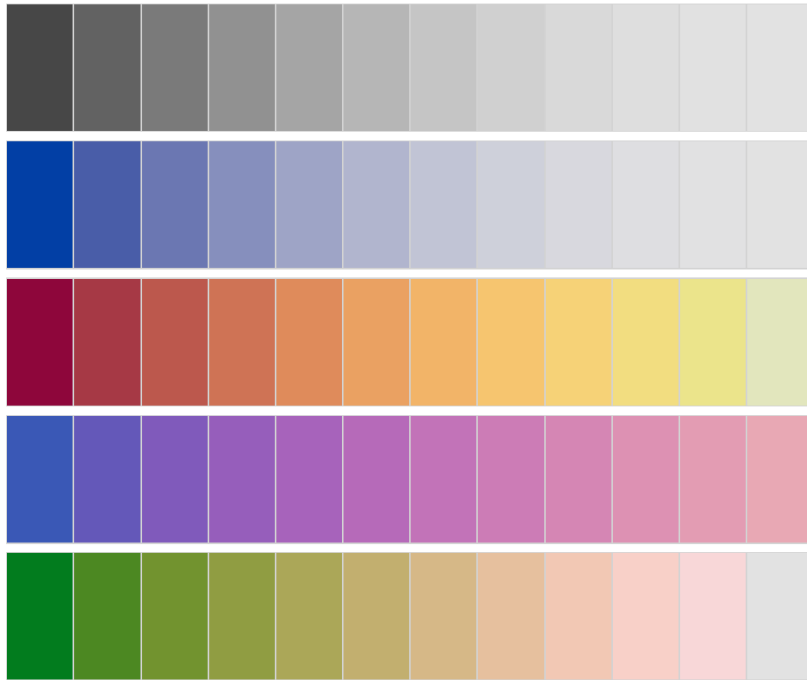
Focus attention where you want: examples (rearrange bars by numerical value and highlighted color)



Types of color

- Sequential colors
- Qualitative colors
- Diverging colors

Examples of sequential palettes



First panel :

varying only luminance

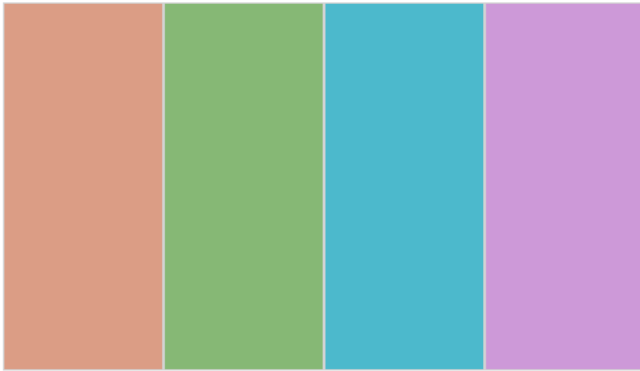
Second panel:

varying chroma and luminance

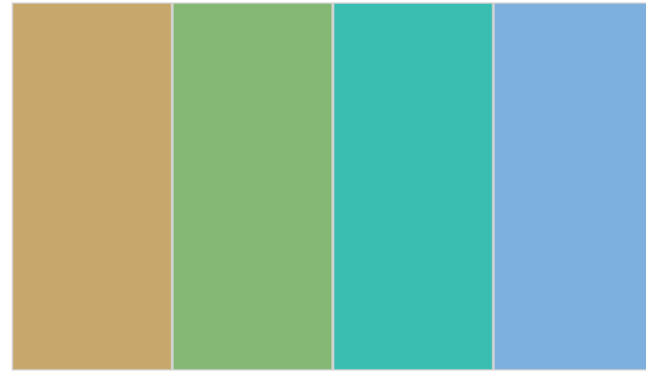
Remaining panels: varying hue,
chroma and
luminance

Examples for qualitative palettes

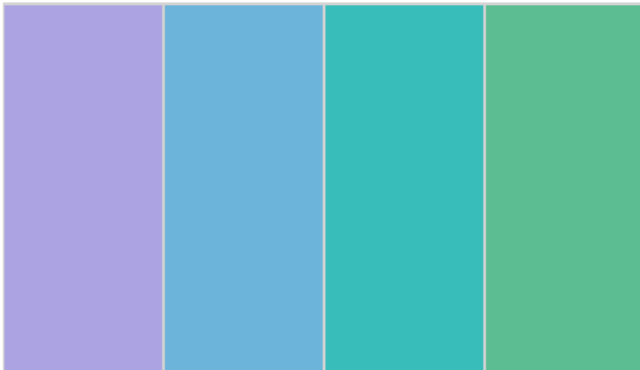
dynamic [30, 300]



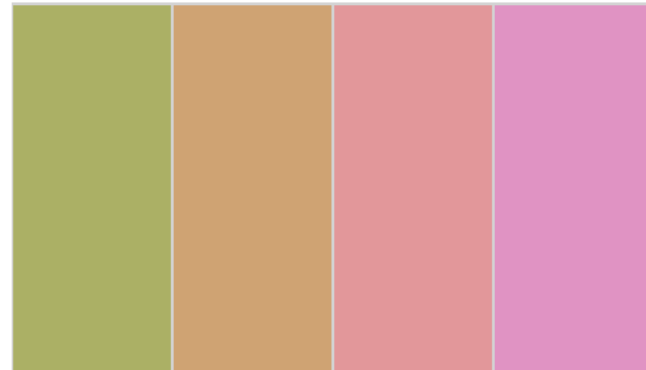
harmonic [60, 240]



cold [270, 150]



warm [90, -30]



- Hue is varied in different intervals for given $C = 50$ and $L = 70$.

Examples of diverging palettes

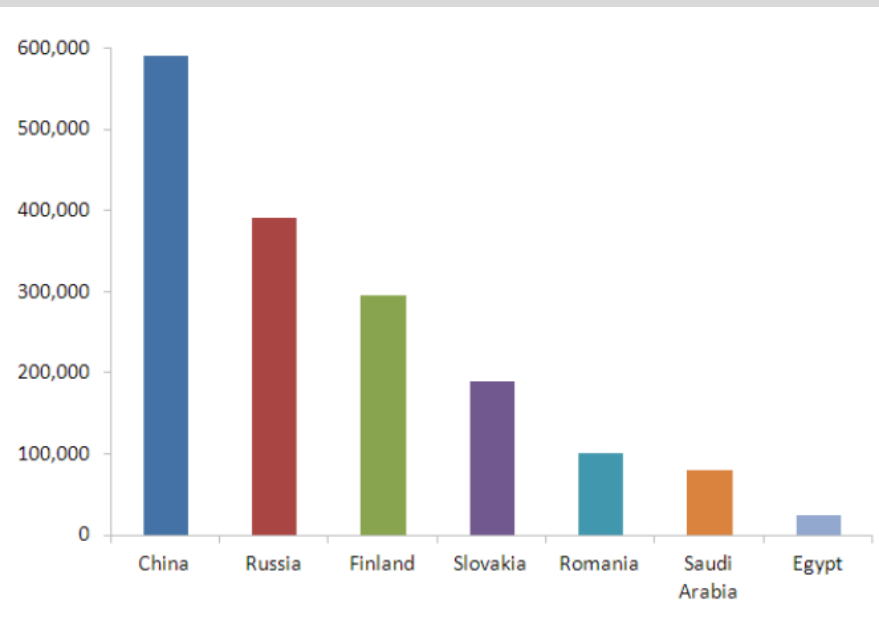


- Different pairs of hues and decreasing luminance contrasts.

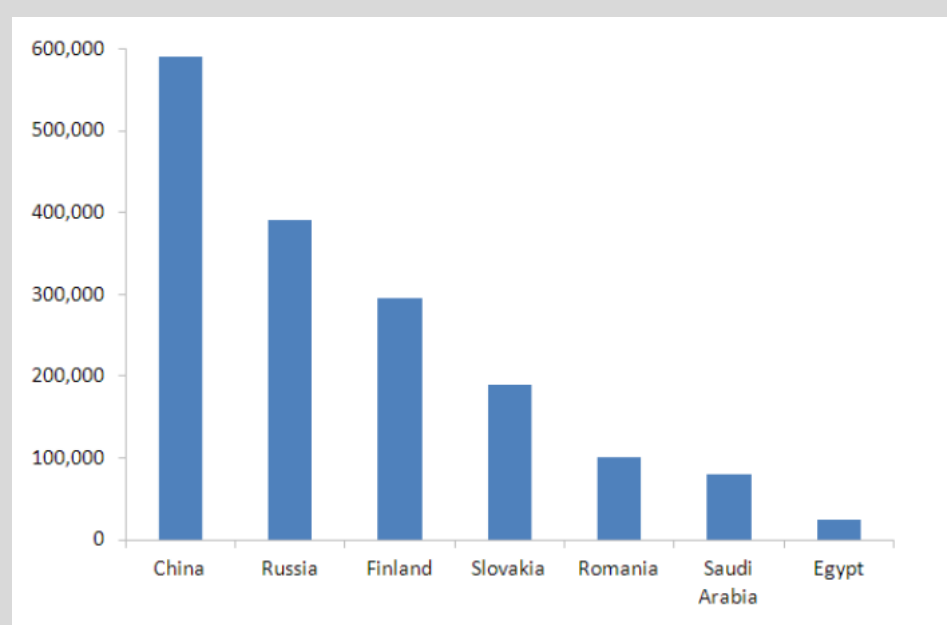
Principle 1: Use colour sparingly and with restraint

- Never use colour if it have no purpose
- People often print documents in black and white.
- Only use different colours when they represent helpful differences of meaning in the data.

Principle 1: Example



- The colours in this graph add no information value.

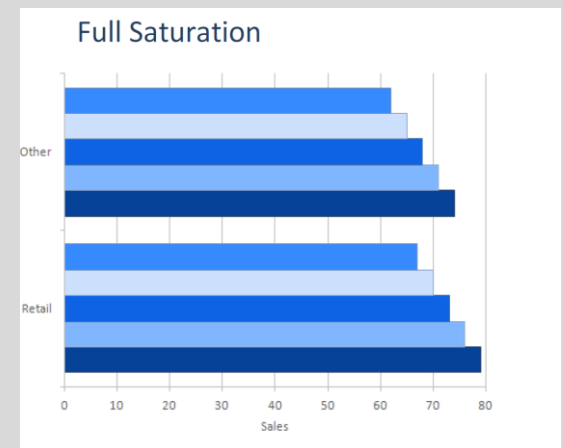
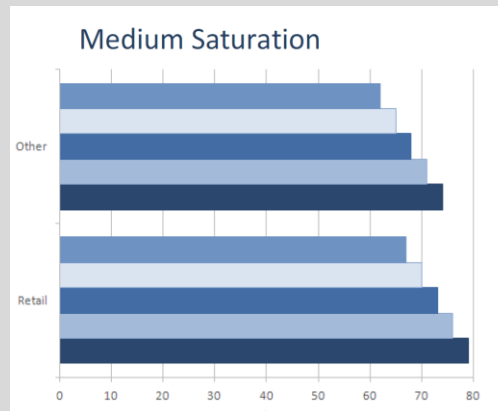
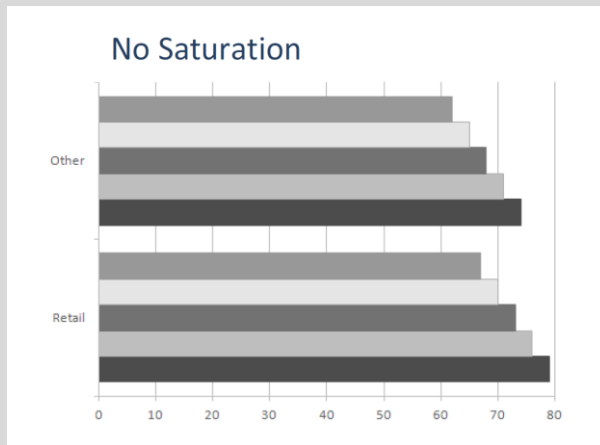


- This graph is more effective.

Principle 2: Don't overuse saturated colours

- Use bold, saturated colours only when you want to draw attention to a specific piece of information, rather than for all of the colours in a graph.
- Do not use saturated colours to highlight information in a table.

Principle 2: Example



- Mid to low levels of saturation are easy on the eye.
- Uncomfortable to look at
 - Best left to highlight key messages/ draw attention to small, hard to see elements like points on a graph
 - Avoid using them to cover large expanses in a graph or table

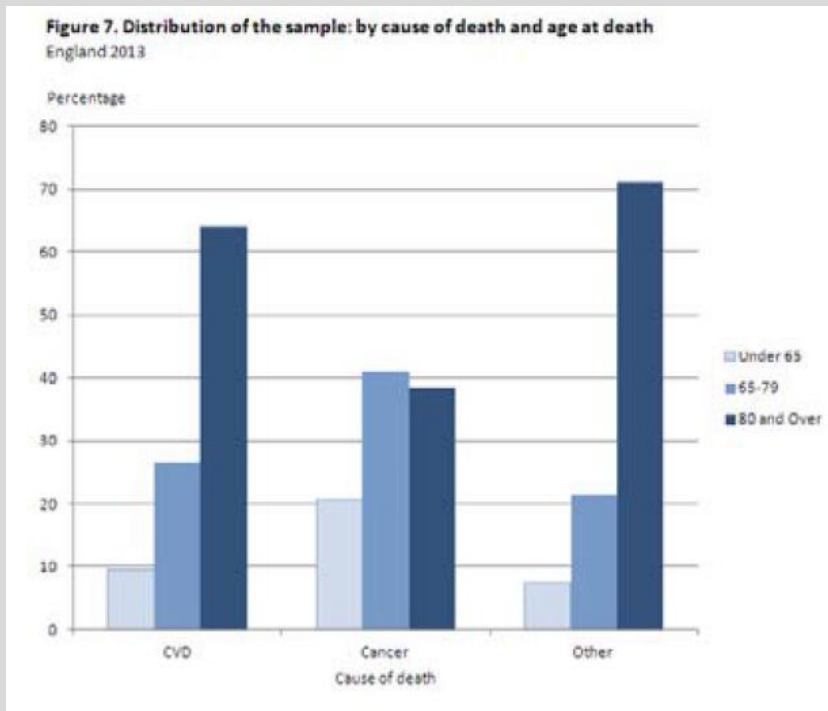
Principle 3: Be consistent in your use of colour

- Use the same colour to mean the same thing in a series of graphs.
- Where possible, use colours that users would expect to see to represent familiar concepts.

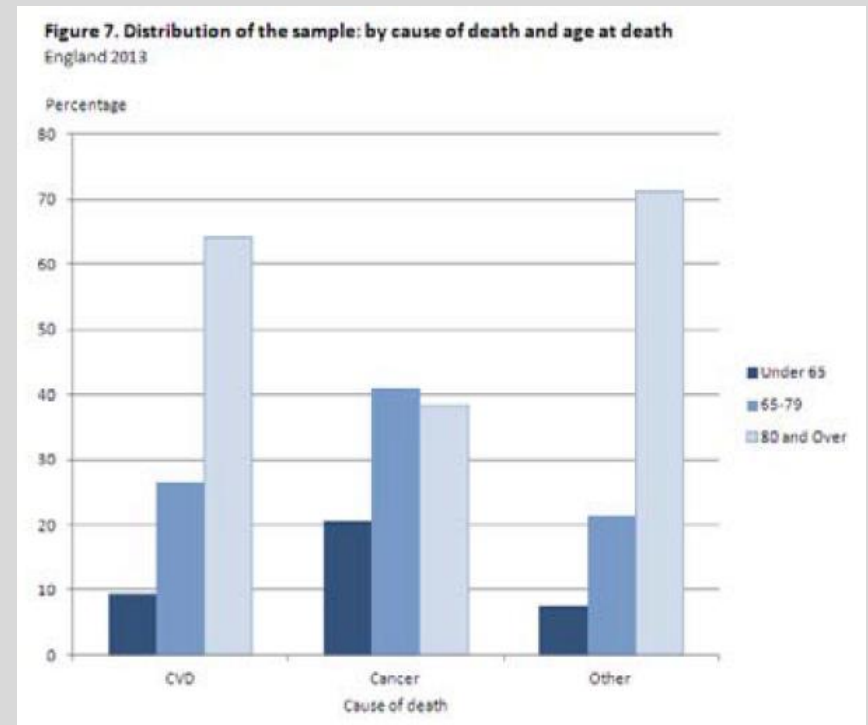
Principle 4: Use colour logically in sequences

- For sequences of colours, ensure that these progress in a way that the user would expect (e.g. in luminance order)
- When representing a sequence, use a single hue (or small set of closely related hues) and vary lightness from pale colours to dark colours, rather than alternating.

Principle 4: Example



- A logical sequence here might be to go from light (young) to dark (old).



- The reverse means that the small bars are easier to pick out and the biggest are less overly dominant.

Principle 5: Use a white background

- Always use white for background.
 - Most colour palettes are designed to appear on a white background.
 - Human vision adopts colour perception relative to the local definition of white.
 - A white background provides a helpful reference “anchor” for the visual system.
- In general, background colour should be avoided in tables unless it is to provide subtle highlighting.

Principle 5: Use a white background (contnd.)

- Confine use of colour to foreground items in graphs.
- Avoid using white as a foreground colour in graphs.
- White colour should also be avoided on maps unless it represents “no data”.
- Use grey palettes for drawing and labelling axes and annotation.
- Never, ever use images as backdrops in graphs or tables. These simply distract the reader.

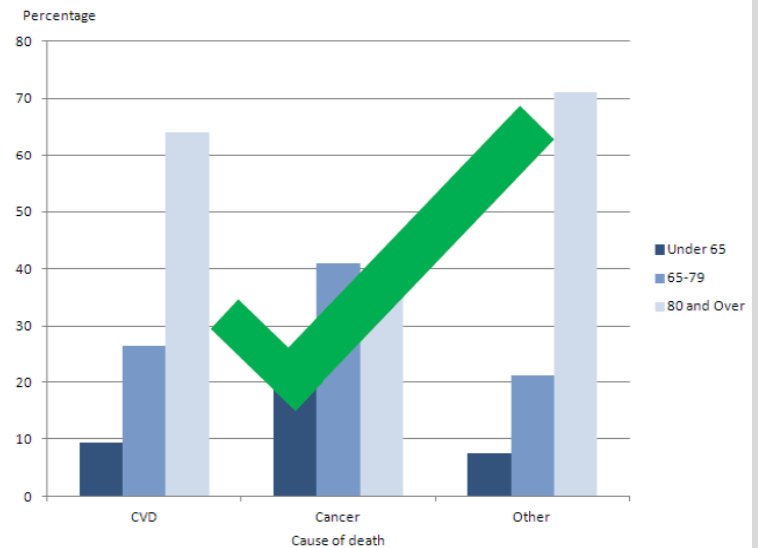
Principle 5: Example

Figure 7. Distribution of the sample: by cause of death and age at death
England 2013



- A logical sequence here might be to go from light (young) to dark (old).

Figure 7. Distribution of the sample: by cause of death and age at death
England 2013



- The reverse means that the small bars are easier to pick out and the biggest are less overly dominant.

Figures: Modern effective graphs

Figures: Dot chart

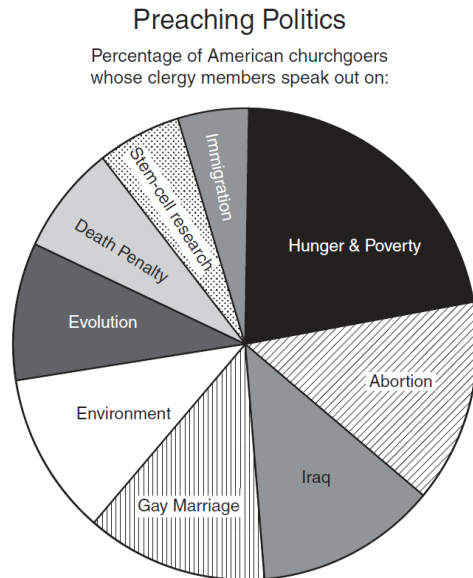


FIGURE 9.3. A typical pie chart representation of the relative popularity of various topics among the U.S. clergy.

Pie chart

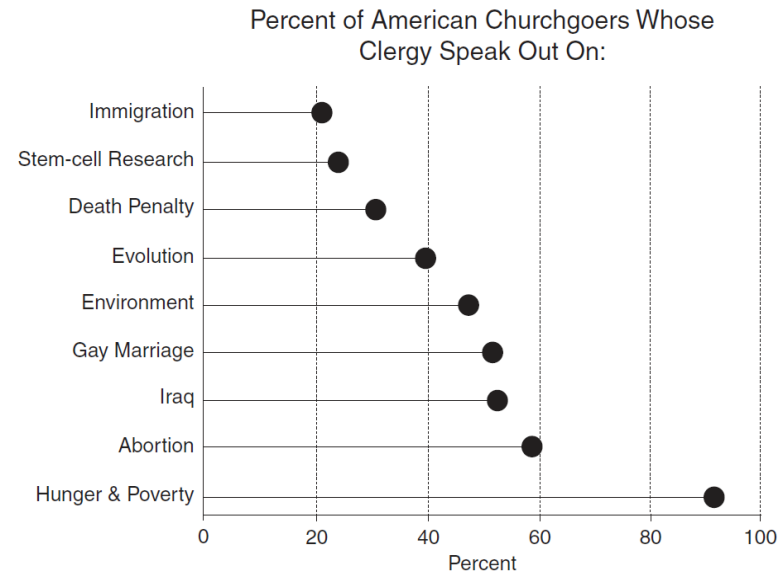
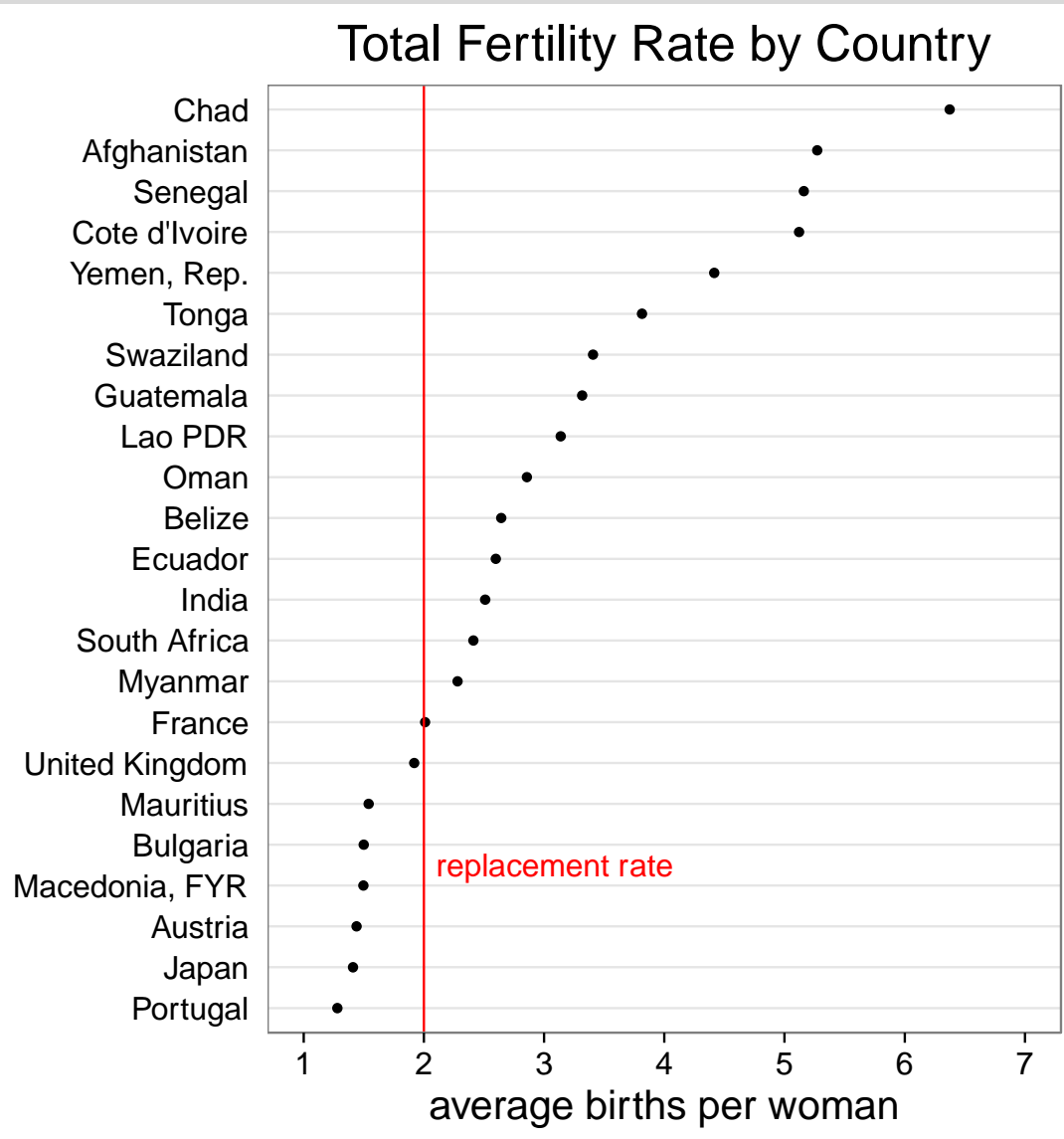


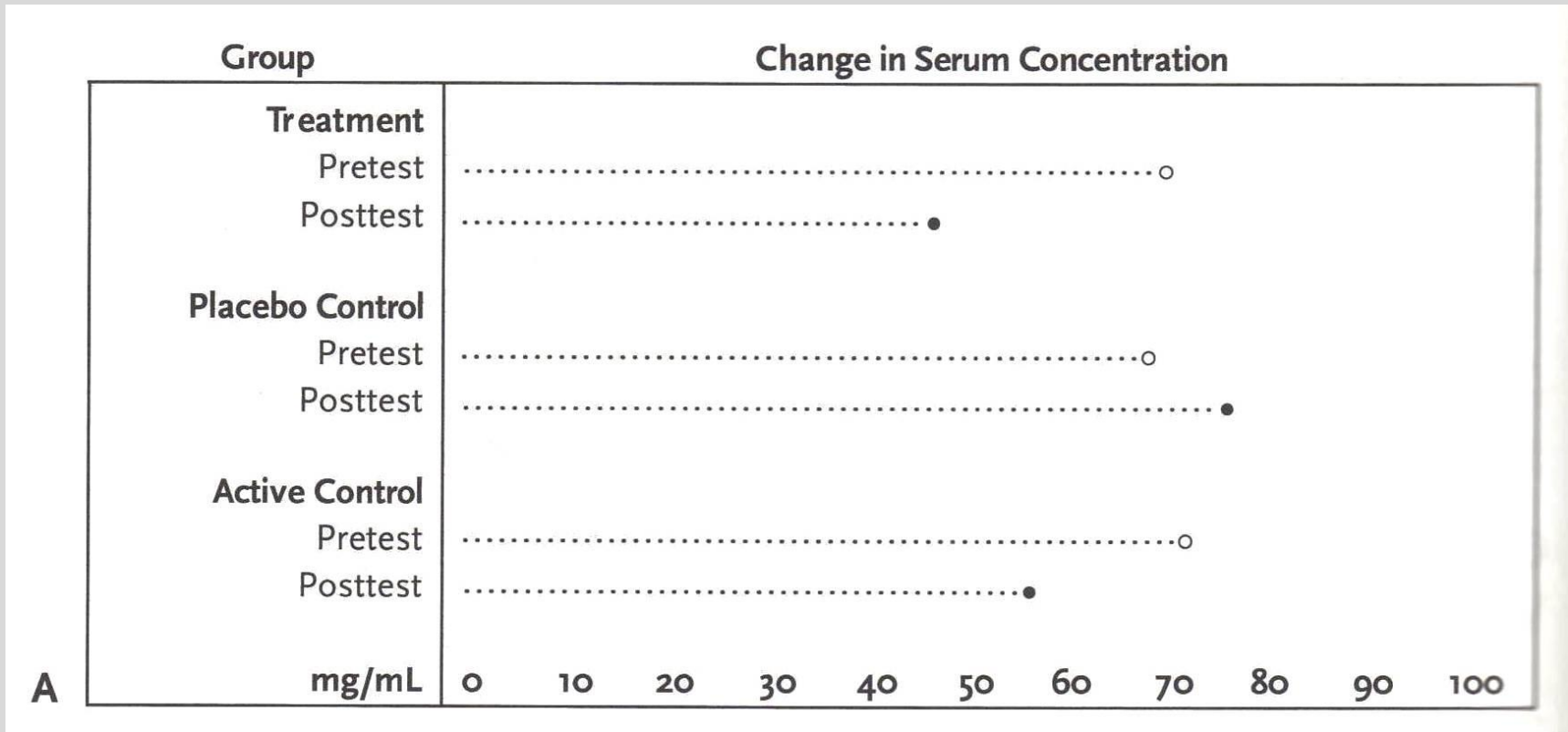
FIGURE 9.6. The same data previously shown in [Figures 8.3](#) and [8.4](#) recast as a line-and-dot plot.

Dot chart

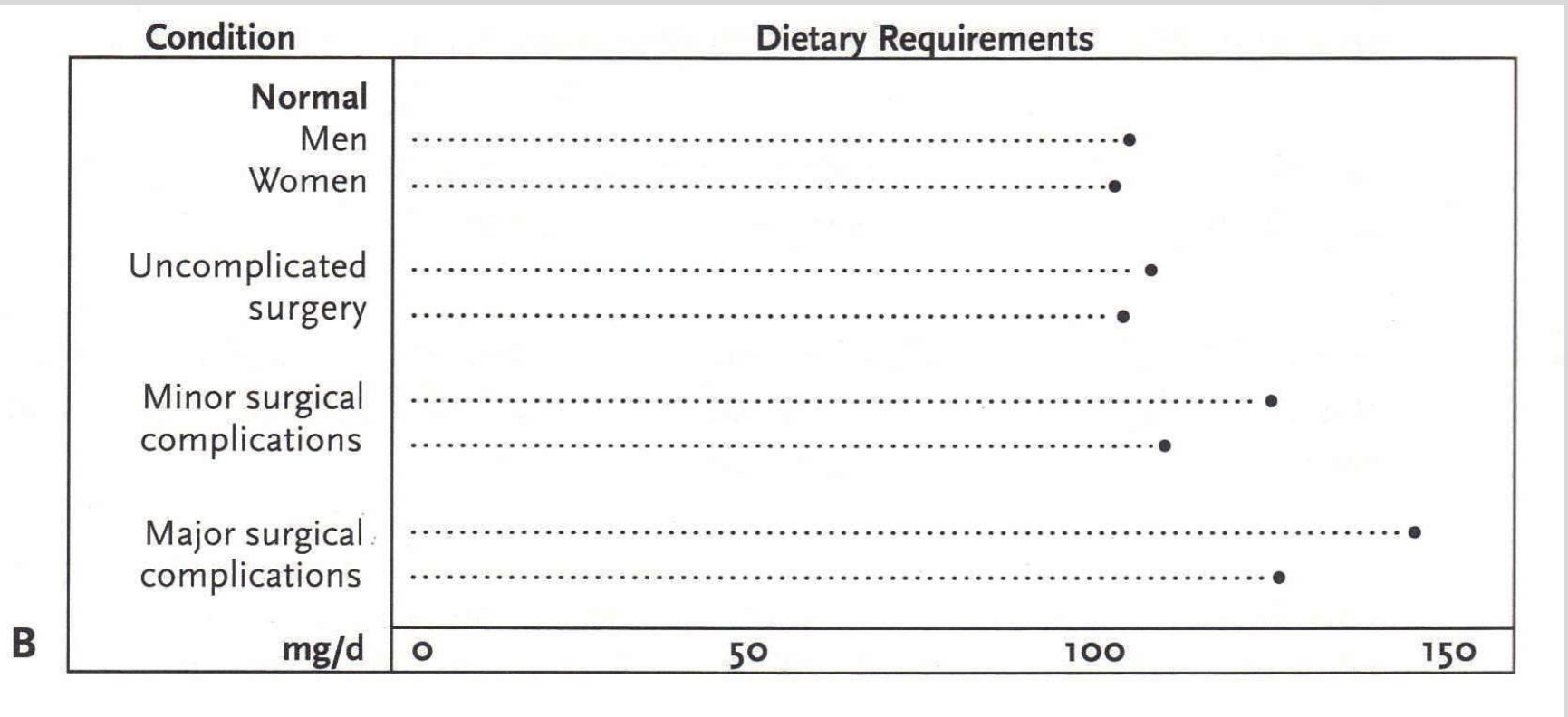
Figures: Dot chart



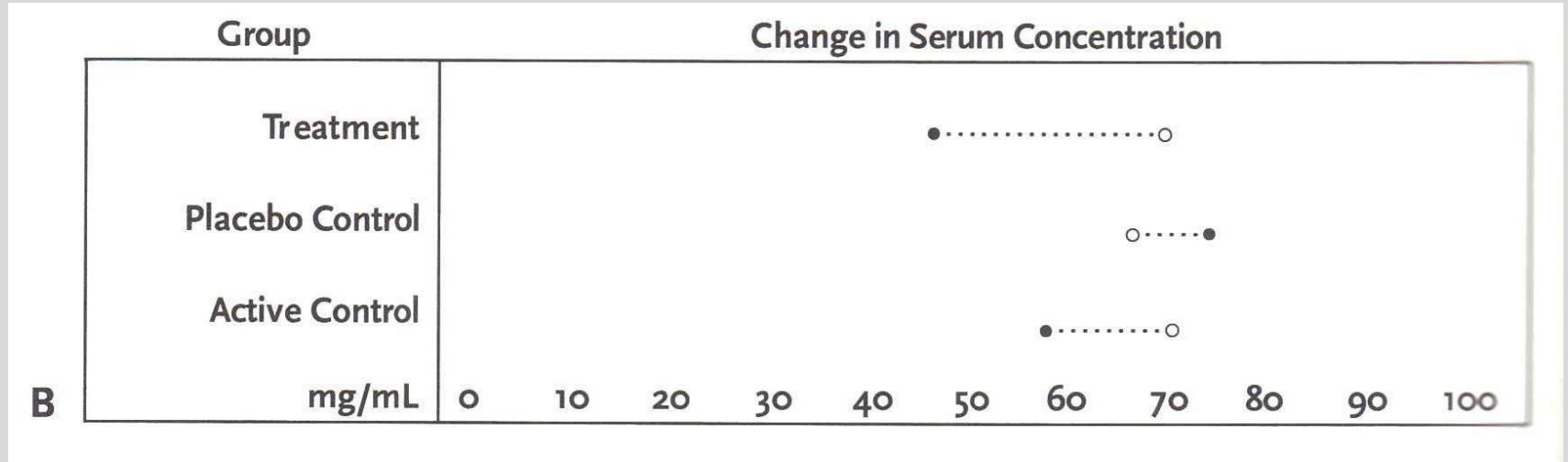
Figures: Comparison with dot chart



Figures: Comparison with dot chart



Figures: Comparison with dot chart



Figures: Comparison with dot chart

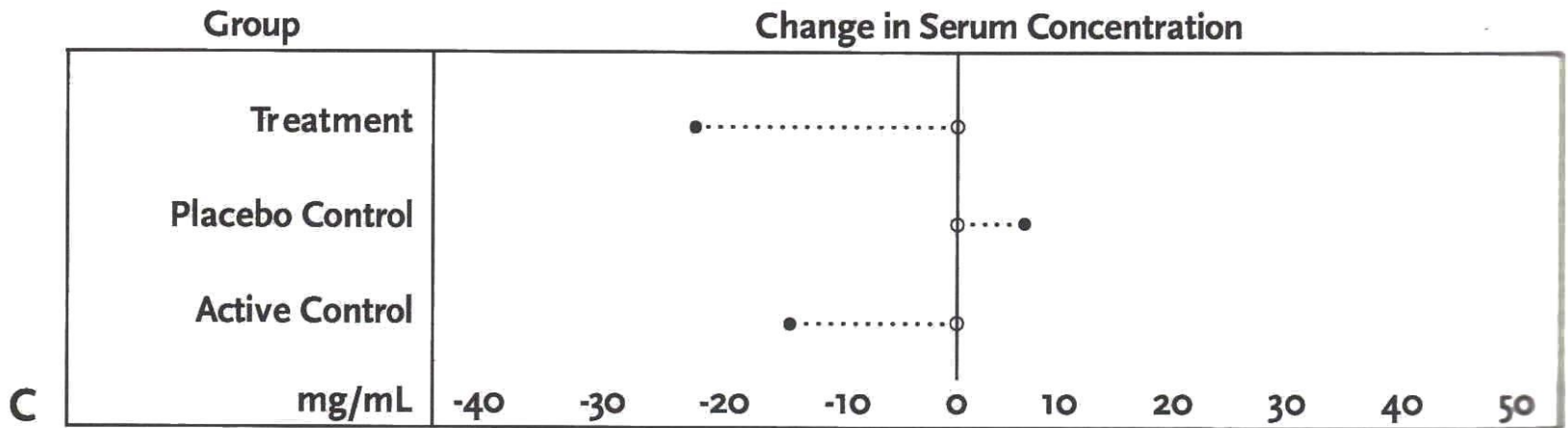
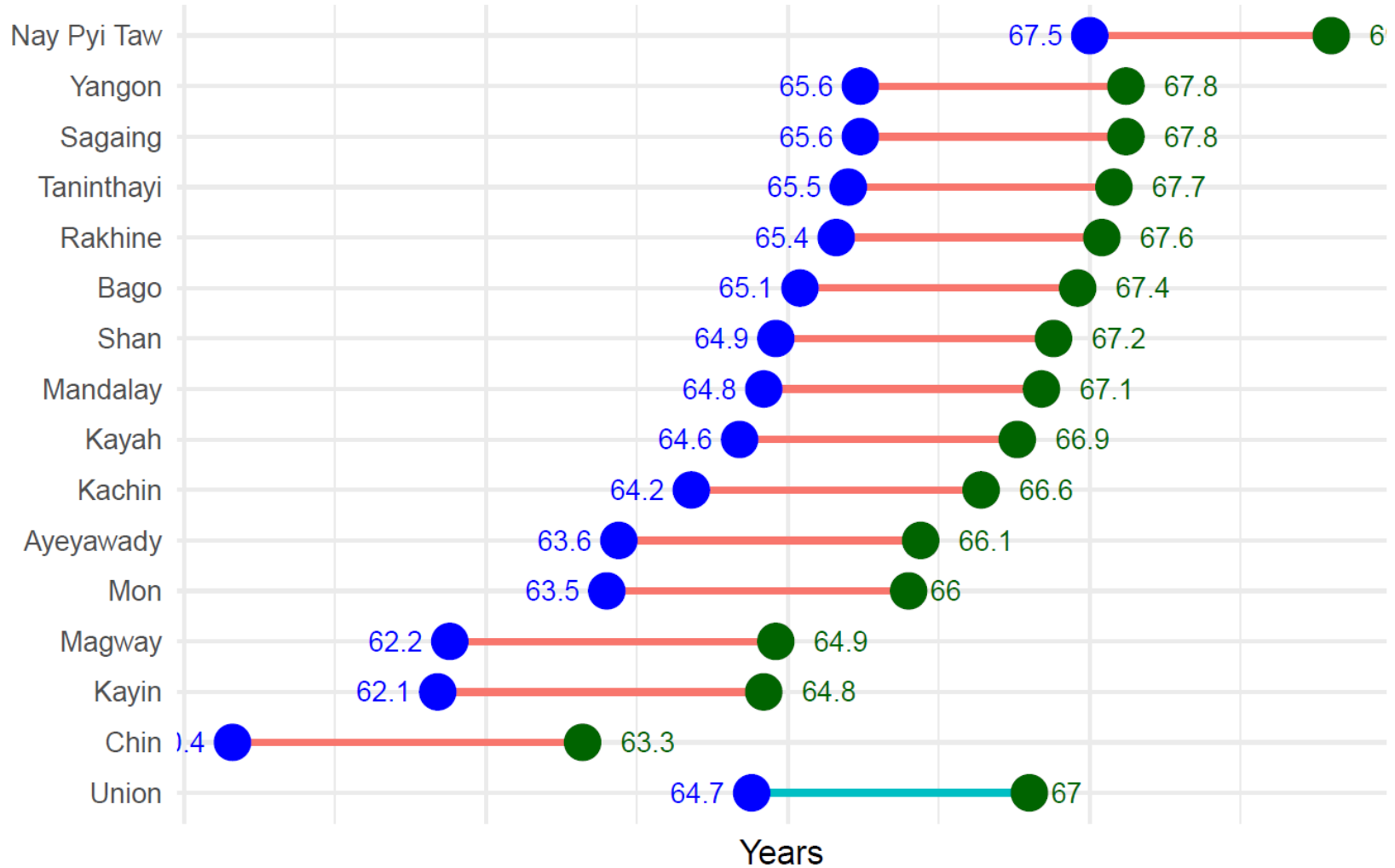


Figure 21.24

Make comparisons visually explicit. Simply presenting the data (**A**) is not as effective as presenting the actual differences of interest (**B** and **C**). Here, **B** emphasizes the differences with respect to the range of actual values, whereas **C** is simpler yet, emphasizing only the direction and magnitude of the changes.

Change in life expectancy in Myanmar 2014 to 2020



Figures: Comparison with slope chart

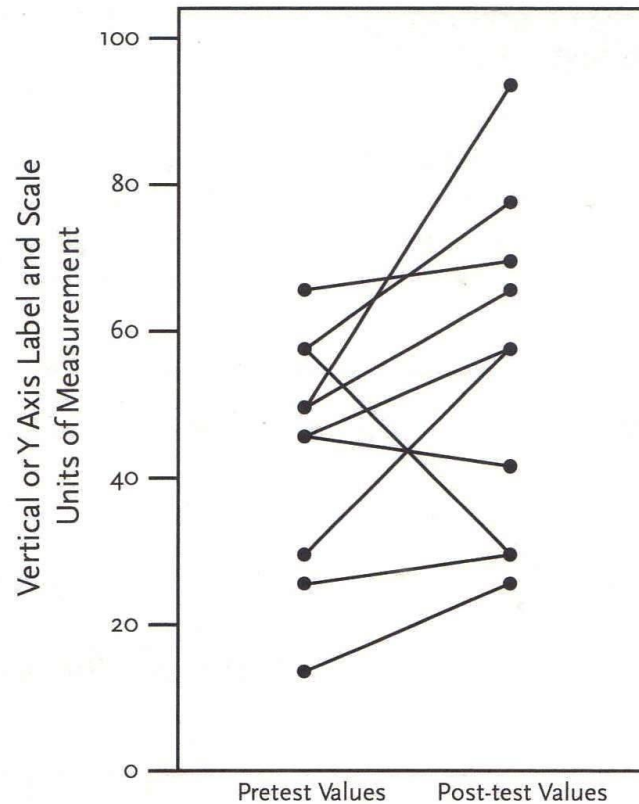
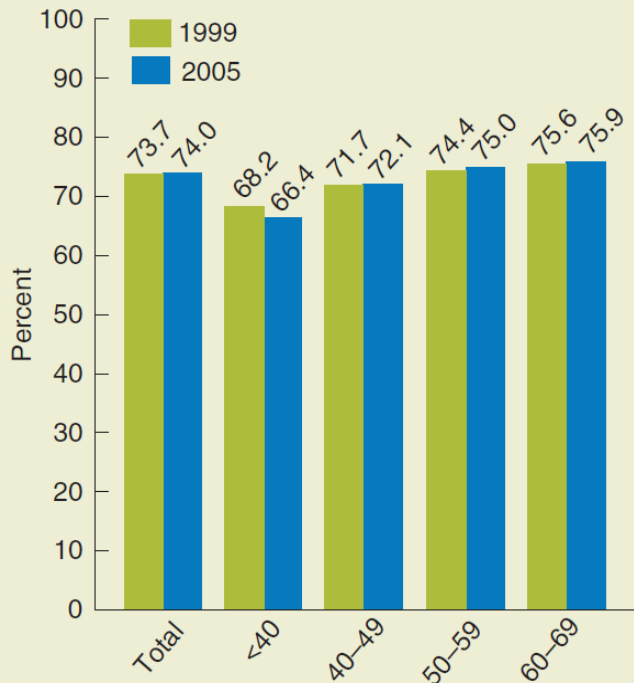


Figure 21.27

A standard graph for reporting paired data. Comparing only the pre- and post-distributions of values can be misleading if individual changes among the pairs cancel each other in the aggregate. When comparing pre-test and post-treatment values for, say, a cell count, the results can be reported as the difference between the pre-test and post-treatment means for each group or as the number of subjects in whom the count increased or decreased.

Figures: Comparison with slope chart

Figure 2.5. Women under age 70 treated for breast cancer^a with breast-conserving surgery who received radiation therapy to the breast within 1 year of diagnosis, 1999 and 2005



The younger the breast cancer patient the less likely she is to receive radiation therapy

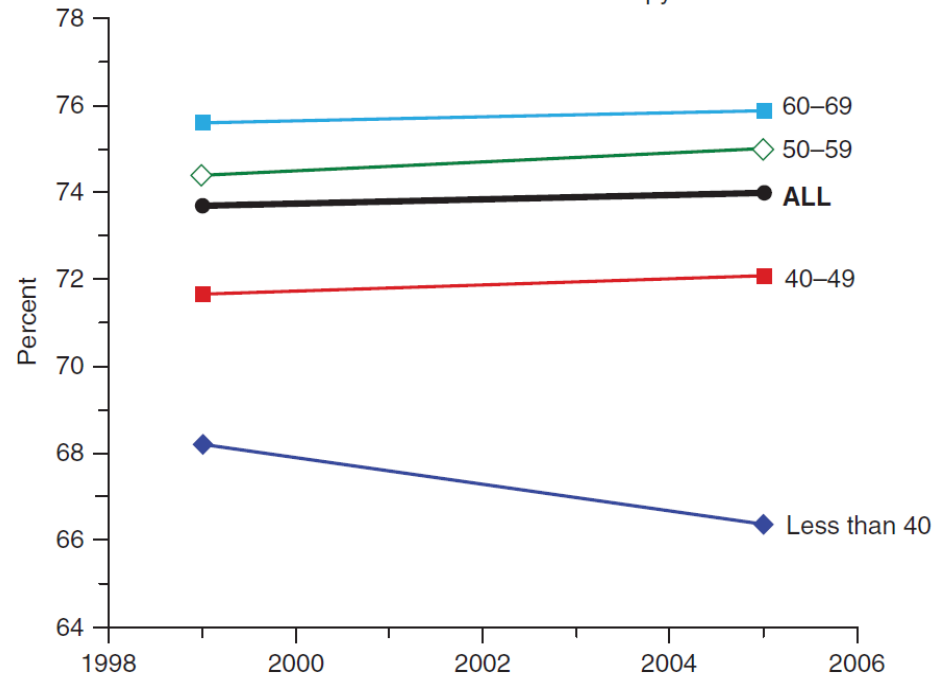
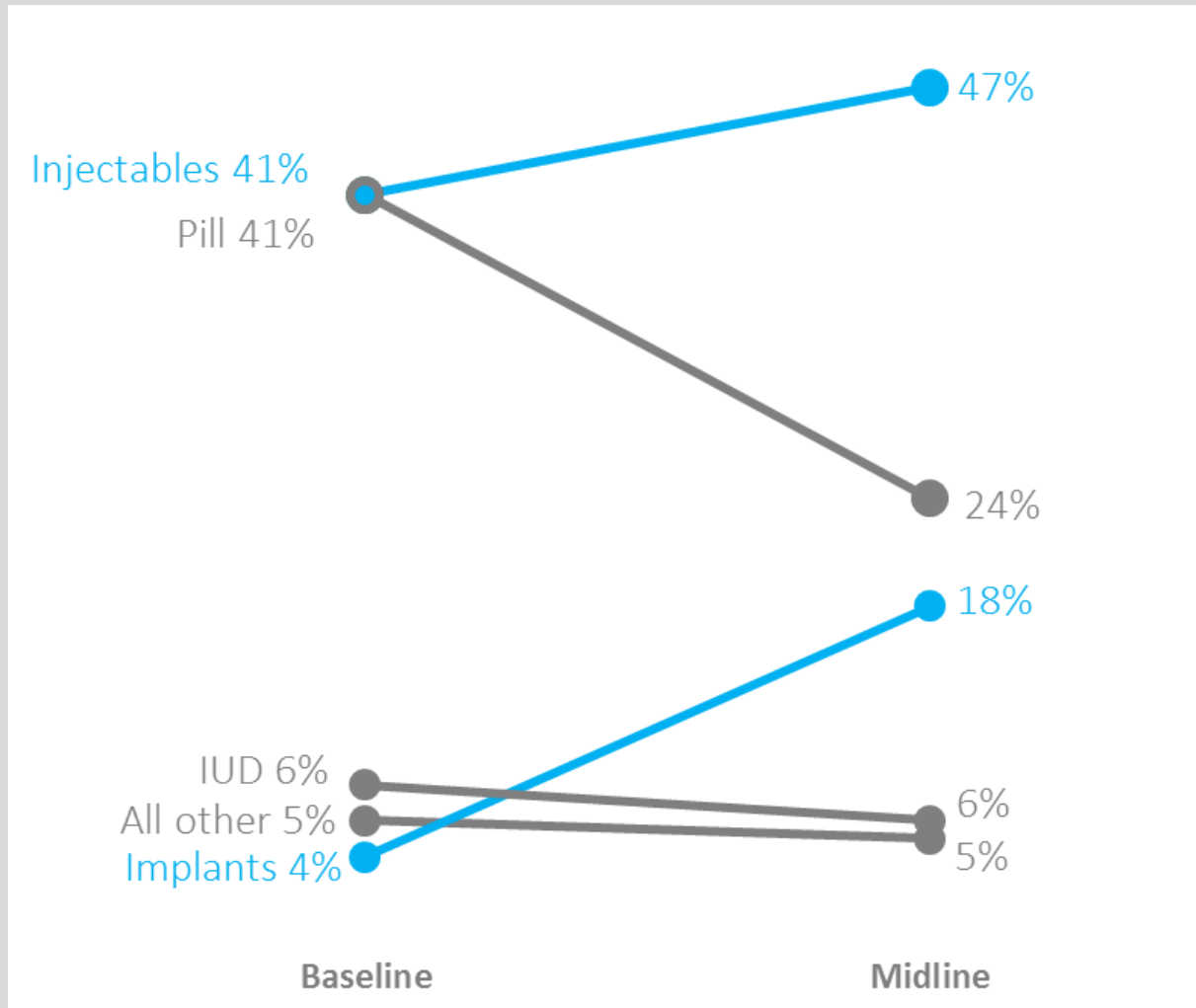


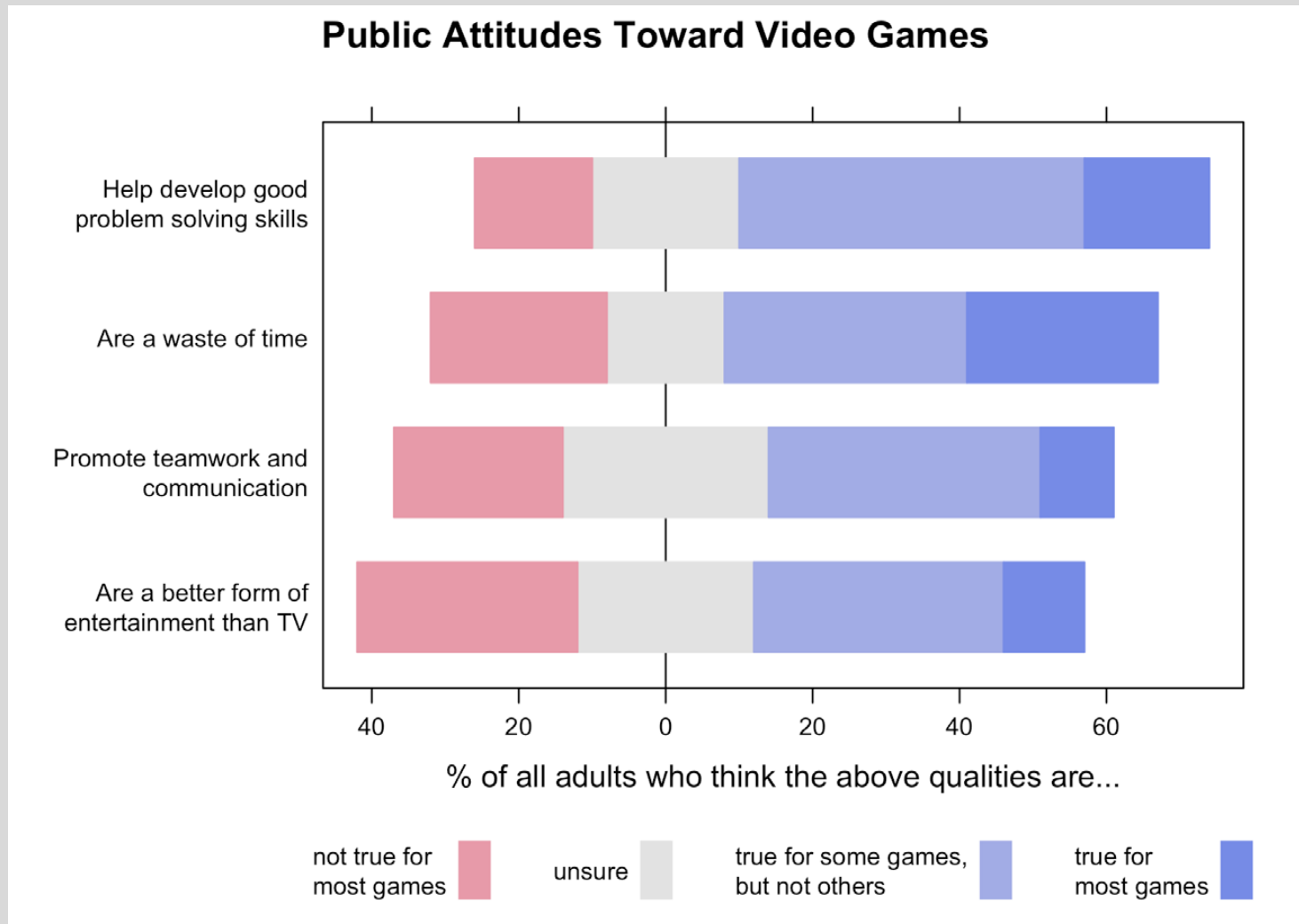
Figure 4.2b Data are the percentage of women, under the age of 70, treated for breast cancer with breast-conserving surgery who received radiation therapy to the breast within one year of diagnosis.

Figures: Comparison with slope chart

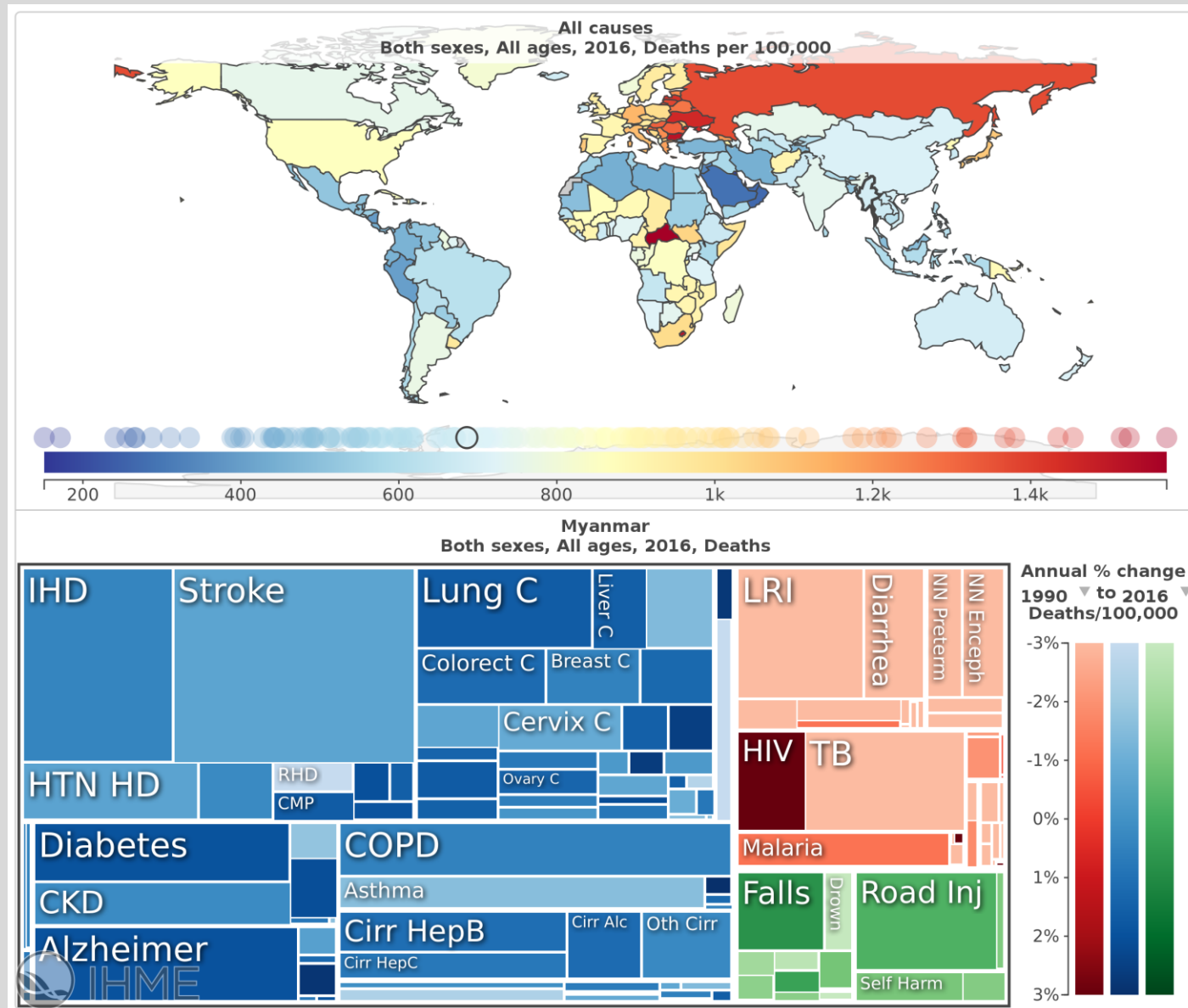
The proportion of family planning users choosing implants & injectables has increased.



Figures: Diverging stacked bar chart



Figures: Tree map

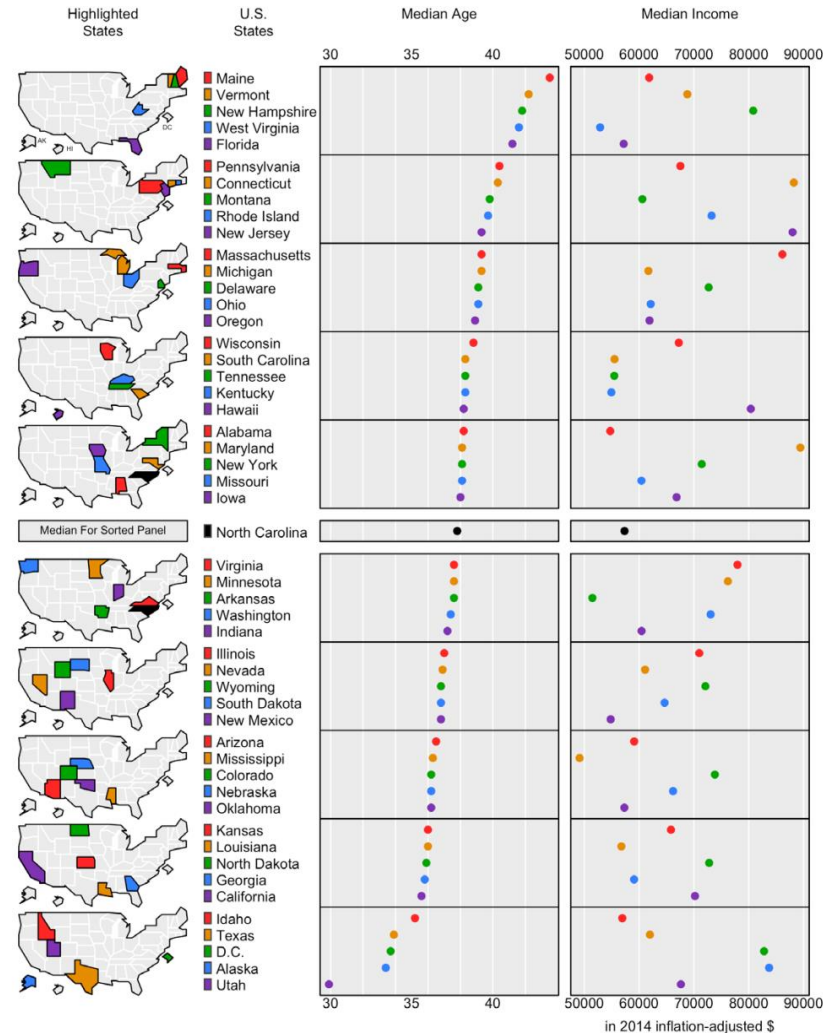


Figures: Heat map

	A	B	C	D
1		2014	2015	2016
2	January	600	708	594
3	February	607	984	749
4	March	901	886	908
5	April	608	615	835
6	May	715	833	734
7	June	520	663	618
8	July	731	521	950
9	August	709	663	987
10	September	633	863	979
11	October	533	651	841
12	November	996	958	749
13	December	792	717	875

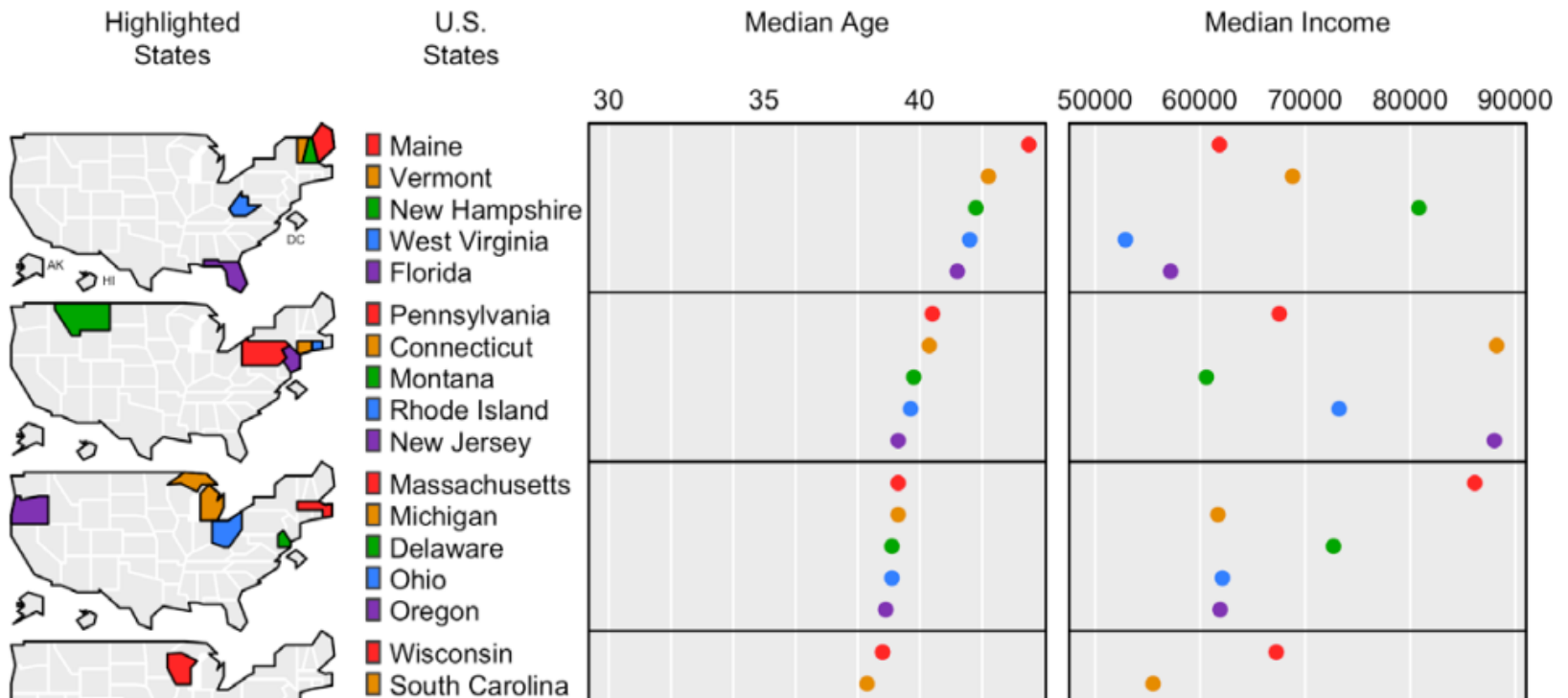
Figures: Linked micromap

2010-2014 American Community Survey: State Age and Income



Figures: Linked micromap

2010-2014 American Community Survey: State Age and Income



Figures: alternative to complex tables

Estimates of relative survival rates, by cancer site

	% survival rates and standard errors							
	5 year		10 year		15 year		20 year	
Prostate	98.8	0.4	95.2	0.9	87.1	1.7	81.1	3.0
Thyroid	96.0	0.8	95.8	1.2	94.0	1.6	95.4	2.1
Testis	94.7	1.1	94.0	1.3	91.1	1.8	88.2	2.3
Melanomas	89.0	0.8	86.7	1.1	83.5	1.5	82.8	1.9
Breast	86.4	0.4	78.3	0.6	71.3	0.7	65.0	1.0
Hodgkin's disease	85.1	1.7	79.8	2.0	73.8	2.4	67.1	2.8
Corpus uteri, uterus	84.3	1.0	83.2	1.3	80.8	1.7	79.2	2.0
Urinary, bladder	82.1	1.0	76.2	1.4	70.3	1.9	67.9	2.4
Cervix, uteri	70.5	1.6	64.1	1.8	62.8	2.1	60.0	2.4
Larynx	68.8	2.1	56.7	2.5	45.8	2.8	37.8	3.1
Rectum	62.6	1.2	55.2	1.4	51.8	1.8	49.2	2.3
Kidney, renal pelvis	61.8	1.3	54.4	1.6	49.8	2.0	47.3	2.6
Colon	61.7	0.8	55.4	1.0	53.9	1.2	52.3	1.6
Non-Hodgkin's	57.8	1.0	46.3	1.2	38.3	1.4	34.3	1.7
Oral cavity, pharynx	56.7	1.3	44.2	1.4	37.5	1.6	33.0	1.8
Ovary	55.0	1.3	49.3	1.6	49.9	1.9	49.6	2.4
Leukemia	42.5	1.2	32.4	1.3	29.7	1.5	26.2	1.7
Brain, nervous system	32.0	1.4	29.2	1.5	27.6	1.6	26.1	1.9
Multiple myeloma	29.5	1.6	12.7	1.5	7.0	1.3	4.8	1.5
Stomach	23.8	1.3	19.4	1.4	19.0	1.7	14.9	1.9
Lung and bronchus	15.0	0.4	10.6	0.4	8.1	0.4	6.5	0.4
Esophagus	14.2	1.4	7.9	1.3	7.7	1.6	5.4	2.0
Liver, bile duct	7.5	1.1	5.8	1.2	6.3	1.5	7.6	2.0

Fig. 2 Cancer survival rates by cancer site and time, adaptation by Tufte

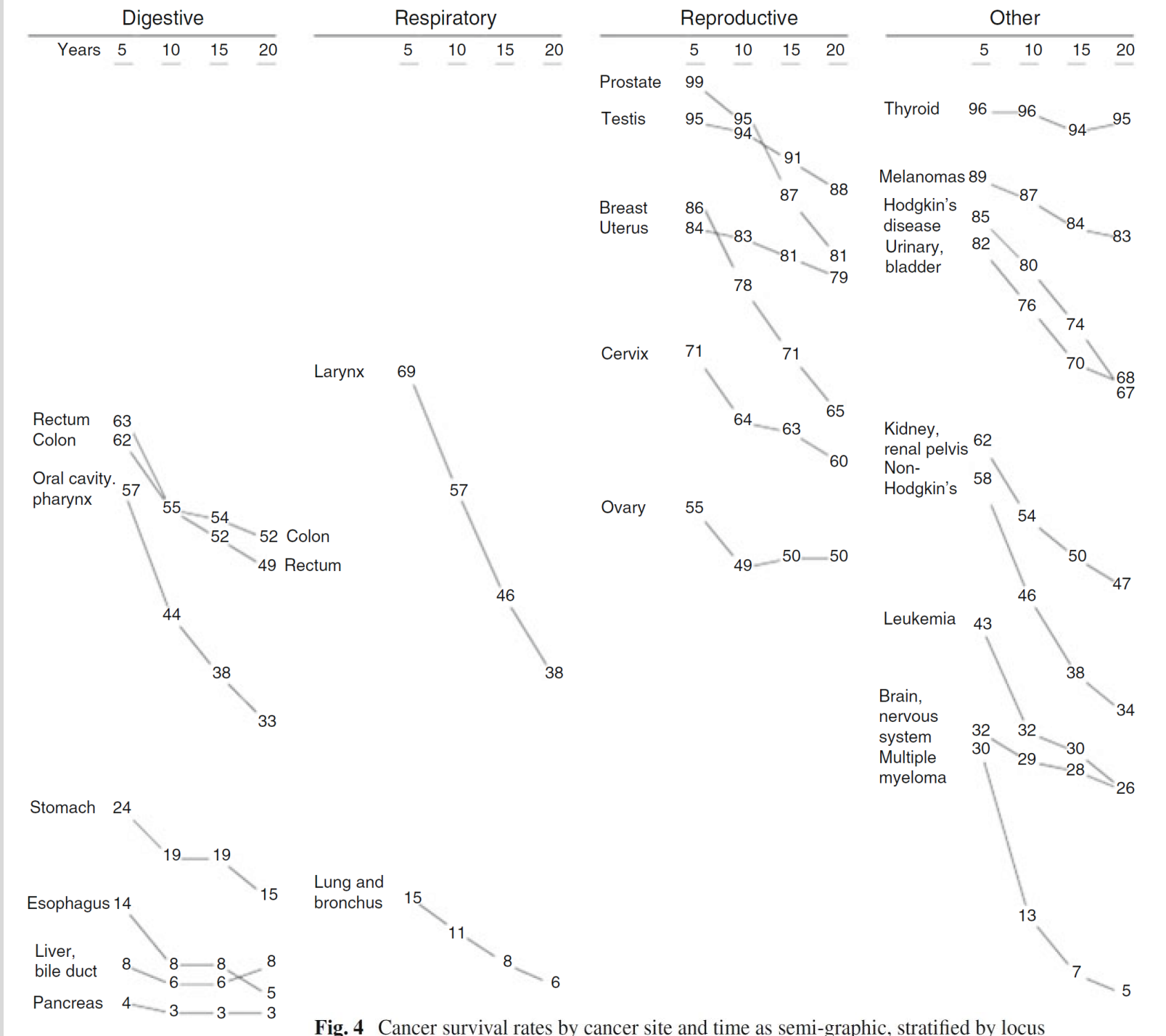


Fig. 4 Cancer survival rates by cancer site and time as semi-graphic, stratified by locus

Figures: Small multiples

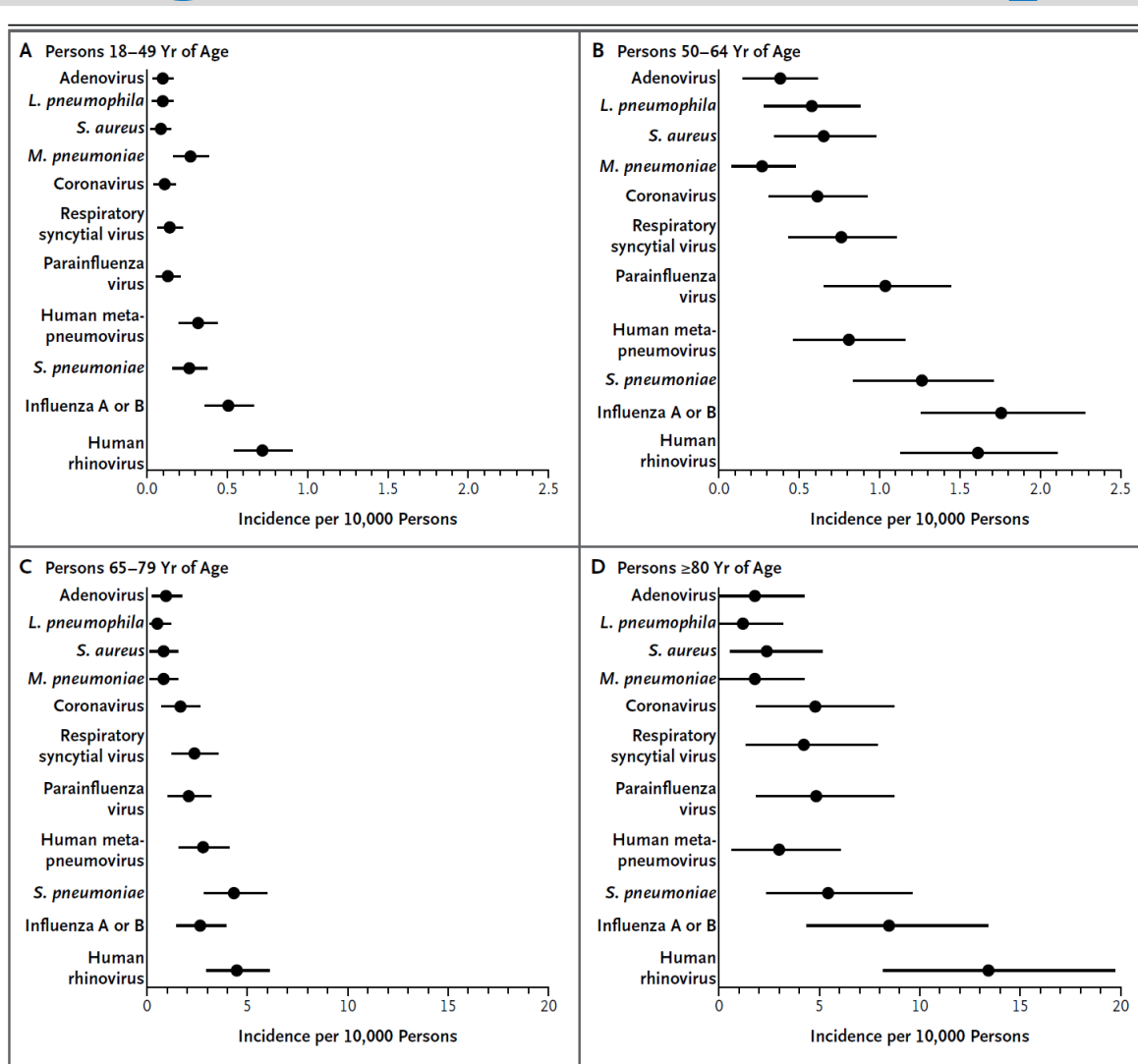
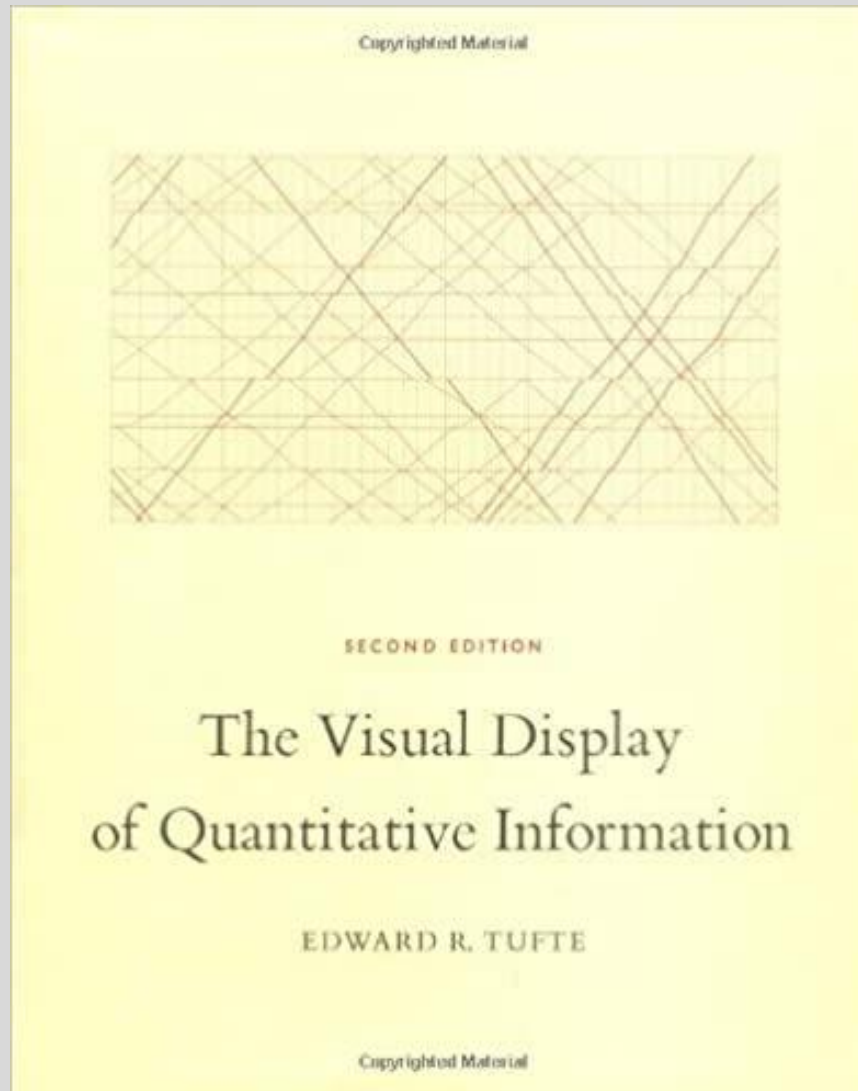


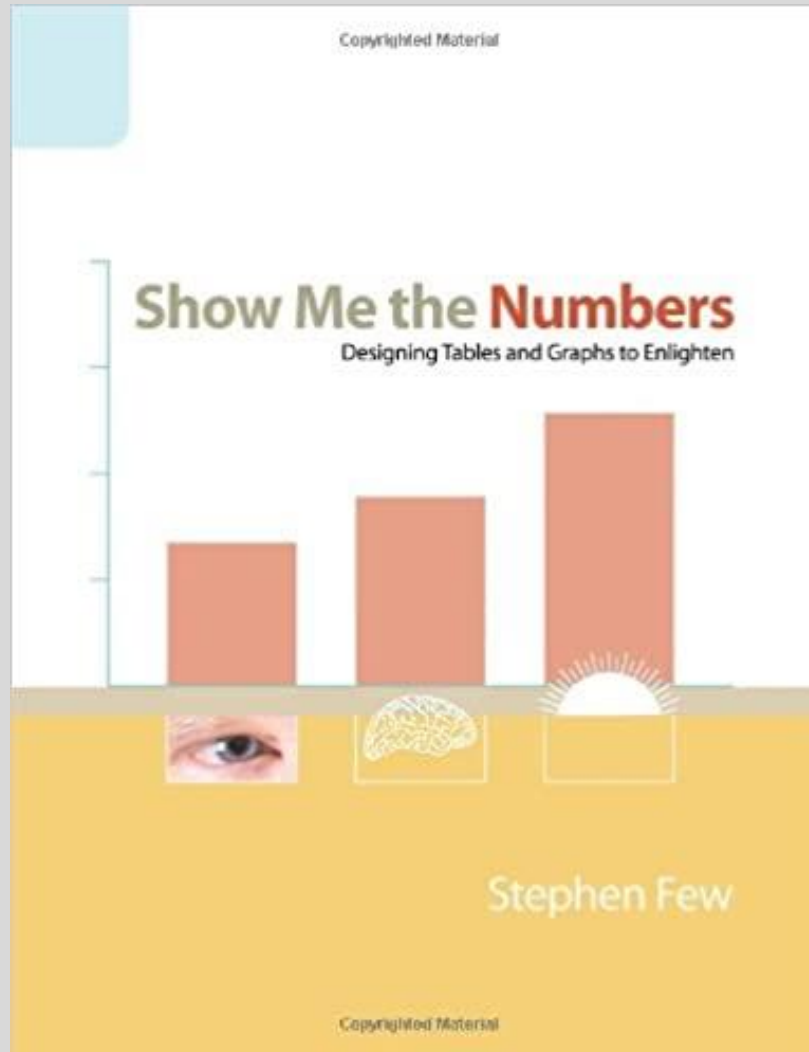
Figure 3. Estimated Annual Pathogen-Specific Incidence Rates of Community-Acquired Pneumonia Requiring Hospitalization, According to Age Group.

Circles indicate the annual number of hospitalizations for pneumonia per 10,000 adults, and the horizontal lines 95% confidence intervals. Rates are based on 10,511,911 person-years of observation. Note the differences in the scale of the x axis for the groups of patients 65 to 79 years of age and 80 years of age or older, as compared with the groups of patients 18 to 49 years of age and 50 to 64 years of age.

Some good references



Some good references

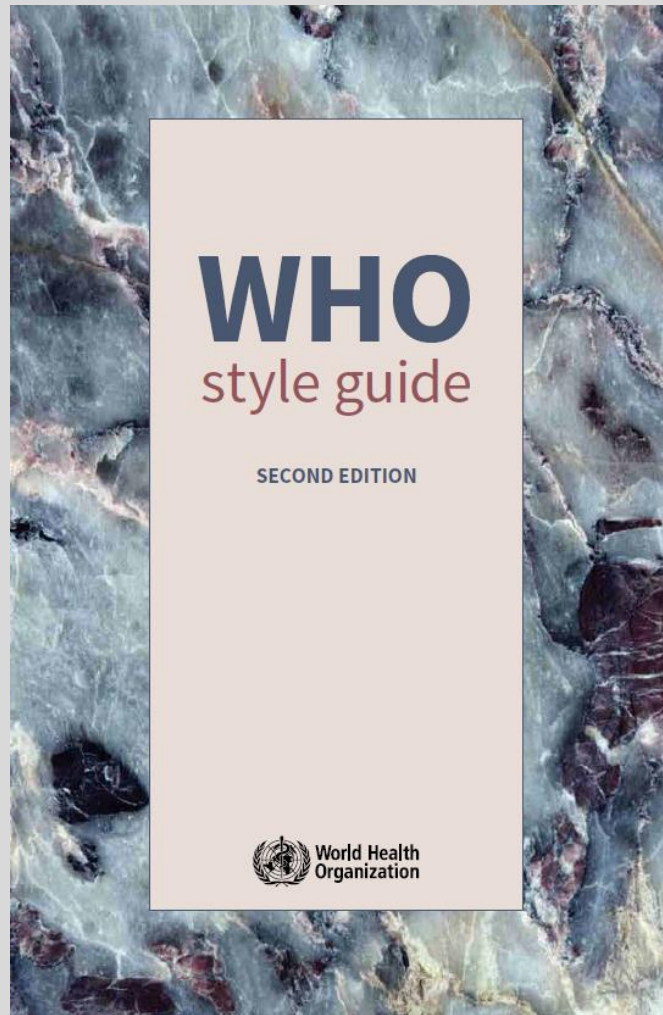


Style guide

A **style guide** is a document that provides guidelines for the way the brand of *an organization* should be presented from both a graphic and language perspective.

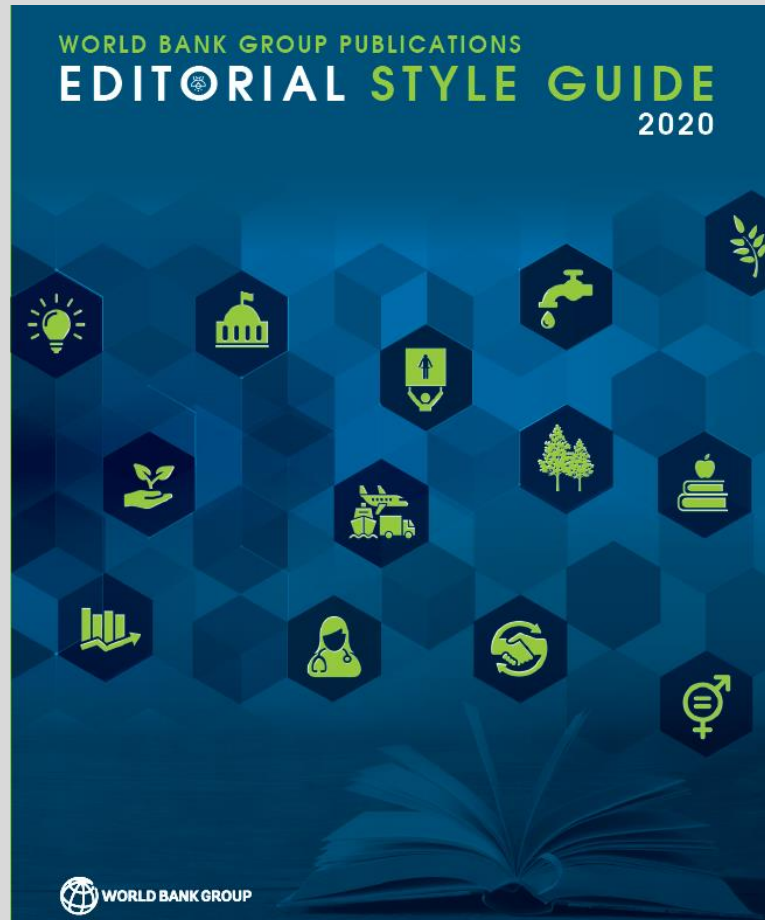
- Style guidelines on language, statistics, tables, graphs and others.
- Thesis and Dissertation Guidelines are style guides of the universities.
- **MOHS has no style guide.**

Style guide: *examples*



https://www.unaids.org/sites/default/files/sg13_web_v4%20pdf%20-%20adobe%20reader.pdf

Style guide: *examples*



<https://openknowledge.worldbank.org/handle/10986/33367>