Cartography 101: Map-Making Tips to Engage Stakeholders

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Health Workforce Technical Assistance Center Webinar

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HealthWorkforceTA.org
What’s on the agenda for today?

• Why are maps important?
• What’s GIS? How can I learn more?
• Cartography 101: In order to make a good map, you need to know...
  o Your audience
  o Your data
  o What kind of map best shows your data
  o How to create appropriate legend categories
  o The best colors to use (or not to use)
  o A little bit about projections
• What more do you want to know?
But first ... getting the lay of the land

Show of “hands”:

• Who has ever made a map or has someone in your office that can map?

• What software do you/they use?
  o ArcGIS
  o MapInfo
  o QGIS
  o Other?

To participate in the poll, look for this symbol at the bottom right of your screen, or if you’re in full-screen mode, look for the Participants button at the top center. Click Yes or No to answer each question as I ask.

Note: The post-webinar evaluation will have additional questions. Please take a few minutes at the end to tell us more about what you would like to learn. We need your input so we can make the webinars more useful and relevant to you.
What’s the big deal about maps?
Maps can be simple, yet powerful

Simply put,
A map takes your data from this... ... to this

Why else?
• A picture is worth a thousand words
• Use maps and data to challenge anecdotal evidence
• Communicate with the tabularly challenged
• Maps grab people – “where’s my county?”

How do you make a map?

Draw by hand

Color by hand

Click and shade in PowerPoint

Use GIS or cartographic software

Use online tools

http://handmaps.org/mapsind.php?mapID=4


What’s GIS?
What is a Geographic Information System?

• GIS integrates hardware, software, and data; this allows us to visualize, question, analyze, and interpret data to understand relationships, patterns, and trends.*

• Connects data to maps based on unique ID

• Allows you to layer different types of data to see and analyze

• Allows you to translate data into meaningful results

• Vector: points, lines, polygons

• Raster: images built on pixels

* Adapted from ESRI definitions, http://www.esri.com/what-is-gis
GIS uses layers

Your layers might be

- Counties, ZIP Codes, Rational Service Areas, Census areas
- Cities
- Road Networks
- Healthcare Providers
- Healthcare Facilities
- Educational Institutions
- Patients
- Transportation (bus routes...)
- Demographics
- Topography

Note: You might have to geocode certain data (e.g., street addresses) to use them in a map

http://guides.lib.byu.edu/c.php?g=246326&p=3440307
Software - examples

• **GIS**
  ArcGIS (industry standard); MapInfo;
  QGIS (free, open-source); Cartographica (Mac)

• **Cartographic**
  Microsoft MapPoint; Tableau; CARTO

• **Design**
  Adobe Illustrator/MapPublisher; CorelDraw

• **Statistical**
  SAS; Stata

• **Web Development**
  Javascript, D3

**Note:** It is helpful to have Excel or a statistical programming package (SAS, Stata, etc.) to manipulate data before mapping.
Online tools - examples

- **Tableau**

- **CARTO (formerly CartoDB)**
  [https://carto.com/](https://carto.com/)

- **HRSA**

- **Robert Graham Center**
  [http://www.graham-center.org/online/graham/home/tools-resources.html](http://www.graham-center.org/online/graham/home/tools-resources.html)
Training

• Universities and community colleges
• ESRI Campus - campus.esri.com
• Lynda.com
• Webinars, workshops, conferences
• One-on-one training
• Books, self-directed
Basics of Cartography
First rule

Know your audience.

- Is your audience technical?
- Are they focused on policy? Research?
- Do they understand complex information?
- How will they use the maps/data?
A word of caution

• The way that you determine the map type and legend breaks, use text and colors, and construct the layout will affect how the reader perceives the map.

• Beware of biasing the reader to promote your own purposes.
Map elements

1. Descriptive title
2. Well-labeled legend
3. Data source
4. Production info, date
5. Notes, as needed
6. Distance scale
7. North arrow
8. Neatline

What kinds of maps are there?

**Choropleth**

Health Professional Shortage Areas Primary Care

![Choropleth Map](https://www.ruralhealthinfo.org/rural-maps/mapfiles/hpsa-primary-care.jpg)

**Graduated Symbol**

Location of ECU Medical School Graduates by Zip Code 2015

![Graduated Symbol Map](https://www.ruralhealthinfo.org/states/images/south-carolina-rural-health-facilities.jpg)

**Dot Density**


![Dot Density Map](https://www.ruralhealthinfo.org/rural-maps/mapfiles/hpsa-primary-care.jpg)

**“Flying pies”**

Percent of Primary Care Health Professionals by Discipline North Carolina, 2005

![“Flying pies” Map](https://www.ruralhealthinfo.org/rural-maps/mapfiles/hpsa-primary-care.jpg)

**Flow**

Patient Origin for North Carolina Residents Inpatient Discharges by County of Residence and Hospital Residents Discharged from North Carolina Hospitals, October 1, 2011 to September 30, 2012

![Flow Map](https://www.ruralhealthinfo.org/rural-maps/mapfiles/hpsa-primary-care.jpg)

**Plain Old Dots**

Selected Rural Healthcare Facilities in South Carolina

![Plain Old Dots Map](https://www.ruralhealthinfo.org/rural-maps/mapfiles/hpsa-primary-care.jpg)

And others...
Different data types

• Point (*hospital*), line (*highway*), polygon (*county*)

• Data types:
  o Nominal – name or class only (*CBSA designations*)
  o Ordinal – rank only (*scale of 1-5*)
  o Interval – value on continuous arbitrary scale (*0.4 to 103.1*)
  o Ratio – value on continuous scale starting with absolute zero (*PCPs per 10K pop*)

*Examples in italics.*
See [http://www.geog.ucsb.edu/~kclarke/Geography183/Lecture06.pdf](http://www.geog.ucsb.edu/~kclarke/Geography183/Lecture06.pdf) as a nice summary of data types and classification
Determining Legend Breaks

- Natural breaks
- Equal count
- Equal interval
- Standard deviation
- Custom
Determining legend breaks

Primary Care Physicians per 10,000 Population
North Carolina, 2011

- **Natural Breaks**
- **Equal Count**
- **Equal Interval**
- **Standard Deviation**
- **Custom**

Note: Primary Care Physicians include active, instate, nonfederal, non-resident-in-training MDs andDos licensed in NC as of October 31, 2011 who indicated a primary specialty of Family Practice, General Practice, Internal Medicine, Ob/Gyn or Pediatrics. Source: North Carolina Health Professions Data System, with data derived from the North Carolina Medical Board, 2011. Produced by: North Carolina Health Professions Data System, Cecil G. Sheps Center for Health Services Research, University of North Carolina at Chapel Hill.
Color options

- One shade or multi-hue, light to dark
- Diverging – e.g., orange values are negative, green values are positive values
- Qualitative – individual colors for individual values
- Two variable schemes – more complex, harder to interpret, but allows you to show “more” data

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One shade

Percent of labor force employed in services, 1960

41 to 48
30 to 39
20 to 29
11 to 19

Multi-hue

Percent of labor force employed in agriculture, 1960

63 to 71
55 to 57
42 to 48
31 to 39
20 to 26
11 to 18
4 to 8

Diverging

Difference between percent of country labor force employed in services, 1980 and percent of total European labor force in services, 1960

Larger proportion in services
Proportion similar to Europe overall
Smaller proportion in services

Qualitative

Dominant sector, 1960
Sector employing largest percentage of labor force

Two-variable

Percent of labor force employed in services, 1960

<30
30–39
≥40

Percent of labor force employed in industry, 1960

http://go.owu.edu/~jbkrygie/krygier_html/geog_353/geog_353_lo/geog_353_lo09.html
Originally accessed June 2014; as of April 2017, link was found to be defunct.
Color pitfalls

• Colors mean different things to different people
• Map format: print, PDF, projector, monitor, color vs. black and white?
• Example: diverging color ramps don’t print well in b&w
• Contrast: ensure that color ranges are easily identifiable on the map. Too many ranges are difficult to interpret.
• Color blindness: avoid red/green combinations; blue and yellow less of a problem
• To see how color looks to those with color blindness: http://www.vischeck.com/vischeck/vischeckImage.php
Vischeck example
Great color resource: http://colorbrewer2.org/
Projections

• A projection is a way to transform the spherical earth to a flat piece of paper (or screen)

• There are many different types of projections

• Different types of projections preserve different characteristics, such as area, distance, shape

• When doing spatial analysis, including distance calculations, you’ll need to choose the appropriate projection

• I prefer to use State Plane Coordinate System for state-level maps; this is personal preference
Projections – State Plane Coordinate System

Regional Equal Area

State Plane Coordinate System

Regional Equal Area

State Plane Coordinate System

Latitude/Longitude
### Dos and Don’ts

<table>
<thead>
<tr>
<th>Do:</th>
<th>Don’t:</th>
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<tbody>
<tr>
<td>- Use clean fonts, no less than 6pt</td>
<td>- Clutter your map with unnecessary labels, text or features</td>
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<tr>
<td>- Use clear text – be succinct yet descriptive</td>
<td>- Try to load your map with too much information</td>
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<tr>
<td>- Use the appropriate map type, legend breaks and colors for your data and message</td>
<td>- Use too many legend breaks</td>
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<tr>
<td>- Balance your whitespace</td>
<td>- Use hard-to-read fonts</td>
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<tr>
<td>- Make sure your colors print in black and white</td>
<td>- Use clashing colors</td>
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<tr>
<td>- Include your data source, give credit where credit is due</td>
<td>- Knowingly manipulate legend breaks and colors to influence your audience</td>
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<td>- Plagiarize (yes, it’s a map thing too)</td>
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Engaging your stakeholders

• Well-designed maps will catch your audience’s attention

• Maps are tweetable – use them to start a conversation on social media

• “Story Maps” – use the maps to tell a story and provide more context. They can add anecdotes that maps by themselves cannot convey.

https://storymaps.arcgis.com/en/

Contact info – I’d love to hear from you

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UNC Program on Health Workforce Research and Policy
www.healthworkforce.unc.edu

North Carolina Rural Health Research Program
http://www.shepscenter.unc.edu/programs-projects/rural-health/