Trends in Health

Este Geraghty, MD, MS, MPH, GISP
Chief Medical Officer, Esri
How do I decide on trends?

- Watch the news
- Review Federal budget allocations
- Listen to what our customers are telling us
2018 Trends guiding our work

- Health Equity
- Access to Care
- Preparedness
- Data Security
Health Equity
Definitions

• Health Equity
  - Health equity is achieved when every person has the opportunity to attain his or her full health potential and no one is disadvantaged from achieving this potential because of social position or other socially determined circumstances. (CDC)

• Health Disparities
  - These are rooted in inequities in the opportunities and resources needed to be healthier. The determinants of health including living and working conditions, education, income, neighborhood characteristics, social inclusion, and medical care. (RWJF)
The social determinants of health are the conditions in which people are born, grow, live, work and age. These circumstances are shaped by the distribution of money, power and resources at global, national and local levels.

-World Health Organization
Medical Variation

Rate of leg amputation with DM or PVD

- Black vs White  4:1
- Place to place  10:1
Moving toward comprehensive care

A comprehensive health record, unlike today's EHR, would incorporate more data types, notably social determinants, she says.

You've probably heard that Epic Systems CEO Judy Faulkner wants to drop the E from electronic health records and replace it with a C.
How your GIS can help…

Identify  Analyze  Intervene  Evaluate
Where are people with the highest diabetes risk index? (based on CDC guidelines)
Where are the hotspots of risk?
Where are community groups?
Which groups are our existing partners?
Where are our targeted new partners?
Can our high risk population access target partners?
We will think differently about partners.
• Are we serving more people?

• Have we improved coverage of our targeted population?
  • Right age
  • Right ethnicity
  • Right locations

• Are the behaviors of our target population changing?
  • Prescription medication adherence
  • Physical activity levels
  • Healthy eating habits
Access to Care
Defining the Trend

- CMS – Network Adequacy requirements
  - Provider and facility specialty types
  - Quantitative standards
    - Organizations must contract with a sufficient number of providers and facilities to ensure that at least 90% of their enrollees within a county can access care within specific travel time and distance maximums.

- General access to care, programs and services

- Universal Health Coverage (SDG 3.8) (WHO)
  - About ½ of the world’s population lacks access to essential health services
  - 100 million people per year are pushed into ‘extreme poverty’ from health expenditures
  - “UHC is more than just a moral imperative. It’s a powerful social equalizer which contributes to social cohesion and stability.”
Network Analysis
Create reports and find opportunities

1. Get your data
2. Make data GIS-ready
3. Perform the analysis
4. Interpret the results
5. Make it repeatable

Bonus

6. Optimize your network
1. Get your data
2. Make it GIS-ready

<table>
<thead>
<tr>
<th>Name</th>
<th>Address</th>
<th>City</th>
<th>State</th>
<th>ZIP</th>
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<tbody>
<tr>
<td>Member 1</td>
<td>23 Monte Vista Ave</td>
<td>Montclair</td>
<td>CA</td>
<td>91673</td>
</tr>
<tr>
<td>Member 2</td>
<td>45 Oasis St</td>
<td>Indio</td>
<td>CA</td>
<td>92201</td>
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<tr>
<td>Member 3</td>
<td>676 Harrison St</td>
<td>Coachella</td>
<td>CA</td>
<td>92236</td>
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<tr>
<td>Member 4</td>
<td>10682 Western Ave</td>
<td>San Bernardo</td>
<td>CA</td>
<td>92411</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Name</th>
<th>Specialty</th>
<th>Line of business</th>
<th>Address</th>
<th>City</th>
<th>State</th>
<th>ZIP</th>
</tr>
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<tbody>
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<td>Dr. Robert Burger</td>
<td>Internal Medicine</td>
<td>Medicare</td>
<td>23 Monte Vista Ave</td>
<td>Montclair</td>
<td>CA</td>
<td>91673</td>
</tr>
<tr>
<td>Dr. Joan Hart</td>
<td>Cardiology</td>
<td>Medicare</td>
<td>45 Oasis St</td>
<td>Indio</td>
<td>CA</td>
<td>92201</td>
</tr>
<tr>
<td>Dr. Sandra Cranley</td>
<td>Family Practice</td>
<td>Medicaid</td>
<td>676 Harrison St</td>
<td>Coachella</td>
<td>CA</td>
<td>92236</td>
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<tr>
<td>Dr. Miles Away</td>
<td>Internal Medicine</td>
<td>Medicare</td>
<td>10682 Western Ave</td>
<td>San Bernardo</td>
<td>CA</td>
<td>92411</td>
</tr>
</tbody>
</table>
3. Perform the Analysis
Time and distance
4. Interpret the results with summary statistics.
<table>
<thead>
<tr>
<th>Specialty</th>
<th>Standard</th>
<th>% members in standard</th>
<th>1st closest provider</th>
<th>2nd closest provider</th>
<th>3rd closest provider</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Practice</td>
<td>30 minutes, 10 miles</td>
<td>97%</td>
<td>7 min</td>
<td>10 min</td>
<td>12 min</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3 miles</td>
<td>5 miles</td>
<td>6 miles</td>
</tr>
<tr>
<td>...</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>...</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
5. Make it repeatable with Tasks
Optimize the network

168 members covered

20 members covered
Five Steps to Calculating Provider Network Adequacy

- **Challenge**: Ensuring that members receive adequate provider access in their community.
- **Solution**: Utilizing ESRI ArcGIS software to map provider locations and distances.
- **Results**: Achieving a more equitable provider network within the community.

**The Challenge**

Esri’s ArcGIS technology is used to optimize provider networks and connect members quickly to the services they need.

**The Solution**

The ArcGIS technology is used to map and optimize provider networks, ensuring that members have access to necessary services.

**The Results**

Members have quicker access to necessary services due to the optimized provider network.
Preparedness
Why it’s a trend

• The number of billion-dollar events is increasing
• The threat of the next epidemic looms…

“The 2014 Ebola outbreak was a stark reminder of how vulnerable our society is to epidemics of infectious diseases. We weren’t ready then, and we’re still not ready now—but we can be. We don’t know when the next epidemic will strike, but I believe we can protect ourselves if we invest in better tools, a more effective early detection system, and a more robust global response system.” (Bill Gates)

• FY2019 Federal Budget
  - $2.2 B to support emergency situations
  - $10 B for the opioid crisis and mental illness (focus on data quality and timeliness for tracking)
  - + 1566% increased investment in the CDC’s Surveillance Data Platform
6 Preparedness Domains per CDC Guidelines

- Public Health Preparedness
- Community Resilience
- Information Management
- Countermeasures & Mitigation
- Surge Management
- Incident Management
- Biosurveillance
Focusing on CASPER

- The Community Assessment for Public Health Emergency Response is an epidemiologic technique designed by the CDC to provide quick and low-cost household based information about a community (essentially a rapid needs assessment)

- Usually used in preparedness planning
  - Before an event or after

- Its also appropriate for non-disaster needs assessments and public health planning
What we learned...

• Two-stage cluster sampling design: 30 clusters x 7 interviews = 210 surveys
• Currently performed with pen/paper
• CDC makes a question bank available
• Teams may create their own questions
• Error prone with data re-entry
• Planning to analysis to report is slow
• CASPER could be more widely used
• Epi Info is usually used for analysis
• Training is always recommended
Jhonatan

Preparation and Analysis
ArcGIS Pro

Field Work
Survey123 for ArcGIS

Web GIS
Opt. dashboard
Story Map
Preparation Stage

- ArcGIS Pro tasks
- Identify clusters
- Print maps
Field Work Stage

- Survey123 used to create a mobile survey
- Has the full CDC question bank included
- Can easily modify, delete, add questions
- Survey is SMART
  - Branch logic
  - Checks accuracy
  - Returns to where you left off if incomplete
- Records time spent completing form
- Integration with Integromat to trigger an email (e.g. medical emergency)
• Operations Dashboard
• Complete operational awareness of the process
• Demographic distribution of responses (e.g. age and race)
• Medical needs review
Analysis Stage

- Options for Analysis
  - Built in quick analysis in ArcGIS Pro tasks
  - Export data formatted for Epi Info
Resources

See the Story Map Go.esri.com/PHP

To learn more about the CASPER tools - contact Jared Shoultz, jshoultz@esri.com

Be aware of the Esri Disaster Response Program
www.esri.com/disaster
disaster_help@esri.com
Data Security

- HIPAA Compliant Geocoding
- Spatial Anonymity
HIPAA-COMPLIANT GEOCODING SERVICE

Jun, 2018
Esri Geocoding Service for Healthcare Data to convert a Human Readable Address To Geographic Coordinates

- Converts a Human Readable Address to Geographic Coordinates Service that can geocode data in single mode and batch mode
- Supports programmatic access to geocoder via API (can be used by other customer apps)
- A web portal for batch geocoding via uploading spreadsheets; for management of uploaded content and results; for reporting on usage metrics (e.g., no. of rows geocoded per day/month etc.)
- Uses ArcGIS Server and StreetMap Premium for ArcGIS (a product from HERE)
## GEOCODING SERVICE - SPECS

### ArcGIS Pro Add-in
- Add-in for ArcGIS Pro
- Requires a username & password to validate user
- Supports
  - Individual Geocoding
  - Batch Geocoding
  - Standard file format for upload

### Web App
- UI for Analysts
- Requires a username & password to validate user
- Supports:
  - Individual Geocoding
  - Batch Geocoding
  - Standard file format for upload

### API
- Direct connectivity to customer’s applications
- API configuration includes username and password
- Supports:
  - Individual Geocoding
  - Batch Geocoding
  - Standard format for accepting data to geocode

### Data Input Formats:
- .xls, .xlsx, .csv and .tsv files
- Max file size per upload - 1GB

### Supported Address Formats
- Address in single column (STREET, CITY, STATE, ZIP)
- Address split in multiple columns in spreadsheet

<table>
<thead>
<tr>
<th>Feature</th>
<th>Spatialitics Health Geocoder</th>
</tr>
</thead>
<tbody>
<tr>
<td>Batch geocode using spreadsheet &amp; APIs</td>
<td>First release</td>
</tr>
<tr>
<td>Quick preview of top 10 results on map prior to geocoding all rows</td>
<td>First release</td>
</tr>
<tr>
<td>View geocoded results on map anytime</td>
<td>Future release</td>
</tr>
<tr>
<td>Language bindings (PHP, Python, JavaScript, Ruby, NodeJS etc.)</td>
<td>Future release</td>
</tr>
<tr>
<td>HIPAA compliant geocoding service</td>
<td>First release</td>
</tr>
</tbody>
</table>
GEOCODING PROCESS FLOW

1. Upload file (csv, xls, xlsx)
2. Write to Azure Blob Storage
3. Triggers
4. Extract only addresses
5. Read from Azure Table Storage
6. Geocoding via ArcGIS Server
7. Write to Azure Table Storage
8. On complete
9. Read from Azure Table Storage
10. Update file with result
LOGIN SCREEN
## Administer your Organization

<table>
<thead>
<tr>
<th>Name</th>
<th>Username</th>
<th>Last Login</th>
<th>Role</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Joan McKinney</td>
<td>joanm</td>
<td>Jun 18, 2018, 05:34 PM</td>
<td>Administrator</td>
<td><img src="view-profile" alt="Options" /></td>
</tr>
<tr>
<td>Steven Gary</td>
<td>steveg</td>
<td>Jun 19, 2018, 05:34 PM</td>
<td>Administrator</td>
<td><img src="view-profile" alt="Options" /></td>
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<tr>
<td>Clarence Randall</td>
<td>clarence_r</td>
<td>Jun 12, 2018, 05:34 PM</td>
<td>User</td>
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</table>
Batch Geocode

Step 1 of 3: Upload file to geocode

1. Supported file types are .xls, .xlsx, .csv.
2. First row must contain headers.
3. First worksheet from Excel workbook will be used for geocoding.
4. Supported file size is up to 1 GB.

Click here for a sample spreadsheet
Batch Geocode

Step 3 of 3: Confirm and submit for geocoding

<table>
<thead>
<tr>
<th>Filename</th>
<th>No. of rows</th>
<th>Balance</th>
</tr>
</thead>
<tbody>
<tr>
<td>sample-addresses-191.xlsx</td>
<td>191</td>
<td>xx geocodes remaining</td>
</tr>
</tbody>
</table>

By clicking 'Start' you confirm that you agree to our Terms of use.
## BATCH GEOCODING PROCESS IN PROGRESS

### Manage Uploads

<table>
<thead>
<tr>
<th>Filename</th>
<th>Records</th>
<th>Status</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>sample-addresses-191.xlsx</td>
<td>191</td>
<td>In progress</td>
<td></td>
</tr>
<tr>
<td>SampleData_20K.xlsx</td>
<td>15674</td>
<td>completed</td>
<td></td>
</tr>
<tr>
<td>SampleData_10k.xlsx</td>
<td>10011</td>
<td>completed</td>
<td></td>
</tr>
<tr>
<td>SampleData_10k.xlsx</td>
<td>10000</td>
<td>completed</td>
<td></td>
</tr>
<tr>
<td>SampleData_15k.xlsx</td>
<td>15014</td>
<td>completed</td>
<td></td>
</tr>
<tr>
<td>data 4.xlsx</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## API KEYS TAB

### Manage API Keys

<table>
<thead>
<tr>
<th>API Key</th>
<th>Date Created</th>
<th>Action</th>
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<tbody>
<tr>
<td>49c4ca4a-eadc-4b93-a0a5-950beb655a1f</td>
<td>Jun 01, 2018, 05:34 PM</td>
<td>![trash] ![delete]</td>
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<tr>
<td>97afba06-a9ae-418a-8481-1a90515b4a6a</td>
<td>Jun 02, 2018, 05:34 PM</td>
<td>![trash] ![delete]</td>
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<td>72ae3a7c-9692-425d-bde6-a1326289713a</td>
<td>Jun 03, 2018, 05:34 PM</td>
<td>![trash] ![delete]</td>
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<td>Jun 04, 2018, 05:34 PM</td>
<td>![trash] ![delete]</td>
</tr>
</tbody>
</table>
Visit Booth 710!

Spatialitics Health Geocoder will be available from July 31, 2018

Packages

• Small – 100,000 Geocodes/year
• Medium – 500,000 Geocodes/year
• Large – 1,000,000 Geocodes/year
• Large+ – 5,000,000 Geocodes/year

Purchase

Subscribe online for Geocoding Service Packages, starting from $200/month

Contact

For any custom need or queries, you can get in touch with Spatialitics Team

• Email: info@spatialitics.com
• Tel: 215-494-2844
Geographic Information Services, Inc.

Inspired by Location
GISinc

25+ Years in Business

160 Passionate Professionals

1 Core Purpose
(Create Insight Through Location Technology)
Spatial Anonymity Toolkit

A full range of geomasking techniques that hide true locations by displacement, allowing the user to select the statistical distribution, as well as its parameters, and any constraints to be applied to the distorted locations. With most methods there exists the possibility of a displacement of exactly zero, but the likely infrequency of such cases diminishes the danger of confidentiality loss.

*The aim of this toolkit is to create a point file for analysis that is locationally representative while preserving anonymity.*
K-Anonymity & Statistical Analysis

- Code that estimates k-anonymity for each record in a database that is subjected to any of the methods of geomasking
- Takes into account the area in the masking, total number of people, and overlapping circles
- Possibilities = how many orange circles the records/points may fall into
- How geomasked your output is in relation to the original location(s)
- Desired k-anonymity is at least 5, the higher the better according to circle studies

<table>
<thead>
<tr>
<th>Stats</th>
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<tbody>
<tr>
<td>Min Possibilities:</td>
<td>15.00</td>
</tr>
<tr>
<td>Avg Possibilities:</td>
<td>80.21</td>
</tr>
<tr>
<td>Max Possibilities:</td>
<td>105.00</td>
</tr>
<tr>
<td>Min K-Anonymity:</td>
<td>5.53</td>
</tr>
<tr>
<td>Avg K-Anonymity:</td>
<td>53.64</td>
</tr>
<tr>
<td>Max K-Anonymity:</td>
<td>168.02</td>
</tr>
<tr>
<td>Min Distance:</td>
<td>167.01 m</td>
</tr>
<tr>
<td>Avg Distance:</td>
<td>544.39 m</td>
</tr>
<tr>
<td>Max Distance:</td>
<td>920.36 m</td>
</tr>
</tbody>
</table>
Donut Masking

- Extent of the masking can be set by drawing a box or assuming your extent is the data frame in view.

- The blue dots are the original record location.

- A circle is generated for the minimum displacement distance (blue) – *that record cannot be placed within that circle*.

- The outer circle (orange) is the farthest displacement distance – *the record should not be placed outside of that circle*. 
K Mean Neighbors

• Primary donut masking algorithm
• K is the number of neighbors around the feature to consider
• Creates the inner and outer circles of the donut based on the value of K and the density / distance of its neighbors
• Each point shifts within the donut in a random compass direction
• Includes a K-Anonymity score
**K Mean Angular Neighbors**

- The direction a feature is moved is based on the location of its neighbors
- Builds a range in the centroid of the direction of the nearest neighbors
- Considers the angular displacement of its neighbors relative to North
- Increases the number of circles that overlap
- Includes a K-Anonymity score
Coordinate Rounding & Truncation

• Two simple displacement algorithms: rounding and truncation
• Allows you to enter the number of spaces past the decimal point on your latitude and longitude to round or truncate to
• Tendency to aggregate data points to a single location depending on the number of spaces past the decimal you are working with
• A report back to the user will indicate how the truncation coarsens the accuracy
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- Allows you to enter the number of spaces past the decimal point on your latitude and longitude to round or truncate to
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Coordinate Obfuscation

- Random distribution of values is created between a min and max value
- That value is added to the coordinates to displace them
The Spatial Anonymity Toolkit will be sold as an extension to ArcGIS Pro in the Esri Marketplace for $1500

Visit Booth 719!
2018 Trends guiding our work

- Health Equity
- Access to Care
- Preparedness
- Data Security
Let’s Talk!

egeraghty@esri.com