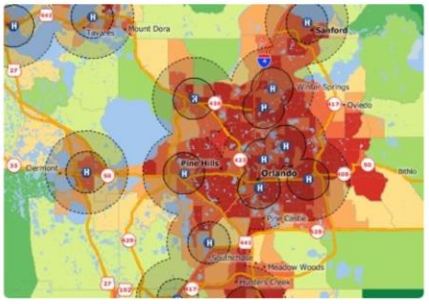
Proximity based analyses

Using GIS Training to Address Blood Pressure Medication Adherence

Learning Objectives

- Explore proximity based tools in the GIS setting
- Explore the concepts of access
- Consider applying the proximity information to inform understanding of resources in space: geographic accessibly



GIS provides us with a number of tools to evaluate relationships between objects in our maps

Proximity relationships help us to measure, understand and relate spatial information with real world implications:

-Where are the closest resources of interest?

-What are the time and distance costs for reaching resources in space?

-Who can reasonably reach what?

Review: Geographic Data?

Components

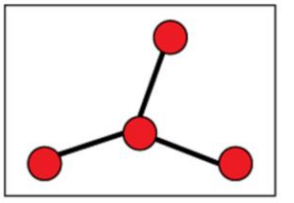
- Spatial (where?)
  - Geometry or shape of an object
  - Where it is located
- Attributes (what?)
  - Tabular data
  - Describes an object

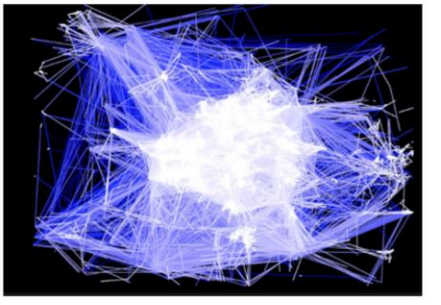
OWNER_ST	LANDUSE_DE	PHYS_ADD	CONSTTYP	YEARBUILT	R
MD	VAC AG/ 10 ACRES OR >	0 OLD OXFORD RD		0	
NC	VAC AG/ 10 ACRES OR >	0 RED MOUNTAIN RD		0	
NC	PRESENT-USE/AG/RICULTUR	0 COUNTY LINE RD		0	
NC	VAC AG/ TMBR 20 ACRES & >	0 COUNTY LINE RD		0	
NC	RES/ RURAL RES W/ ACREAG	811 COUNTY LINE RD	R/SD/CL-D/SH-2/AV	1985	
NC	RES/ RURAL RES W/ ACREAG	721 COUNTY LINE RD	R/SD/CL-D BV/SH-2/AV	1985	

Review components of geographic data

Understanding Proximity

- The characteristics of spatial data help define connections among objects in coordinate space
- Allow us to determine the distance relationship between objects space: proximity





For the purposes of this discussion we will limit of definition of topology to: how points lines and polygons relate to each other.

Along with explicit spatial definition (i.e. coordinates) your geographic data includes topological information that helps define relationships to objects in space:

-How far is A from B?

-What is connected to what?

-What is within what?

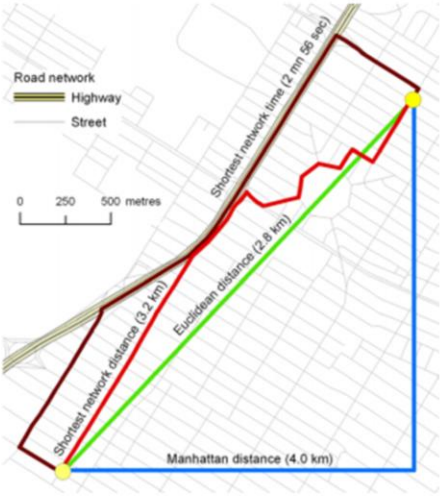
-What is beside what?

GIS software keeps track of this information allowing you to use it for a number of spatial operations that are useful when you interested in the relationships between these layers?

Where is the closest hospital with a primary stroke center classification?

Measuring Proximity

- Options for measuring distances
  - Manhattan
  - Euclidian
  - Network based
- Best choice depends on available data and objectives



DOI: 10.1186/1476-072X-7-7

Manhattan: The distance between two points in a grid based on a strictly horizontal and/or vertical path (that is, along the grid lines),

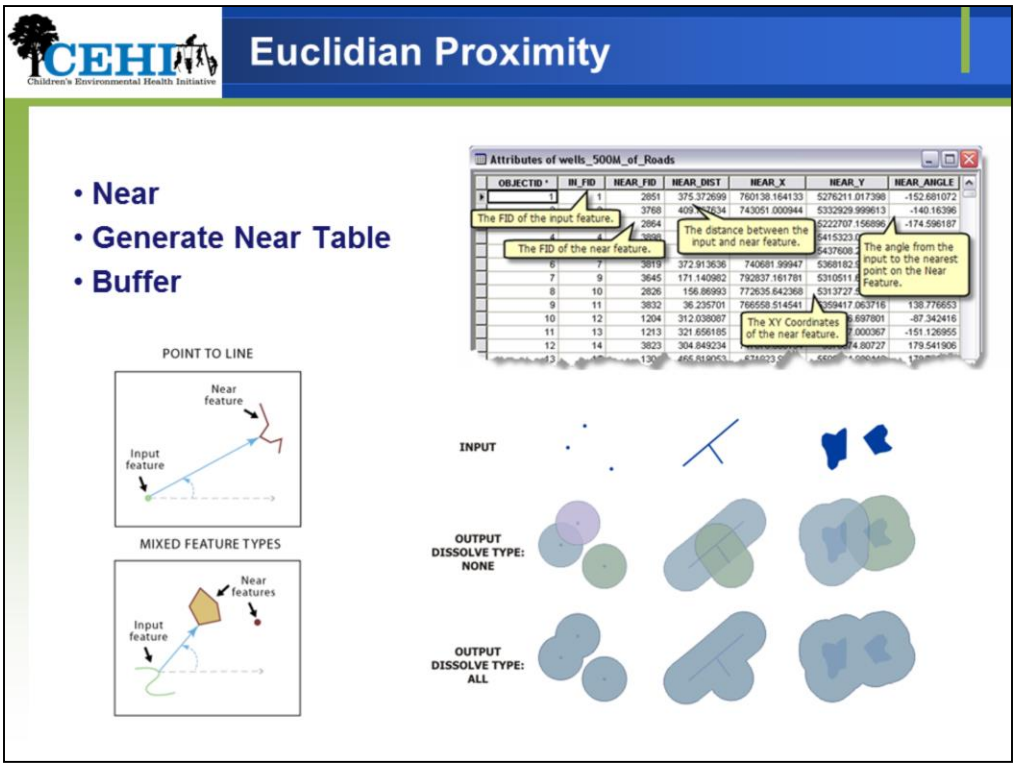
Euclidian "as the crow flies" distance

Network distances measured via network of interconnected points (nodes) and lines (edges)

Let's take a closer look at

Euclidean and

Network based methods



Near:

Used to find the area within a given distance of a set of features

Near Calculates distance between the input features and the closest feature in another layer or feature class

Input and near features can be points, lines, or polygons

Adds information as new fields in input feature table

Generate Near table:

Calculates distances and other proximity information between features in one or more feature class or layer

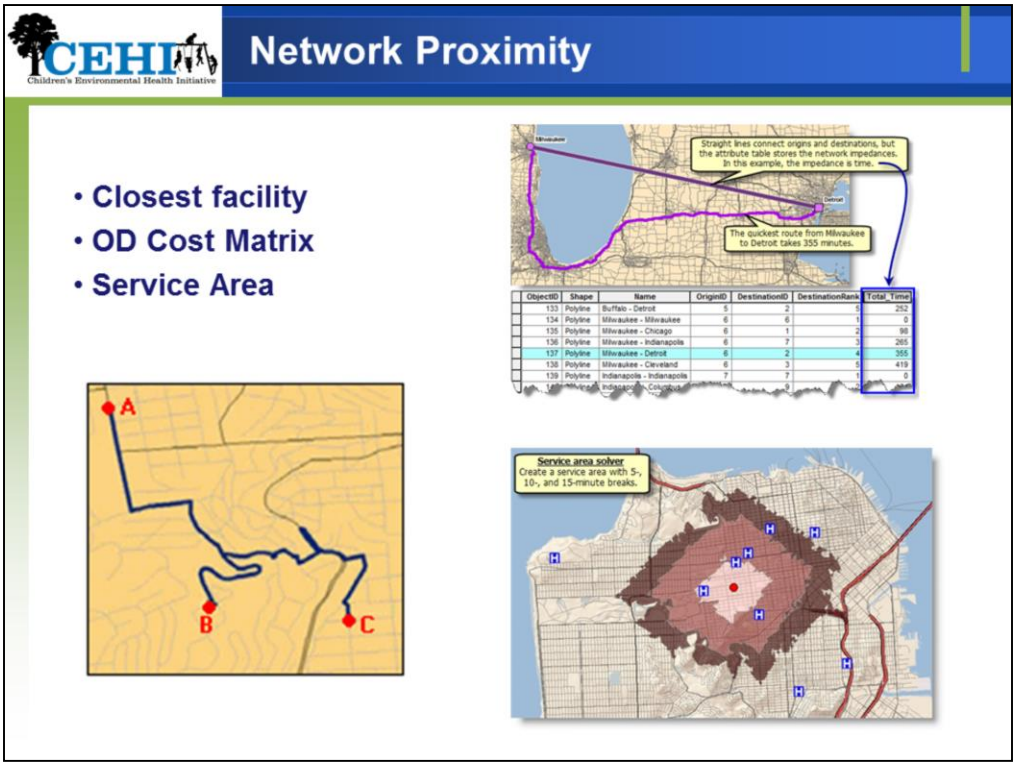
Unlike the Near tool, which modifies the input, Generate Near Table writes results to a new stand-alone table and supports finding more than one near feature

Buffer:

Used to find the area within a given distance of a set of features

Input features can be points, lines, or polygons

Output feature will always be polygons



Closest facility:

Measures the cost of traveling between incidents and facilities and determines which are nearest to one another. When finding closest facilities, you can specify how many to find and whether the direction of travel is toward or away from them. The closest facility solver displays the best routes between incidents and facilities, reports their travel costs, and returns driving directions.

Optimized analysis

Origin Destination Cost Matrix:

Creates a cost matrix from multiple origins to multiple destinations

Good for calculating distance or time between multiple start and end points

Can find a desired number of destinations and or set distance threshold

Service Area:

Calculate an area based on time or distance from or to a point

Good for estimating populations

Different than a simple buffer since area represents the drive time/distance to or from a point of interest

What is Access?

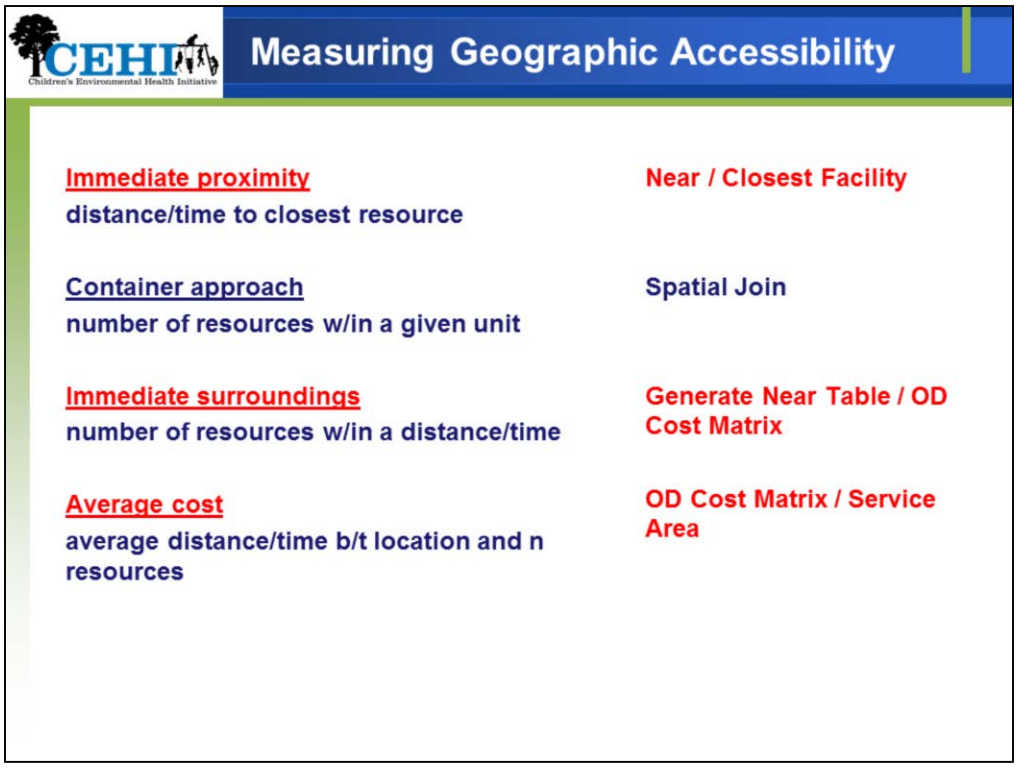
- Multiple dimensions*:
  1. availability
  2. Geographic accessibility
  3. accommodation
  4. affordability
  5. acceptability
- Geographic accessibility
  - *cost* for reaching resources, where cost is based on distance or travel time
  - Depends on the relative locations of population/individual and the resource(s) of interest

*Penchansky R, Thomas JW: The concept of access. Definition and relationship to consumer satisfaction. Medical Care. 1981, 19 (2): 127-140. 10.1097/00005650-198102000-00001.

Evaluating accessibility of resources for individuals and or populations in multiple contexts…

Assumption; In other words: the individual/population is a potential user of the facility/service

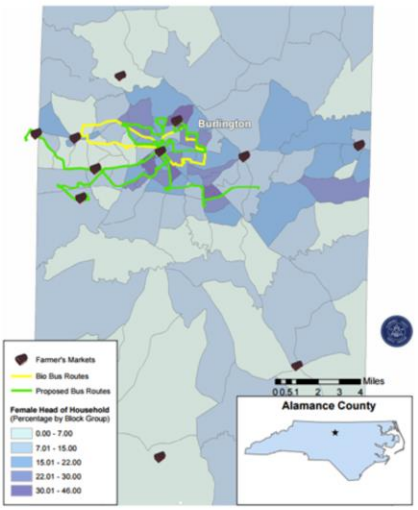
Even with these assumptions identification of areas/populations/individuals with low to high geographic accessibility provides useful and practical information



Most of these methods require proximity based measurements

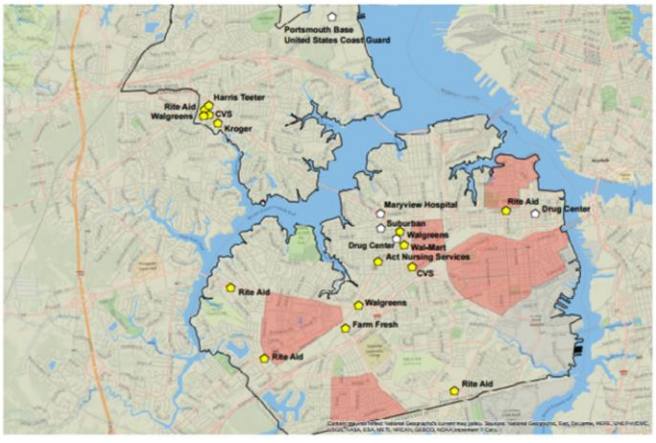
Operationalizing Geographic Accessibility

- Define area of interest and appropriate scale
- Aggregate population
- Choose a measure of geographic accessibility
- Choose a distance type



Bringing it All Together

Medication Therapy Management (MTM) Pharmacies within a 10 Minute Drive Time from High-Need Communities, Portsmouth Health District, 2016



Sources: US Census Bureau, 2010; VA Vital Statistics, 1999-2011; VA Geographic Information Network, 2013; VA Department of Health, 2015