New Mexico Health Policy Commission

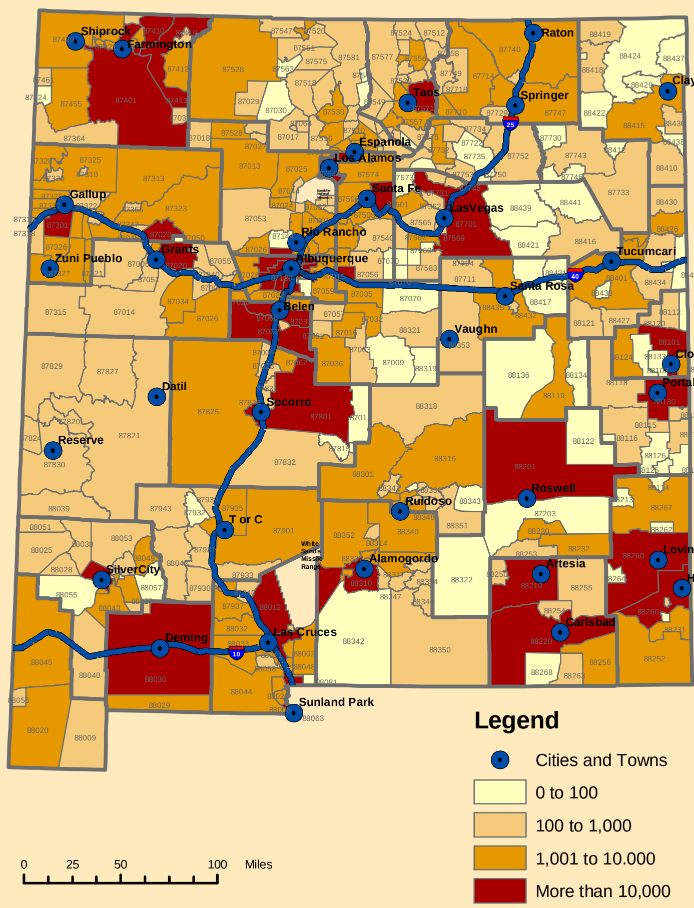
http://hpc.state.nm.us

Measuring Geographic Access to Primary Care Physicians in New Mexico

http://www.unm.edu/~dgrint

The University of New Mexico DGR

Estimated Population by ZIP Code

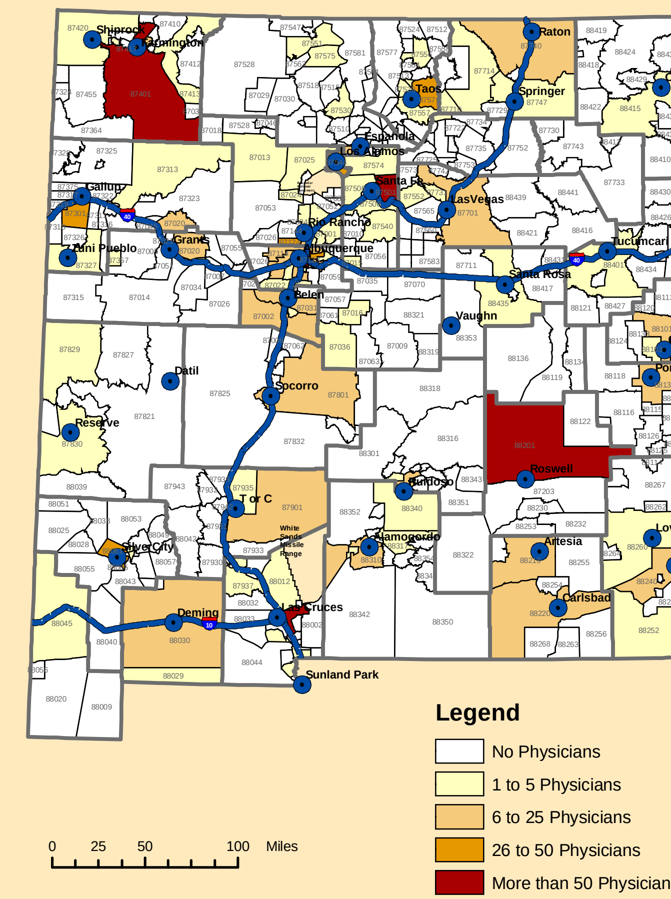


This map shows the estimated number of people per ZIP Code in New Mexico based on 2002 counts of licensed drivers and 2001 population by county. The population estimation process is described below.

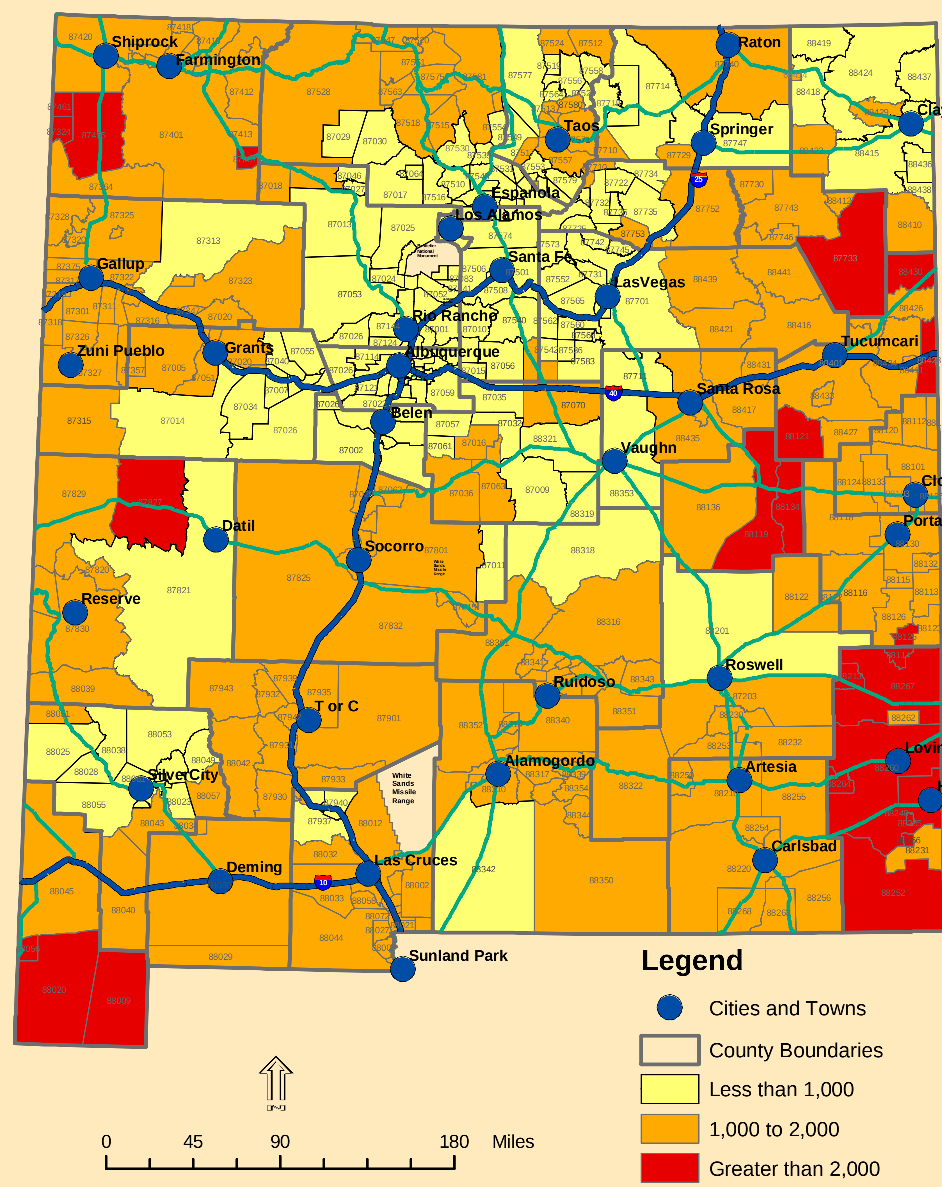
This map shows the number of primary care physicians by ZIP Code in NewMexico as of March, 2002 based on data obtained from the New Mexico Board of Medical Examiners.

This map combines the information from the previous two maps to show potential access to primary care physicians in New Mexico. Population per primary care physician is derived by using a specially designed gravity model (see below).

Primary Care Physicians by ZIP Code



Population per Primary Care Physician



The Problem of Measuring Geographic Access

Gravity models (a class of spatial interaction models) and other spatial analysis methods have a history of successful application for retail and marketing studies and more recently health care studies (Cromley and McLafferty, 2002). The New Mexico Health Policy Commission (NM HPC) and the University of New Mexico's Division of Government Research (UNM, DGR) have been working cooperatively to collect data and develop spatial analysis methods to provide better information concerning geographic access to health care facilities and providers in New Mexico. This poster illustrates the application of a gravity model to the problem of measuring geographic access to health care.

The maps (top left and right) illustrate that it is possible to collect and display data about the distribution of population and primary care physicians (family practice, general practice, pediatrics, obstetrics and gynecology, and internal medicine with active licenses and a primary licensing address in New Mexico). However, it is not easy to compare these two maps and effectively measure geographic access to primary care physicians.

In order to measure geographic access, a reliable measurement technique was applied that compares the distributions of population and health care providers. This gravity model based measurement technique considered the following:

- Provided compatibility with traditional ratio-based measures (e.g., federal and state service capacity standards expressed as persons per MD).
- The arbitrary boundary problem imposed by data collection units such as ZIP codes (people cross ZIP code boundaries to obtain health care).
- Spatial interaction: the closer medical services are the easier it is to access them.
- Distance decay: the decline of spatial interaction over distance, termed the *friction of distance*
- A common scale that allows for the relative comparison of values by ZIP code.

Population Estimation and Gravity Model Methodology

This gravity model uses estimated number of people per ZIP Code based on 2002 counts of licensed drivers and 2001 population by county. This estimation process allocates a portion of a counties population to each ZIP Code. Estimated population per ZIP Code is equal to the ratio of licensed drivers per ZIP Code divided by the total number of licensed drivers per county multiplied by the total population of a county.

The population estimation and the gravity model (see right panel) were programmed in SAS (Statistical Analysis System). The results were transferred to ArcGIS as dBASE files and joined with a ZIP Code shapefile attribute table in ArcMap. This poster was produced in ArcMap.

Cromley, E.K. and McLafferty, S.L. (2002) *GIS and Public Health*. New York: The Guilford Press.

Potential Accessibility Gravity Model

$$PA_j = \frac{\sum_{i=1}^{n} f(d_{ij})\,pop_i}{\sum_{i=1}^{n} f(d_{ij})\,prov_i}$$

PA_j = Potential accessibility for ZIP code j
pop_i = Population of ZIP code i
$prov_i$ = Number of providers or facilities in ZIP code i

$f(d_{ij}) = 1$	for all $0 < d_{ij} < 35$
$f(d_{ij}) = 1/(d_{ij} - 34)$	for all $35 <= d_{ij} <= 100$
$f(d_{ij}) = 0$	for all $d_{ij} > 100$

NOTE: This is a dual gravity model, one for population (numerator) and one for providers (denominator). The result (PA_j) is expressed as a traditional service capacity ratio. Unlike most traditional gravity models that use an exponential function for distance decay, this model uses a rule-based function that allows for a more gradual distance decay. There is no distance decay within 35 miles. The distance decay is gradual between 35 and 100 miles. Beyond 100 miles this model does not measure the cumulative effects of population or providers. The 35 mile distance is used as a proxy for 45 minutes of travel time which is the geographic access standard specified by a New Mexico Senate Joint Memorial 36 (SJM 36).

Interpretation of Results

The core areas of New Mexico are within the established guidelines for geographic access (SJM 36) to primary care physicians. It is apparent that the north and central portions have greater geographic access than the rest of the state. In general, geographic access seems to decline in some rural ZIP Codes and others that are close to the Arizona and Texas borders.

NOTE: Senate Joint Memorial 36 sets a service capacity standard of 1 FTE per 1,500 population and a geographic access standard that allows for persons to be within 45 minutes of primary care service.

Estimated ZIP Code Boundaries Current as of July 2002

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