

# Health Resources and Services Administration

## Geospatial Data Warehouse

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## **Health Resources and Services Administration Geospatial Data Warehouse**

### **ABSTRACT**

This paper describes how the Health Resources and Services Administration (HRSA) Geospatial Data Warehouse (HGDW) supports the HRSA mission: improving the availability of and access to quality health care for all. HRSA directs financial resources by operating grant, loan and scholarship programs. The HGDW provides information about HRSA programs and related health resources, demographic data, and serves as the foundation for geospatial data analysis. The HGDW architecture couples ESRI's ArcSDE software with Microsoft SQL Server 2000 utilizing a customized ArcIMS/Hyperion Performance Server interface to provide web-based user access. Through these technologies, the HGDW report and map tools facilitate information integration in support of HRSA business practices including health planning and policy-making in a geographic context.

### **INTRODUCTION**

The Health Resources and Services Administration (HRSA) is the access agency of the U.S. Department of Health and Human Services (DHHS). HRSA is charged with assuring the availability of high quality health care to low income, uninsured, isolated, vulnerable and special needs populations. In support of the mission to improve and expand access to quality health care for all, HRSA programs provide funding targeted at eliminating barriers to care and health disparities and improving the quality of public health care and health care systems. Access to a single integrated geospatial information repository is critical to accomplishing these goals.

The HRSA Geospatial Data Warehouse (HGDW) and its associated applications were developed to provide HRSA and the public a single point of access to a broad range of HRSA programmatic information, related health resources, and demographic data useful for planning and policy purposes. The information within the HGDW can be displayed as tables/reports and/or as maps depicting what HRSA does in a given area.

The HGDW is envisioned to become the single information source for reporting on HRSA activities. It is being developed to promote information sharing and collaboration among HRSA staff, HRSA partners, state and local health planners and policy makers, and stakeholders. The HGDW continues to evolve as analytical functionality and data needs change.

The HGDW is accessible from the HRSA website at (<http://www.hrsa.gov>) or directly at <http://datawarehouse.hrsa.gov>. It can also be found in the *Human Health and Disease* channel on the Geospatial One-Stop portal ([geodata.gov](http://geodata.gov)). This portal is part of the Geospatial One-Stop E-Gov initiative that provides access to geospatial data and information. Additionally, the HGDW spatial metadata collection is registered with the Federal Geographic Data Committee (FGDC) Clearinghouse ([fgdc.er.usgs.gov](http://fgdc.er.usgs.gov)).

## TECHNICAL ARCHITECTURE

The geographic scope of the HGDW includes the United States and all its Territories, in addition to some ancillary information on Mexico in support of HRSA's U.S. – Mexico Border initiative. The HGDW is comprised of several Microsoft SQL Server databases that house the spatial data managed through ArcSDE along with 5 data marts, a data staging area, and an operational data store.

The information in the databases is organized by subject:

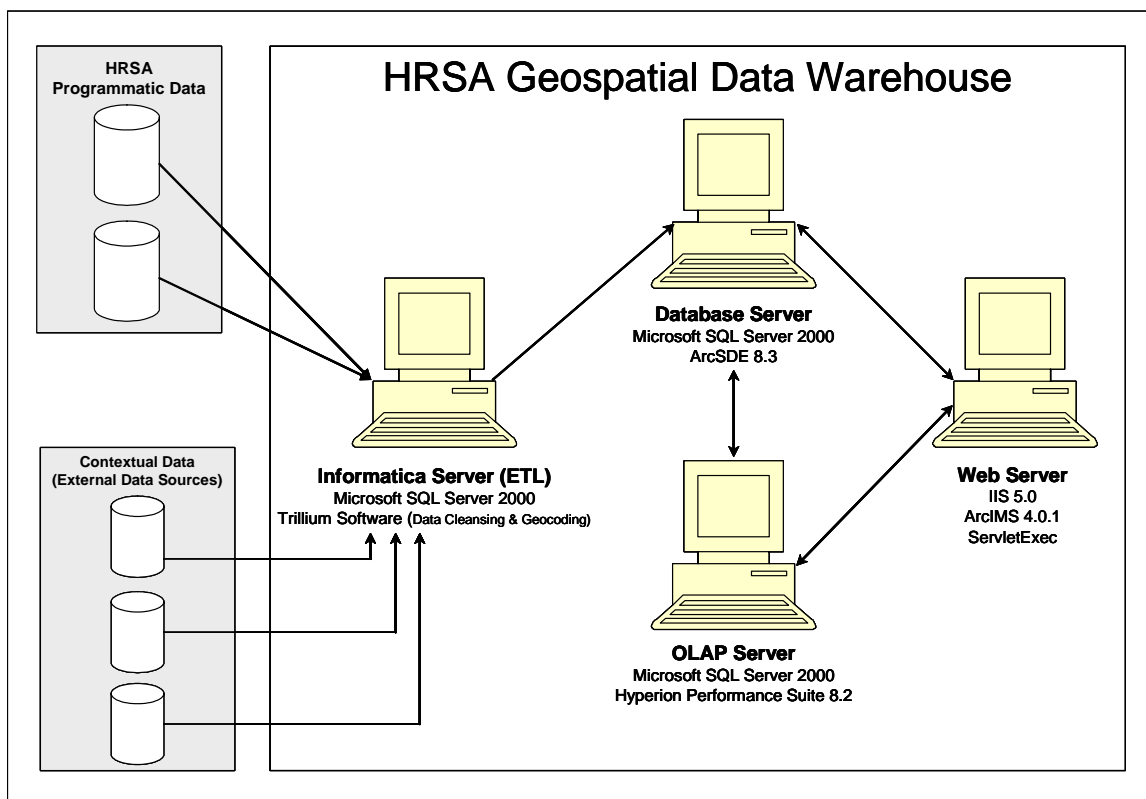
- **Grant Information** - Information on the programmatic aspects of awarded grants. For example, who are the grantees in a particular program, where are they located, and how much money has been awarded for one or more fiscal years. The HRSA Geospatial Data Warehouse currently includes 6 years of grants data (fiscal years 1999-2004). The information for the current fiscal year is subject to change with each refresh.
- **Health System Information** - The health system data in the HRSA Geospatial Data Warehouse focus on Health Professional Shortage Areas (HPSA), Medically Underserved Areas/Populations (MUA/P), health workforce composition, health professionals, health care facilities, and Primary Care Service Areas (PCSA).
- **Demographics and Statistics** – This includes a broad range of data elements from the Census including population counts for a large number of population subgroups (e.g., age/sex/race categories) as well as information on poverty rates, income, and other household characteristics. Additionally, a variety of data elements that describe births and deaths (e.g., infant mortality, rates of low birth weight babies, and disease-specific death rates) at the county level also are available.
- **Spatial Information** – This includes the base cartographic information and Census boundary information to provide context for the display of HRSA awarded grants, HPSAs, MUA/Ps, health care facilities, PCSAs, and birth/death rate information.

All tabular data is loaded through the Informatica ETL (extract, transform, load) tool; spatial data is loaded via a combination of ArcSDE command line utilities and ArcCatalog. Extensive geocoding at both the street address and ZIP code level is conducted to transform the HRSA grant, health care facility, and health provider information into spatial layers accessible through the Map Tool on the HGDW web site. The ESRI StreetMap USA data currently serves as the reference data for all geocoding, however, Trillium Software is currently being incorporated into the ETL processing and will be used for all address cleansing and geocoding against its certified copy of the U.S. Postal Service database.

The web-based Map Tool provides access to the broad base of information within the HGDW from a spatial context. Users are lead through the process of creating a map in three steps: selecting the geographic area of interest (state, county, ZIP, etc.), selecting the data layers and demographic/statistical themes to be displayed, and confirming these selections prior to clicking the *Make Map* button. The Map Tool is developed in ASP and Javascript and uses the ArcIMS ActiveX connector in addition to sending AXL requests directly to the map service for generation of the map, overview map, and legend. Features on the map can be identified and are linked to the Report Tool enabling users to drill down further into the HGDW information resources.

The Report Tool also is accessible from the HGDW web site and is the tabular mechanism for accessing the information. The report tool is developed using the Hyperion Performance Server, formerly Brio, and allows users to filter data and export the results to Microsoft Excel.

Figure 1 provides a diagrammatic representation of the HGDW architecture.



**Figure 1** HRSA Geospatial Data Warehouse Technical Architecture

Comprehensive tabular and Federal Geographic Data Committee (FGDC) and International Organization for Standardization (ISO) compliant spatial metadata are accessible from the HGDW web site through the data element dictionary and data sources components of the business metadata as well as through a customized spatial Metadata Explorer and gazetteer interface.

Users with GIS client software can access the HRSA specific layers through the HGDW\_Mapping Feature Service available from the HGDW web server (datawarehouse.hrsa.gov). The Feature Service facilitates use and sharing of HRSA spatial data resources and, along with the metadata is registered with the Geospatial One-Stop (GOS) portal in the *Human Health and Disease* channel.

The HGDW web site also provides links to a variety of help resources including PDF files, organized by subject, of the data element dictionary.

## **BUSINESS USES**

The HGDW supports HRSA's daily activities primarily through providing access to spatial and tabular information in response to questions regarding the location of HRSA resources to enhance the supply, diversity, and distribution of the Nation's health care work force. In support of HRSA's mission, the HGDW is continually evolving to support HRSA and its stakeholders in evaluating the need for establishing and expanding health-related resources.

A major issue for HRSA is providing affordable access to primary and preventive health care in the U.S. For example, HRSA provides grants as incentives for establishing, expanding, and staffing community health centers. These centers are designed to provide an alternative to the hospital emergency rooms; emergency rooms are not cost effective or appropriate places to receive primary care.

The HGDW supports stakeholders planning to apply for HRSA funding as well as HRSA staff responsible for evaluating grant applications. For example, funding for the establishment of a community health center designed to serve one or more populations of need. For illustrative purposes, suppose an organization wishes to apply for a HRSA grant to establish a community health center in the city of Desert Center in Riverside County, California. Riverside County is part of HRSA's U.S. – Mexico Border Health Initiative Area. Figure 2 is a screen capture of the HGDW Map Tool showing the 100km initiative area buffer in peach and the counties that are part of the initiative area highlighted in blue. The HGDW team is working closely with the US-Mexico Border Health Commission (USMBHC) (<http://www.borderhealth.org/>) in support of their goal to institutionalize a domestic focus on border health, which can transcend political changes and create an effective venue for bi-national discussions to address public health issues and problems which affect the US-Mexico border populations. The initiative area and the counties/municipios within it are viewed as one epidemiological unit.



**Figure 2** U.S. - Mexico Border Health Initiative Area

Although Riverside County is part of the initiative area, the city of Desert Center is just outside the 100km buffer as shown in Figure 3. This is an indication of an overall need for health care resources in the area. This need can be further described by examining the area around Desert Center with respect to populations of need. A requirement for the location of a community health center is that it must be accessible to a population of need.

The Map Tool within the HGDW website allows the characterization of need through the display of Health Professional Shortage Areas (HPSA) and Medically Underserved Areas/Populations (MUA/P). The MUA/P designations identify areas and population groups with a shortage of primary health care services, whereas HPSA designations identify areas that have a shortage of primary health care professionals. This information, when coupled with the thematic display of demographic information from the 2000 Census allows further characterization of the population in the proposed area for the health center. Figure 4 is a printout from the Map Tool showing the HPSA and MUA/P boundaries around Desert Center. Figure 5 shows the income under 2 times the Federal poverty level at the census tract summary level. In general, HRSA programs utilize up to 2 times (200%) of the Federal poverty level as the standard for determining poverty status in a given area.



**Figure 3** U.S. - Mexico Border Health Initiative Area - Riverside County, California

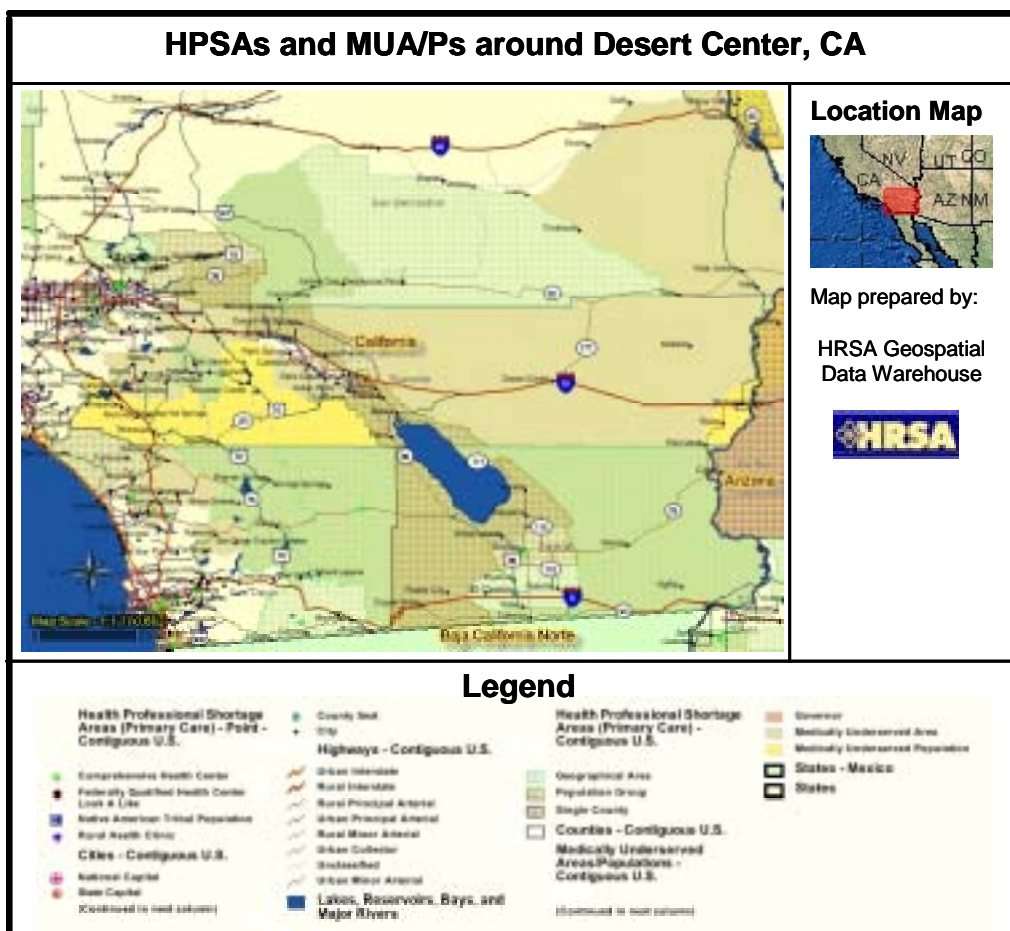
The map in Figure 4 shows that the area around Desert Center is not within a primary care HPSA. However, Desert Center may still lack needed health care professionals as this part of the county is in the Chairaco Summit/Desert Center Service MUA/P. Furthermore, as shown in Figure 5, the city is located within a Census tract with a low income population of approximately 10%. Adding additional demographic themes and using the identify function in the Map Tool provides information on all features displayed in a given location, such as Desert Center. This enables a demographic and health care need profile to be constructed using the tabular information from the identify results shown in Figure 6. These results confirm that the city is located in a rural area according to the 2000 Census housing unit data and that slightly more than a third of the county's population is low income.

To complete the analysis, existing HRSA resources in or around Desert Center must be identified. Organizations may apply for grants under one or more programs within any of HRSA's 10 key program areas (Primary Health Care, HIV/AIDS, Health Facilities, Health Professions, Maternal & Child Health, Office of the Administrator, Organ Transplantation, Rural Health, Special Programs, and Tele-Health). Across the 10 key program areas for fiscal year (FY) 2003 there were 194 programs. The screen capture in Figure 7 shows no FY2003 grantees around the Desert Center in any of the key program areas. Furthermore, there are no Health Center Cluster Sites, National Health Center Corps (NHSC) providers, Federally Qualified Health Centers, and Rural Health Clinics in the area. However, there are resources located along either side of

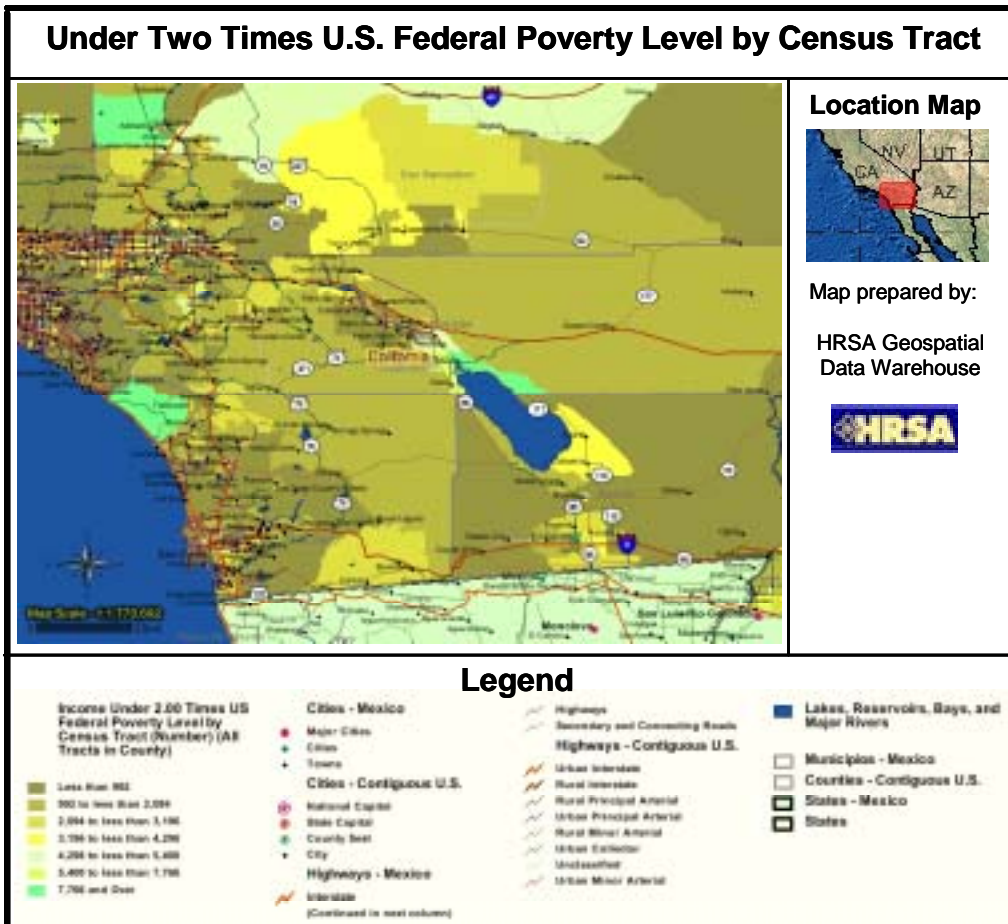


the county boundary in the Palm Springs through Desert Springs corridor and points west as well as in the city of Blythe. The legend for this map is large and is not included here for the sake of brevity.

Therefore, based on the information in the HGDW, establishing a community health center in Desert Center appears reasonable. This analysis can be carried further using the report tool to drill down into data. The report tool is accessible through the web site and is hot linked to specific fields, such as grantee name, in the identify results window. Using this tool, state planners, for example, can dig deeper into the information regarding HRSA resources in the surrounding area and utilize this information to begin to determine if there is the ability within the city to support a health system.



**Figure 4** Health Professional Shortage Areas and Medically Underserved Areas/Populations



**Figure 5** Under 2.00 Times of U.S. Federal Poverty Level by Census Tract

**FUTURE DIRECTION**

The example of determining the location for a community health center illustrates the power and utility of the centralized repository of spatial and tabular information in the HRSA Geospatial Data Warehouse. At present, the types of analyses possible are somewhat cursory. The addition of other HRSA data related to health professionals (e.g. service providers, nursing education loan repayment, nursing scholarship programs) and data from external sources (e.g. health indicators, emergency room visits that do not lead to admissions) will strengthen the analytical capabilities of the HGDW. Additionally, the Map Tool continues to evolve. Development of additional tools such as distance measurement and spatial analytical capabilities are currently being discussed. These enhancements coupled with the ability for obtaining detailed/additional information on map features through the Report Tool will expand the role of the HGDW for HRSA and its stakeholders.

**Medically Underserved Areas/Populations**

MUA/PMUA ID	Date Designated	Score	Designation Type	Date Data Last Reviewed or Updated	MUA Status	Service Area Name	Service Area Type	In U.S. - Mexico Border Health Initiative Area
00256	6/29/1995	50.6	Medically Underserved Area	[No data]	D	Chairaco Summit/Desert Center Service	Partial County	Y

**Income Under 2.00 Times US Federal Poverty Level by Census Tract (Number) (All Tracts in County)**

State Name	County or County Equivalent	Complete ID Number	Tract Number	Total Population (2000)	Population Density (per square mile, 2000)	Income Under 2.00 Times US Federal Poverty Level
California	Riverside County	06065045800	0458.00	11,127	2.92	1,091

**Income Under 2.00 Times US Federal Poverty Level by County (Number) (All Counties in State)**

State Name	County or County Equivalent	Total Population (2000)	Population Density (per square mile, 2000)	Income Under 2.00 Times US Federal Poverty Level
California	Riverside	1,545,387	211.61	529,144

**Income Under 2.00 Times US Federal Poverty Level by County (Percent of total population) (All Counties in State)**

State Name	County or County Equivalent	Total Population (2000)	Population Density (per square mile, 2000)	Income Under 2.00 Times US Federal Poverty Level
California	Riverside	1,545,387	211.61	34.24%

**Housing Units Rural by ZIP Code Tabulation Area (ZCTA) (Number) (All ZCTAs in State)**

State Name	ZIP Code Tabulation Area	Total Population (2000)	Population Density (per square mile, 2000)	Housing Units Rural
California	92239	962	2.13	630

**Housing Units Urban by ZIP Code Tabulation Area (ZCTA) (Number) (All ZCTAs in State)**

State Name	ZIP Code Tabulation Area	Total Population (2000)	Population Density (per square mile, 2000)	Housing Units Urban
California	92239	962	2.13	0

**Figure 6** Identify Results



**Figure 7** HRSA Resources around Desert Center, California

The HRSA HGDW development team welcomes comments and suggestions regarding the addition of data and functionality in the Mapping and Reporting Tools. Comments and suggestions for enhancements can be submitted through the HRSA Call Center:

HRSA Call Center  
 20201 Century Boulevard  
 3rd floor  
 Germantown, MD 20874  
 Phone: (877) GO4-HRSA  
 (1-877-464-4772) or (301) 353-1899  
 Fax: (301) 601-0127  
 E-mail: [CallCenter@HRSA.Gov](mailto:CallCenter@HRSA.Gov)

## ACKNOWLEDGMENTS

The HRSA Geospatial Data Warehouse Team would like to acknowledge Dr. Elizabeth M. Duke, HRSA Administrator, for her continued support of this project.

## END NOTES

The data in the HRSA Geospatial Data Warehouse is refreshed on a continual basis. The data refresh dates/cycles are available on the web site and are subject to change.

For example, the refresh frequency for the HRSA grants data is actively being discussed. All data presented in this paper is in accordance with the refresh dates in the following table.

<b>Data Set</b>	<b>Refresh Date</b>	<b>Refresh Cycle</b>
HRSA Grants	December 15, 2003	Annually
Health Professional Shortage Areas (HPSA)	February 5, 2004	Quarterly
Medically Underserved Areas/Populations (MUA/P)	January 19, 2004	Quarterly
Birth and Infant Death Statistics	March 31, 2003	Annually
National Health Service Corps (NHSC) Providers	January 14, 2004	Quarterly
Health Center Cluster Sites	January 14, 2004	Quarterly
Census 2000 Summary File 1	March 31, 2003	---
Census 2000 Summary File 3	January 23, 2004	---
Spatial Data	February 13, 2004	Quarterly
Congressional Districts	January 23, 2003	Bi-annually

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