GIS Supports Strategic Planning for Veterans Health Administration

By Susan Harp, ESRI Writer

The Veterans Health Administration (VHA) operates the United States’ largest integrated health care system, public or private, with 1,100 facilities serving 8.5 million enrolled veteran beneficiaries. The system is divided into 21 service regions, which in turn are divided into 80 market areas, 103 submarkets, and 508 sectors. Access by distance to VHA health care facilities is monitored at all these levels.

Planning for such a large system requires accurate and timely geographic analysis of facility and enrollee locations. To that end, the VHA geocodes its inventory of facilities quarterly and its list of beneficiaries—all 8.5 million of them—annually. This work is done by the Planning Systems Support Group (PSSG) in Gainesville, Florida, which houses the majority of the VHA’s geographic information system (GIS) personnel and resources.

Historically, the PSSG provided planners with a host of static cartographic products and statistical reports on access to facilities at all levels of VHA geography. In basic ways, these products identify spatial gaps in access to health care where new facilities might best be located. They also compare local access statistics to various benchmarks.

However, as demand for planning support grew, Duane Flemming, a director in the office of the Assistant Deputy Undersecretary for Policy and Planning in Washington, D.C., realized that the PSSG needed to grow as well. The first major advance would be to enable hundreds of planners and administrators nationwide with little or no GIS background to perform pre-defined but sophisticated GIS-based planning activities on their own. This would greatly improve systemwide planning in terms of quality, relevance, and timeliness. It would also free GIS staff to do other planning and ad hoc analyses.
Health Information Exchange Provides Secure Network for Clinical Data Sharing

The following is an interview with Kim Pemble, executive director of the Wisconsin Health Information Exchange (WHIE). Pemble was a guest speaker at the 2009 ESRI Health GIS Conference, held September 21–23 in Nashville, Tennessee.

WHIE, a nonprofit organization, is an example of a regional health information exchange. An exchange is a secure electronic network that allows the sharing of clinical information about individual patients between authorized users in different health care organizations. WHIE, whose vision is “improving the quality, safety, efficiency, and accessibility of health care and public health,” started with initial stakeholders that included several health care organizations, primarily hospitals and medical practices, providing care for patients across the Greater Milwaukee area.

What is the significance of a health information exchange?
Let’s think of it in the context of a collection of tools that allows a community or a region to bring together, in real time, pieces of a patient’s medical record to help that community address the challenges of safety, quality, and efficiency of patient care delivery and applications for public health. An exchange is infrastructure that allows us today to share information and, tomorrow, as electronic medical record (EMR) systems continue to advance, to have the ability for those communications to include integration of external clinical data within a local EMR.

How many patients do you track in the Wisconsin Health Information Exchange?
In excess of 725,000 patients. Our implementation started with the focus on Milwaukee County working with the Milwaukee Health Care Partnership, whose members include the health systems and federally qualified health centers, and with public health in that community, as well as the state Department of Health Services [DHS]. Data collection from health systems began in November 2007, and our first clinical use was in March 2008.

What kind of data does WHIE include?
We receive data from 22 different hospitals across five competitive delivery networks and from a federally qualified health center. We receive real-time data regarding patient admissions, the reason or chief complaint, final discharge diagnosis, patients’ primary care provider as reported from that visit—allergies, etc. We also receive, from the Wisconsin Department of Health Services, Medicaid pharmacy claims. That gives our clinicians background on Medicaid patients’ pharmacy history. Last, DHS also provides Medicaid encounter data, including diagnosis and procedures performed. The Medicaid data is for all Medicaid encounters in Wisconsin. These are both updated weekly with data updates from the state.

In the future, we want to bring clinical data into an exchange. We also think about what I refer to as “patient-focused but community-based” documents—things like a referral for a patient from an emergency department to a clinic. The real emphasis here is that the data is patient centered; we are putting the patient in the center of the circle of health care delivery.

What kind of technology are you using to keep track of the data?
Microsoft Amalga Unified Intelligence System is the foundation for the exchange, and our model is a completely hosted solution. Our primary operation site is in McLean, Virginia, and our [backup] hot site is in St. Louis, Missouri. Data feeds are live to both concurrently. One of the HIPAA [Health Insurance Portability and Accountability Act] security elements is that you have the ability to failover and continue operations in the event of a disaster at the primary site, and we have successfully tested that ability. The WHIE test environment is also located at the Virginia site.

How does geography science contribute to the data?
I believe that geography is a paramount element to how we are thinking about health care delivery in the future, particularly from a public health perspective. Because we have this data centralized but not commingled, I can know about encounters that are occurring in a broad geography and can make available de-identified information about what is transpiring in those encounters.

That is a tremendously useful tool for public health surveillance purposes. It takes what historically has been a labor-intensive process to acquire and integrate information and makes it available in a format for analysis. By the way, we don’t own the data; it belongs to the source, and we are just acting on its behalf, answering questions from organizations such as public health.

With the exchange, data is available to public health officials in real time. It is fully de-identified for the privacy of patients, but we know where and why an encounter occurred and fundamental geography about the patient, such as a ZIP Code. That allows public health
From My View . . .

By Bill Davenhall
Global Marketing Manager
ESRI Health and Human Services

Innovation in Evidence Building . . .

Getting practical value out of health data has never been more problematic than it is now. Patient confidentiality, small sampling frames, and the lack of geographic representation limit what researchers can do with data and slow down the construction of intelligence that is applicable to wider populations. However, these problems may soon be diminished by two converging forces—society's compelling need to achieve good health and the ubiquitous Internet.

Most of what we know about the impacts of lifestyle, genetics, environment, and health care utilization comes from "old school" data collection and research methods. The familiar sequence of study design, data collection and analysis, and outcome reporting takes many months or years to complete and is always limited by data collection resources. This is not to say that we have done this poorly for the last half century, but rather that some disruptive innovation is appearing on the horizon.

The drivers for this change, I believe, are societal, such as the need for wellness; the demand for timely response to illness; and a savvy, data-generating and information-using population. Increasingly, patients of all age ranges and geographies have learned that they don’t need to wait around for research results to make decisions, especially if the research is not broadly applicable or was collected either by a process they don’t understand or without the patient’s personal participation. (When was the last time you were in someone else’s health study?) Today, people are willing to trust evidence that comes from the experience of millions of others. Call this “crowd-sourcing research” if you like; it is showing up more frequently.

Unlike fine wine, long and complex data collection processes do not always lead to better information. They do, however, cost a lot, and the information takes longer to enter mainstream thinking and even longer to become practice. Building larger bodies of knowledge is getting easier to do, thanks to the Internet. The ability to collect evidence at a lower cost is a compelling proposition, whether you are a physician, microbiologist, social worker, or medical geographer. With today’s technology, we can build huge datasets in days or weeks, not months or years.

What if we asked patients directly about their symptoms, treatments, and outcomes in real time? What if we increased the sample size far beyond what statistical significance requires and with broader geographic reach? What if we engaged the consumer in every step of the research process, validating our findings as we progressed?

Could we then use more of our time analyzing the data and less time and money collecting it?

Such health-focused Internet communities with very large patient datasets are already forming. To see an example of this approach to knowledge building in health, visit www.patientslikeme.com. What you will find there is a fundamental change to how we might build and accept actionable information about treatments and therapies that are and are not working. How well this type of health research will be accepted is yet to be determined, but you may find it well worth watching or participating in, especially if you have one of the 15 diseases represented.

As always, I welcome second opinions.

Regards,

Bill

Visit www.patientslikeme.com to see an example of user-generated health datasets.
[organizations] to see patterns that might be emerging for health issues.

From the context of planning for growth and resource demand of public health and managing the costs of health care, one challenge is—how do we make care available in the right places at the right times? Understanding where patients are coming from and going to for care may shed some light on where there is a demand for resources and where we could think about expanding clinics or federally qualified health centers. The exchange data then, being encounter specific and with geographic location, allows us to support public health surveillance that is a foundational tool for policy and resource planning.

You have said that health information exchanges can be a transformational tool for patient-centered care.

Would you give me an example?
Sure. A patient entered an emergency department with an infection and reported that he had an allergy to penicillin, but he forgot to report an additional allergy to sulfa-based medications. As a result, the patient was prescribed a sulfa-based medication and subsequently had a traumatic allergic response. The patient’s allergy had been documented in his primary care physician’s records, but these were not available to the emergency clinicians at the time of the encounter.

When we connect not only the hospitals but also ambulatory physician records, it becomes a useful tool for care delivery. The clinician, at a minimum, knows where to go to find information.

What feedback are you getting from users of WHIE?
Our clinicians report that the exchange is reducing the amount of time they spend gathering information about a patient visiting an emergency department. Time is critical to the patient, care providers, and the other patients in the emergency department waiting for care. So the value goes not just to the physician or payer but to the patients, and that is the critical element.

How do you support your organization?
Our funding has been primarily from a Medicaid transformation grant and a contract with the state Department of Health Services. Additionally, we’ve received funding from the health systems that are participating in the exchange, and we have a relationship with our first private payer. We also recently had a large group of self-funded employers that provide financial support for the exchange for their patients who have encounters at the emergency departments where the exchange is being used.

The [financial] sustainability question is one of looking at an entire community. Some states, such as Vermont, suggested taxing paid health care claims to support development of state health information technology and health information exchange initiatives. Maryland wants to look to health systems to provide funding support for the exchange; some of that funding will come from the incentive dollars that hospitals will get from the HITECH [Health Information Technology for Economic and Clinical Health] Act.

To see Pemble’s Plenary Session presentation at the 2009 ESRI Health GIS Conference, go to the conference proceedings Web site at www.esri.com/events/health. For more information about the Wisconsin Health Information Exchange, contact Pemble at kpemble@whie.org or visit the Web site www.whie.org.

The Wisconsin Health Information Exchange shares data among 23 medical facilities and maintains real-time data connections with 11 of them.
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Institute Puts Health in Motion with Time-Sequence Maps
Institute for Health Metrics and Evaluation Uses Online Maps to Share Information on Population Health and Its Determinants

With the explosion of data from global health indicators now available, how do we make sense of the information? The Institute for Health Metrics and Evaluation (IHME), a global research center based in Seattle, Washington, is tackling that challenge and using GIS technology to share the results.

IHME, established in 2007 with support from the State of Washington and the Bill & Melinda Gates Foundation, has a mission to improve the health of populations worldwide by making the best information on population health available to others in comprehensible formats. IHME is doing this by gathering and examining many kinds of data (census, vital statistics, surveys, administrative, and others) to produce scientific evaluations of health conditions and health systems’ performance. The results are intended to empower researchers, policy makers, decision makers, practitioners, and donors to develop health-related policies that achieve the highest benefits. With a staff of 75, IHME is currently leading nearly 20 research projects, including the Global Burden of Disease (GBD), Injuries, and Risk Factors Study, a project that involves more than 800 collaborators worldwide and aims to estimate the overall global burden of disease.

Foreseeing the production of large amounts of data, IHME needed a way to make study results (statistics and tables) available in a way that a variety of audiences would find useful. Peter Speyer, IHME director of data development, promotion, and dissemination, was tasked with finding a solution. Based on advice from the foundation and examples of data presentation methods, he pursued an approach that used GIS to provide a Web-based, visually intuitive way to manage and explore large amounts of data.

“GIS seemed an obvious choice in terms of visualizing data,” said Speyer. “It enables us to take information and instantly give it meaning for a wide variety of audiences, from the general public to senior health officials. By allowing audiences to map the data and view it alongside other indicators and over time, the data becomes more engaging and offers further insight into how best to fund, design, and implement effective health policy programs.”

After consulting with potential vendors on possible approaches, cost, and time frames, IHME chose GCS Research LLC of Missoula, Montana, an ESRI business partner, to build the application. Speyer said, “GCS [staff members] seemed very advanced in their abilities, were quick in understanding what we needed, and were able to offer a solution at a cost we could afford.” IHME staff worked with GCS during the design phase by comparing existing applications, defining project goals, identifying the audiences and their needs, and discussing the best way to present data according to those needs. The design called for an online application that could

- Present datasets by location as well as time (year) on a map and in tables.
- Display a global map view as well as detailed views at national levels.
- Provide interactive tools for
  - Selecting, combining, and viewing different datasets and attributes
  - Viewing data in a time series
  - Communicating with others about data and results via reports
- Be scalable and ready to add functionality, tools, and data.

The resulting IHME GIS tool is a rich Internet application (RIA) built with the ArcGIS API for Flex. The need to display detailed information from numerous datasets over time presented challenges for data retrieval and display in a Web browser, and the Flex solution allowed construction of a fast and highly interactive user experience. Previously, this could not be accomplished with traditional HTML Web technologies.

On the back end, ArcGIS Server was paired with Microsoft SQL Server to serve map tiles, perform complex spatial queries, and provide fast processes for updating the GIS data with ArcGIS Desktop tools. ArcGIS Online services provide access to basemaps.

To meet the challenge presented by serving large amounts of data for the time series

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The other goal was to enhance and modernize the infrastructure for the GIS staff in Florida and make those resources available to GIS professionals throughout the VHA.

To achieve these goals, Flemming contracted with Penobscot Bay Media, LLC (PenBay), an ESRI business partner, to develop a Web-based mapping and planning portal and upgrade GIS hardware, software, and data infrastructure. He also recruited Dr. Mark Guagliardo, an authority on geospatial accessibility of health care, to help design and manage the project.

The Web Portal
A Web-based GIS mapping portal for planners and administrators went online in October 2009. It runs on ArcGIS Server and leverages a number of new technologies to deliver powerful tools with an easy-to-use interface. Planners are able to see how their current facility locations relate spatially to the residential locations of beneficiaries. They can also instantly activate a cached layer that identifies drive-time service areas to quickly find unserved areas that are densely populated with beneficiaries.

With the candidate site evaluation tool, users can choose potential health care facility locations by clicking on the map or entering an address, presumably in a densely populated unserved area. The tool renders drive-time service areas around the new location. Best of all, the user can request a statistical report on the impact of the new facility on an area of interest (e.g., a VHA health care market area) that gives the number of newly served beneficiaries and the change in percentage of beneficiaries who are within VHA drive-time guidelines. A similar tool assesses the impact of decommissioning an existing health care facility.

A number of additional map layers help planners identify potential non-VHA partners for care delivery in underserved areas. These include point locations for military treatment and Indian Health Service facilities, as well as health care facilities supported by the Health Resources and Services Administration.

The portal also supports planning in rural areas, a topic of particular interest to Congress. Users can activate a layer showing urban, rural, and highly rural areas according to VHA definitions for rurality. This and all layers have pop-up metadata in Federal Geographic Data Committee format, a handy resource that has reduced the number of inquiries that must be fielded by PSSG staff.

GIS Infrastructure and Benefits
The portal provided direct access to information and freed GIS analysts to meet other demands for ad hoc cartographic and analytic reports. It also enabled them to explore how higher levels of geospatial analysis might benefit VHA planning. Flemming and Guagliardo wanted to make the PSSG GIS resources available to analysts in other parts of the country. The addition of a Citrix server allowed designated analysts to access a host of ArcGIS applications. The analysts can now apply these tools to a rich array of geodata, including the portal map layers and a dataset of the 8.5 million geocoded beneficiaries.

The geocoded beneficiaries dataset is noteworthy for more than its size. Each record has a
drive-time and driving distance estimate to the nearest VHA facility offering primary, secondary, and tertiary care services.

For example, beneficiary point locations can be color-coded for drive times to primary care, showing for the first time how the beneficiary travel burden is distributed in any given area of the country. This is a valuable supplement to the picture achieved from the overlay of service area and beneficiary density.

The VHA also plans to join actual health care utilization data to the geocoded beneficiary points. This will allow cutting-edge analyses of how the probability and intensity of utilization changes with increasing drive time. It will also enable the VHA to take on more rigorous pilot programs to explore opportunities for improving geographic access to health care for veterans.

sequences, GCS built a custom Web service using Microsoft .NET Windows Communication Foundation (WCF) technology. WCF is a programming model that enables rapid building of applications for communicating between the Web and the enterprise and was used to optimize data retrieval and associated geoprocessing queries. This approach housed complex operations on the server side and made users’ data exploration on the Web browser seem like simple, one-button choices.

Future plans to grow the application include adding new data, enabling data downloads, and making it possible to upload data so people can work with their own data on the viewer.

For more information about this application, contact Peter Speyer by e-mail at speyer@uw.edu or visit the Web site www.healthmetricsandevaluation.org. For more information about GCS Research, contact Michael Beltz at mbeltz@gcs-research.com or visit www.gcs-research.com.

See Your GIS Work in Print

Did you give a talk or make a poster for an ESRI conference in 2009? Your presentation might make a great article for the HealthyGIS newsletter. For information about submitting an article, visit www.esri.com/health and click HealthyGIS Newsletter, or contact managing editor Susan Harp at sharp@esri.com.

This world map indicates the 2005 country data for malaria aid funds received (circles varying by size and color), combined with mortality rates for children under five (blue color gradient for each country). In the left column, specific datasets and years can be selected and displayed in a table.

The IHME GeoWiki page shows posted comments with a map that corresponds to the comment discussion. In this example, Child Mortality Bolivia (right column) contains a comment about Bolivia, and the map displays total 1998 aid received by Bolivia. The left column lists estimates of childhood mortality by country and data confidence level ranges.
Innovators in the use of GIS technology in health and human services received recognition during the ESRI Health GIS Conference, held September 21–23, 2009, in Nashville, Tennessee.

Presented to Stephanie Bailey, M.D., M.S., chief of the Office of Public Health Practice, Centers for Disease Control and Prevention, the ESRI Service Award recognizes individuals who do an outstanding job of advocating GIS technology and helping others understand its value and purpose in their everyday work.

“Stephanie Bailey is currently helping set public health practice standards and is a great friend of GIS,” said Bill Davenhall, global marketing manager, ESRI health and human services, as he presented the award. He added, “Behind every good leader are loyal followers—people who trust where the leader is heading—and she has a long history of public health competence at all levels, from the local to the state to the federal.”

Health InfoTechnics, LLC, of Brentwood, Tennessee, received the Vision Award, which honors organizations that use GIS in innovative ways. Health InfoTechnics supports health planning initiatives by providing market intelligence and support to hospitals, hospital systems, consultants, and investors. The company recently developed EnvisionHIT, a platform based on ESRI’s ArcGIS Server software, which delivers a robust, interactive, and intuitive visual environment for researching and viewing market data.

“Health InfoTechnics has taken a leap forward in meeting the community health information needs of the customers and, in doing so, has improved the spatial literacy of America’s health care system,” said Davenhall.

The Communication Award, recognizing excellence in map presentation, visualization, and communication, went to three public health services professionals in Saskatoon Health Region, Canada. They are Tracy Creighton, GIS analyst, Public Health Observatory; Daphne Goodman-Eifler, supervisor of Tobacco Reduction Strategies; and Tanya Dunn-Pierce, manager, Health Promotion Department. Their poster, Mapping the Availability of Tobacco Products to Youth in the City of Saskatoon, tells the story of using GIS to convert school health survey results into information that will help health officials develop policies for reducing tobacco use among middle school students.

ArcGIS Online provides ArcGIS users with a set of foundation services that are deeply integrated with ArcGIS but do not require a big commitment for software or data acquisitions. ArcGIS Online services are hosted by ESRI, and new content is updated and added often. As an ArcGIS user, you have immediate access to map and task services, software developer kits (SDKs), and other content via the Web.

ArcGIS Online services are available as standard, no-cost services for internal and noncommercial external use. ArcGIS Online premium services require the purchase of an annual subscription and can be used internally or externally for commercial use.

For more information, visit www.esri.com/arcgisonline.

New Sourcebooks Give You the Most Accurate Demographic Data

The softcover books *ESRI Sourcebook of ZIP Code Demographics*, 23rd edition, and *ESRI Sourcebook of County Demographics*, 21st edition, are now available. Both include more than 80 of ESRI’s 2009/2014 demographic variables such as population, age distribution, and income. Information also includes spending potential indexes for 20 products and services along with reference information such as database methodology statements and maps.

The CD-ROM version, *Sourcebook•America*, combines all the data from both printed editions and includes ArcReader map display and ZIPS*Search analysis software. The *Sourcebook•America, Tract/Place* CD-ROM provides additional data for more precise analyses.

For more information about ESRI’s Sourcebook products, visit www.esri.com/sourcebooks.
Identifying deficiencies and achieving better outcomes using GIS technology were major themes during the 2009 ESRI Health GIS Conference, held September 21–23 in Nashville, Tennessee. More than 200 health and human services professionals from more than 34 states and 10 nations participated. The conference was opened by keynote speaker David Goodman, M.D., Dartmouth Medical School professor of pediatrics and community and family medicine and coprincipal investigator of the Dartmouth Atlas of Health Care.

“The science of health care delivery will provide the greatest gains in terms of improving the health and well-being of populations,” said Goodman. “Changes need to be aligned with patient preferences, developing more efficient delivery systems, and being able to use findings to generalize on ways to make our health delivery system sustainable.” Goodman described how GIS analyses contribute to identifying the variables that correlate with better-quality health care delivery and health outcomes. Alternatively, GIS helps identify unwarranted variations in health care delivery. Results provide policy makers with new kinds of information to use for improving health care quality and cost.

Featured speaker Kim Pemble, executive director, Wisconsin Health Information Exchange (WHIE), discussed health information exchange networks and their advantages.

“Exchanges provide a way for health professionals to have real-time communication about a patient,” said Pemble. (Read the interview with Kim Pemble on page 2 of this issue of HealthyGIS.)

Featured speaker Chris McInnish, Alabama Department of Children’s Affairs liaison to the Alabama Criminal Justice Information Center, described how the Alabama Resource Management System (ARMS), based on ESRI’s ArcGIS Server, gives online access to 109,000 layers of information ranging from demographic and juvenile crime data to state statistics relevant to child services. The ARMS innovative dashboard viewer gives state legislators and community partners tools for viewing the data in graphs, maps, or reports. McInnish concluded, “We are teaching our decision makers to think spatially.”

In the closing session, Stephanie Bailey, M.D., chief of the Office of Public Health Practice, Centers for Disease Control and Prevention, recognized GIS as a technology that promotes understanding that can help public health organizations take action that protects the public they serve.

Slide presentations from the conference Plenary Session are available at www.esri.com/healthgis.

Errata HealthyGIS

The summer 2009 HealthyGIS article “Disaster Risk Reduction for Hospitals Has a Global Scope” reported that, during the June 2009 Global Platform for Disaster Risk Reduction meetings, “... the World Health Organization (WHO) and United Nations Children’s Fund (UNICEF) called on governments to strengthen risk reduction measures in schools and hospitals.”

The corrected text should read: “... the World Health Organization (WHO); United Nations Children’s Fund (UNICEF); World Bank; and United Nations Educational, Scientific, and Cultural Organization (UNESCO) called on governments to strengthen risk reduction measures in schools and hospitals.”
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