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Data Fusion and the 9-1-1 Center

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On October 25, 2003, a hunter started a small fire in the Cleveland National Forest east of San Diego. Within hours, hot winds blowing west off the desert at speeds up to 60 miles per hour had whipped the blaze into a fast-moving wildfire bearing down on San Diego County and its 3 million residents. Public safety agencies battled the flames for days and by the time the fires were contained, more than 2,200 homes had been burned and 15 people, including one firefighter, had been killed. During those first days of the wildfires, most residents were unaware that, nestled inside the computers of San Diego Medical Services Enterprise (SDMSE), the city's fire and EMS agency, a special type of data software was aggregating and analyzing incoming 9-1-1 calls to track call patterns and identify trends. On Day Three, just as the fires began to be contained, the system came to life and issued an alert for a high number of medical calls.



Sounding the Alarm

During the first two days of the wildfires, San Diego officials were concerned about air quality and asked local businesses to allow their employees to remain home. But on the third day, as people ventured outside, SDMSE's data aggregation software noted a prominent spike in respiratory-related 9-1-1 calls and sounded an alert. According to Wayne Johnson, chief operating officer of SDMSE, respiratory calls had increased 110 percent.

After reviewing the alert data, Johnson quickly redeployed his EMS units to the high-cluster areas. Meanwhile, Jim Dunford, M.D., the city's EMS medical director, alerted county health officials to issue public alerts advising residents with asthma and other respiratory conditions to be cautious about going outdoors.

During the firestorm, residents may not have known how crucial it was that a data-aggregator tool was being used, but Dunford, Johnson and a growing number of 9-1-1 providers nationwide agree that the analysis and pulling together of data, also referred to as data fusion, can have significant benefits for overall quality of service.

What Is Data Fusion?

Data fusion involves combining several sources of raw data to produce more complete and more informative sets of data. One of the greatest benefits of this technology is that it has the ability to link otherwise disparate 9-1-1 databases from several communications centers in a region and look at the big picture—trends, patterns, and reports—and then synthesize the data. Currently, most communications centers lack the means or data standards to share information with other agencies. However, by joining their data, agencies are able to identify larger regional trends that might have been missed if these centers were operating as individual units.

For example, in Las Vegas the Clark County Fire Communications Center joins its fire and EMS dispatch data with data from the City of Henderson Communications Center and two private EMS providers in Las Vegas, American Medical Response and Southwest Ambulance of Las Vegas. By pulling call data from Clark County and the city of Henderson, a neighboring area that is not usually monitored by Clark County, these providers are synthesizing their separate data and creating a bigger, overall picture of call trends.

Another benefit of data fusion is that it is not bound by the constraints of geography—it allows similar sources of data to be collected and synthesized from different communities across the country. In January, public health officials announced that certain communities in five central U.S. states—Texas, Oklahoma, Missouri, Kansas, and Iowa—would begin tracking potential flu outbreaks. The so-called influenza network, the first of its kind, automatically monitors live call data in 9-1-1 computers, watching for increases in designated symptoms, including respiratory problems, abdominal pain, headache, and other indicators associated with the flu, whether they appear in geographic clusters or across the entire population being monitored.

Operational Uses

Apart from monitoring 9-1-1 trends across different regions, data fusion has practical uses that improve the operations of any agency. For example, in some agencies, data from 9-1-1 calls are used in conjunction with a real-time electronic medical record system that compiles the data that paramedics record at a patient's side. A communications center or operations manager then looks at trends collected from both systems to see what adjustments need to be made internally, whether staffing more employees or sending more ambulances out to a specific cluster spot.

Another benefit to operations is that data fusion facilitates an automatic, computerized quality assurance feedback loop to measure the quality and efficiency of a public safety system. Although this procedure is currently performed manually by staff in many cities, data fusion can fast-track this process from initial call pick-up to its conclusion. An example from EMS shows that data fusion facilitates a three-fold feedback loop: 1) 9-1-1 call takers input data into their CAD and EMD systems; 2) paramedics input patient information into their electronic patient care report system; and 3) doctors input their diagnoses into the hospital's clinical system.

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The Impetus and Challenges Behind 9-1-1 Data Fusion

Why is data fusion gaining traction? First, as more communications centers moved from traditional card-based (or even paper-based) systems to computer databases in the past decade, dispatch personnel have recognized that their electronic data contain a wealth of information. Some are asking themselves, "If I can use Google to search millions of Web pages in seconds, why can't I get my CAD to tell me how many calls we took last month where both the sheriff and the fire department responded?" The Year 2000 computer fiasco, or Y2K, also provided a funding source for older systems to upgrade to newer, Y2K-compliant models where data previously available only to programmers became easily accessible by anyone with Crystal Reports or Microsoft Access or Excel.

Perhaps the biggest driver of the trend is that the public—accustomed to 24-hour news channels, instant access to information via the Internet and interested in improved security in the wake of 9/11—expects it. In fact, many people already believe that communications centers are constantly sharing and communicating information and, if told otherwise, are often surprised to find how limited the connections really are.

So what's holding back the tide? Besides funding, major challenges to data fusion involve bypassing technological, political, and psychological barriers. It will take time and resources to convince all public safety agencies, public health officials and their local and state governments and hospitals to change existing models of data collection and surveillance and move toward a new approach.

Todd Stout began his career in public safety as an EMT and paramedic, eventually holding senior positions in several major EMS systems, as well as with a CAD system vendor. In 1998, he started Stout Solutions, where he earned national recognition for his work in creating database management solutions and custom reports for emergency dispatch centers internationally. Currently, he is president of FirstWatch, Inc. (Encinitas, CA), a data aggregation and monitoring company. He can be reached at (760) 943-9123, ext. 202, via e-mail at tstout@firstwatch.net, or visit the Website at www.firstwatch.net.

The Privacy Issue

If your agency is cautious about sharing data with other agencies because of concerns about the privacy and security regulations set forth in the Health Insurance Portability and Accountability Act (HIPAA), you're not alone. According to Doug Wolfberg (www.pwwemslaw.com), while most 9-1-1 centers and secondary PSAPs may not be subject to HIPAA, some are, or have been advised to comply with HIPAA requirements. The truth is that rather than functioning as a barrier to data fusion, HIPAA can provide a structure for how to handle data sharing—for example, the Security Rule spells out how electronic protected health information, or e-PHI, must be safeguarded. As for privacy, signing a "business associate agreement" with an outside source such as a data aggregation provider allows you to share protected health information, or PHI, and obligates that organization to follow the same rules you do. Privacy and security are also addressed by state laws and regulations, so agencies must be up-to-date about local rules, too. NASA MODIS satellite image showing smoke pattern during San Diego wildfires.

Training Requirements

While every system is different, the best approaches to data fusion/aggregation involve little or no difference in the day-to-day processes of communications center personnel. Most centers already gather data about each call in sufficient detail to be useful within their own system, and as part of a larger, aggregated database. So, a well-designed data fusion approach usually does not require any additional training on the part of the line call takers and dispatchers, and in many systems, line personnel may not be aware their data is being aggregated. IT and quality improvement staff, as well as management personnel, need different levels of training depending on the system chosen, and their involvement and responsibilities.

Facilitating Relationships

A key component that fuels the coordination of data fusion is the quality of the relationship between people in public health and those in public safety who are using data-aggregator tools. Effective communication and support must come from both sides.

In 2004, James Buehler, M.D., research epidemiologist at the Rollins School of Public Health at Emory University in Atlanta, stated that an ideal syndromic surveillance system—a tool that surveys health-related data and alerts public health officials of the probability of an outbreak—is only as effective as the "people relationships" behind it. In 2003, Amy Khan, M.D., then a medical epidemiologist at the Nevada State Health Division in Carson City, stated that by working directly with Washoe County's Regional Emergency Medical Services Authority staff on implementing a new biosurveillance tool, she was able to build ties with both 9-1-1 PSAPs and EMS that could later prove vital in the event of an outbreak or health threat.

With an ideal system, if 9-1-1 personnel were concerned about an infectious disease outbreak based on an increased number and type of calls, they would contact their local public health authorities who would in turn conduct an epidemiologic investigation to determine whether a problem exists, Dr. Khan says. Based on the interpretation of their findings, public health officials would then develop a timely response plan and communicate this to the public to control the disease.

Resources

The list below provides a starting point for learning more about data fusion, data aggregation, and related topics. It is not intended to be a complete list, as there are many great sources of information available.

- www.data-fusion.org
- www.nemsis.org
- www.fbi.gov/hq/cjisdc/cjis.htm
- www.usfa.fema.gov/nfirs
- Riaz Khadem, Robert Lorber. *One Page Management*. William Morrow & Co., 1998.



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