

Predicting pandemics: HealthMap.org tracks emerging hot spots in real time

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Disease outbreaks appear on the HealthMap as yellow push-pins. When the user clicks on a particular push-pin, a window opens with links to information about a disease outbreak report.

(PhysOrg.com) -- At the end of July 2008, major news agencies reported an outbreak of jalapeño-related salmonella that sickened more than 1,000 people in Mexico and the United States. It was the biggest outbreak of its kind in decades.

Two months earlier, HealthMap.org had flagged the uptick in gastrointestinal illness, which signaled the emergence of a novel strain of salmonella. HealthMap had culled the information from a story that appeared in a local newspaper in New Mexico. HealthMap's warning was a little yellow balloon that popped onto the site's map, linking it to the

news story. The Centers for Disease Control and Prevention (CDC) had yet to make an announcement.

HealthMap.org was launched in 2006 by epidemiologist John Brownstein, a Harvard Medical School assistant professor of pediatrics based in the Informatics Program at Children's Hospital Boston, and software developer Clark Freifeld of the Informatics Program. Today it combs 24,000 Web sites per hour, tracking and mapping 75 infectious diseases, including malaria, cholera, plague, Ebola, avian flu, and the ominous-sounding "not yet classified." Receiving about 30,000 hits a month, HealthMap's most frequent visitors are the World Health Organization and the CDC, who check the site daily.

A visit to the site reveals red and yellow warnings popping up across the continents. "If you look at the map, you see that no place is protected from diseases," said Brownstein. "Infectious disease is a major problem in the developing world, but the emergence of diseases is a huge public health threat everywhere, especially with the impact of being able to travel to any point in the world in a day. Diseases don't respect borders."

Brownstein and Freifeld started HealthMap as an unfunded side project. Frustrated by privacy issues regarding the use of clinical data, Brownstein approached Freifeld to see how they could tap into publicly accessible information to paint a real-time picture of outbreaks of contagious disease.

"We were thinking about all the information that exists on the Web in an unorganized sense," said Brownstein. "Information is distributed across different types of data sources and different types of Web sites, and we thought, what if we tried to organize that information and make it freely available on a simple interface like a map?"

Freifeld built a Web-crawler that seeks key words about diseases,

symptoms, and locations from local newspapers, news feeds, and blogs. One of the biggest tasks was creating a dictionary of diseases, names, and locations.

“The dictionaries needed constant refining,” said Freifeld. “For example, Crimean-Congo hemorrhagic fever is a tick-borne disease. Initially, when the program picked up any references to the disease, it put the alert in the Congo. To avoid this problem, we created a string of words to label the disease, so the program would not confuse the disease with the location.”

The site merges this data with clinical reports created by content partner ProMED-mail. ProMED members all over the world generate and upload public health information. By blending clinical data from the frontlines with automatically generated information, the site achieves Brownstein’s goals of timeliness and accuracy. The map interface displays emerging patterns geographically, giving visitors greater insight into where epidemics are most likely to spread.

With so much information being processed so rapidly, there are bound to be a few quirks. “A horse named Antarctica had equine herpes,” said Brownstein, “which led the program to detect an outbreak of herpes in Antarctica, which of course was wrong.”

Soon after the site launched, it generated attention when an article titled “Get Your Daily Plague Forecast” appeared in Wired Magazine (Oct. 19, 2006). Brownstein and Freifeld landed a grant from Google.org and obtained funding from the CDC to expand the site. They added new diseases and more news sources and increased the number of searched languages, a feature that was necessary to create a global tool. Today, the program searches for information in English, French, Spanish, Chinese, and Russian. Portuguese and Arabic will be added in the next few months, followed by Khmer, Malay, and Thai.

The CDC is one of the site's biggest users. The agency incorporates information from HealthMap into the daily reports they distribute to public health leaders all over the world. Jean O'Connor, policy officer for the Office of Critical Information Integration and Exchange at the CDC, is enthusiastic about HealthMap's potential to aid public health officials in prevention efforts. "HealthMap was really the first Web site to take informal public health information and anecdotal reports and make it possible for a public health leader to look at all of those pieces of information globally," said O'Connor. O'Connor also noted that the site's display of disease outbreaks among domesticated animals and wildlife can help pinpoint potential threats, since many diseases spread from animals to people.

The New England Journal of Medicine started using the site recently. "We just added HealthMap to the tools we use for gathering health-related news from around the world," said Stephen Morrissey, managing editor of the *New England Journal of Medicine*. "The geographic interface is extremely useful, and we look forward to seeing whether this approach will alert us earlier to important events that should be brought to the attention of physicians and health policy experts."

Brownstein and Freifeld are off to Geneva this month to consult with the World Health Organization on another project, and hope to gain insight into how that organization is using HealthMap while they're there.

Brownstein's passion for public health was ignited during a semester spent in Africa as an undergraduate in 1998. "I went to Kenya and Uganda, where I spent a lot of time in the field studying wildlife," said Brownstein. "I began to realize the incredible impact infectious diseases have on human populations, things like malaria and HIV, the linkage between infectious diseases and the environment, and how human encroachment into wildlife areas led to the emergence of infectious diseases. Almost every infectious disease you can look at, at one point

came out of an animal population.”

Today, with a second Google grant, Brownstein envisions the site moving beyond its role as an information provider to becoming an engaged, online community. “Everyone is talking about social networks like Facebook. HealthMap will be a social network of disease experts engaged in the global public health good,” said Brownstein. “The real vision is that we are going to be much more integrated with our user base. We will be relying on people reporting, commenting, and verifying outbreaks that are happening. They will really be interacting with the data, collaborating with the data, and making use of it.”

On the Web: www.healthmap.org/en

Provided by Harvard University

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