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## GIS to Assist in Early Detection of Infectious Diseases

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In Michigan, public health workers are testing a program which utilizes GIS technology to aid in the detection and prevention of disease. According to the Centers for Disease Control and Prevention (CDC), nearly 70 percent of emerging infectious disease episodes during the past 10 years have been zoonotic diseases, which are diseases transmitted from animals to humans. Since animals can be sentinels for both infectious diseases and bioterrorist agents, it is important to ensure that systems exist in both human and animal populations to identify disease outbreaks, both naturally occurring and intentionally induced.

Surveillance for zoonotic diseases requires coordinated efforts between animal and human disease specialists. The Michigan Disease Surveillance System (MDSS) is in the pilot stage of overlaying human and animal disease surveillance maps to help identify possible outbreaks.

Nationwide, few systems exist that can monitor the health status of both humans and animals simultaneously. In Michigan, human disease surveillance and reporting is being conducted in a web-based environment using the newly implemented MDSS, created by Scientific Technologies Corporation (STC). This system was created to be compatible with the National Electronic Disease Surveillance System (NEDSS) and incorporates GIS into its mapping capabilities. By leveraging the systems implemented by the CDC and the Michigan Department of Community Health (MDCH), web-based animal disease surveillance systems can be developed and integrated with human disease surveillance systems to provide seamless disease reporting, analysis, and prevention recommendations.

As Jim Collins, Section Manager-Surveillance Coordinator/Project Manager of the MDSS, Bureau of Epidemiology, relates "...GIS had not been integrated in any appreciable way to traditional communicable disease surveillance. The Michigan Department of Health knew that integration of geo-spatial information would be critical to any new implementation. The web mapping interface allows health departments to examine the case database by visualizing the potential relationship between a case of interest and other cases in the jurisdiction. Further, integration of mapping with the reporting functionality allows for near real-time visualization of incident disease across the State."

Animal disease surveillance does not have corresponding guidelines to follow. These systems have been developed by multiple vendors, often focusing on only a specific disease, health issue, or animal species, or have been specifically developed to meet international trade requirements. Individual states are responsible for receiving reports of, and responding to, notifiable animal diseases. Without data standardization and interactive databases, the ability to monitor reported diseases is difficult.

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The Michigan-System to Report Integrated Disease Events (MI-STRIDE), developed by STC, will be a comprehensive, integrated, and web-based surveillance system based on the existing MDSS platform and replacing the current animal surveillance system. Both components use real-time geocoding to plot suspected disease events.

Upon record entry, the system sends the address to the Michigan Center for Geographic Information (CGI) geocoder. The geocoder queries the ESRI ArcSDE spatial database for the x,y coordinates (latitude, longitude) for the address. This data is returned by the geocoder to the system in the http response. Using the ESRI software ArcIMS in conjunction with ArcSDE, the system can display a case map showing cases of the same disease, in a given area over the last seven days. This case map uses the previously stored coordinates for the address to plot the points. The system also has access to the animal disease data and displays cases of any particular animal disease in the given area, helping find the relation between animal and human disease outbreaks

ArcIMS provides the web application with the map images that are displayed. The value of visual assessments in disease surveillance may help epidemiologists spot events earlier, which is critical for implementing essential disease prevention and control methods, reducing morbidity and mortality in affected populations.

MI-STRIDE will provide a foundation for decision making in public health, animal health, food safety, environmental health, and international trade. By using **GIS** to map and overlay events within both the animal and human realms, this program may potentially spot devastating outbreaks in earlier stages than previously possible.