Enhanced Informatics Response through Collaboration of Public Health Nurses and Epidemiologists

Araceli Rey RN MPH[1], Doug Thoroughman PhD MS[2], Margo Riggs PhD[2], David Kim MD[3] John Dunn DVM PhD[4], Beth Stover RN CIC[5], Meeyoung Park[5], Carl Kinkade[6], and Linda Karr RN[7]

[1]Centers for Disease Control and Prevention, National Center for Public Health Informatics, Division of Integrated Surveillance Systems and Services; [2]Centers for Disease Control and Prevention, Coordinating Office for Terrorism Preparedness and Emergency Response, Kentucky Department for Public Health; [3]Centers for Disease Control and Prevention, Coordinating office for Terrorism Preparedness and Emergency Response, Georgia Division of Public Health; [4]Tennessee Department of Health; [5]McKing Consulting Corporation; [6]Bearing Point; and [7]Association of State and Territorial Directors of Nursing

Abstract

CDC, in partnership with the Association of State and Territorial Directors of Nursing (ASTDN), introduced a mobile Geographic Information Systems (GIS) field data collections system integrating handheld computers, ESRI® ArcView software, Global Positioning System (GPS) technology, GeoAge Field Adapted Survey Toolkit (FAST), and CDC's Natural Disaster Morbidity Report Form in three states. The purpose of this effort was to initiate and evaluate an informatics technology solution to enhance emergency response health assessment, surveillance, and disease outbreak detection through the collaboration of public health nurses and epidemiologists.

Public health officials in Georgia, Kentucky, and Tennessee were trained to use GIS and GPS technology. A simulated field exercise was conducted to assess the applicability of this model for disaster response. The feasibility for routine use of GIS, GPS, and mobile handheld computers to facilitate surveillance and tracking for event and outbreak detection was also explored.

Background

Real-time and accurate epidemiologic data collection is critical to early event detection, the delivery of appropriate public health services during emergency events such as disease outbreaks or disasters, and public health decision-making.

- Historical norm for data collection: Manual data collection with subsequent data entry
  - ➢ Labor intensive and error-prone
  - ➢ An impediment to a quick and effective response
  - ➢ Lack of standardized data collection methods limits comparison across jurisdictions
- New technologies exist ⇨ Handheld data entry/GPS data collection capability
  - ➢ Reduction of data entry time and error
  - ➢ Implementation of early event detection
  - ➢ Enhancement of community public health emergency preparedness and response

• **Overall project goal**: Introduce and evaluate a handheld data collection device solution to enhance emergency response health assessment, surveillance, and disease outbreak detection through the collaboration of public health nurses and epidemiologists.

Figure 1. Natural Disaster Morbidity Report Form v1.4

Methods

- Developed and collected training materials: GIS/GPS training software training, Natural Disaster Morbidity Report Form (Figure 1), tornado exercise and patient scenarios
- Provided participating states (Georgia, Kentucky, Tennessee) with equipment:
  - Laptop computers
  - Trimble® GeoXT™ handheld devices (Figure 2)
  - Software: ArcGIS, FAST, SAS 9.1, Microsoft Office
- Trained epidemiologists, nurses, and other public health officials in each state, using same format at each site:
  - GIS training: 2 days
  - GPS training/FAST training/form development: ½ day
  - Tornado exercise: ½ day
- Evaluations completed:
  - Pre and post GIS and GPS training and the exercise
  - Overall evaluation
  - Quality control assessment on data entry
- Assessed integration capability

Objectives

- Enhance the capacity of states to identify pre-event community health needs, facilitate emergency response activities, and respond to outbreaks, through use of mobile GIS/GPS handheld computer technology
- Improve state and local health departments' ability to systematically collect analyze, and disseminate real-time data and public health information
- Facilitate collaboration and expand partnerships among state nursing directors, state epidemiologists, CDC's Career Epidemiology Field Officers (CEFOs) and other CDC groups

Figure 2. Trimble® GeoXT™ handheld

Results

CDC/NCPHI, together with ASTDN and GeoAge, successfully provided training in each of the three states.

Combined total attendance:

- GIS Training — 71 persons (49 nurses, 20 epidemiologists, 2 other)
- GPS training and exercise — 78 persons (39 nurses, 28 epidemiologists, 11 other)

Evaluation

- Pre-Post, both training events and exercise, all attendees
  - ➢ Positive feedback in all three states
- Overall Evaluation by coordinating epidemiologists and nursing directors
  - ➢ Enhanced state capability to facilitate emergency response activities
  - ➢ Use of mobile GIS/GPS handheld computer technology feasible in emergency response
  - ➢ Facilitated collaboration and expanded partnerships among state nursing directors, state epidemiologists, CDC's CEFOs and other CDC groups.

Variables	GA (n=82) Errors	(%)	KY (n=121) Errors	(%)	TN (n=123) Errors	(%)	Total (n=326) Errors	(%)
State	0	--	1	(0.8)	0	--	1	(0.3
Shelter	2	(2.4)	0	--	0	--	2	(0.6)
Patient ID	0	--	1	(0.8)	0	--	1	(0.3)
Age	0	--	1	(0.8)	0	--	1	(0.3)
Sex	0	--	1	(0.8)	0	--	1	(0.3)
Race	5	(6.1)	1	(0.8)	1	(0.8)	7	(2.1)
Work Status	1	(1.2)	1	(0.8)	1	(0.8)	3	(0.9)
Disposition	9	(11.0)	3	(2.5)	8	(6.5)	20	(6.1)
GPS Coordinates	3	(3.7)	21	(17.4)	6	(4.9)	30	(9.2)

Table 1. Data Entry Errors in Objective Variables

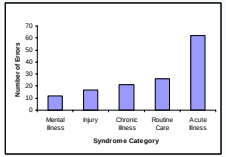

Figure 3. Syndromic Characterization Errors

Quality control assessment - Used to determine the accuracy of the data entered by the participants

- Compared to database used to create the patient scenarios
- 400 patient scenarios assigned to exercise participants
  - ➢ 77 (19%) records were missing (lost or not entered).
  - ➢ Duplicate entries (n=3) were included in the quality control assessment
  - ➢ 326 records evaluated for errors
  - ➢ Two types of possible errors are depicted:
    - Data entry errors in objective variables (Table 1)
    - Errors resulting from mis-characterization of symptoms into syndromes (Figure 3).

The participating states plan to use the equipment and training to enhance their current capacity to conduct surveillance and tracking for event and outbreak detection on a daily basis. However, lack of dedicated staff, IT solutions, and funding may limit effective statewide implementation and integration of this technology.

Limitations

- Training schedule was reduced in time to accommodate state needs
- Limited number of laptops and mobile GIS/GPS handheld devices
- GPS signal variability
- Data lost during exercise limited quality control analysis
- Participant group size limited by staffing shortages or facility capacity
- Inability to perform "live test" of mobile GIS/GPS handheld devices to assess capability for receiving/transmitting web-based real-time data

Conclusions

Implementation of this mobile GIS/GPS handheld computer electronics technology expands collaboration of public health nurses and epidemiologists within states, between states, and with CDC. Furthermore, it enhances the capacity of public health nurses and epidemiologists to meet the needs of state and local programs and achieve CDC health protection and preparedness goals.

The participants were enthusiastic about conducting this type of exercise and increasing their knowledge in this technology. Although participants believed the training and exercise was useful, addressing the problems encountered, especially with regard to errors in data collection, is critical. Overall, the collected data were accurate, despite the number of missing records. Errors often occurred within the same patient record or were entered by the same person. The greatest number of errors occurred while attempting to capture GPS coordinates. This might have been caused by variability in signal reception or unfamiliarity with the devices. The small screen and font might have contributed to inaccuracy in data entry. Misclassification of syndromes can be attributable to unfamiliarity with the form or having insufficient medical expertise with regard to triaging and characterizing symptoms into broader categories. Because syndromic surveillance serves as an early warning to detect outbreaks, this type of error might have serious implications in an emergency by impeding detection of clusters of conditions or illness. Diseases often have overlapping or multiple symptoms that make determining the hierarchy difficult.

We successfully introduced new GIS/GPS technology to state health departments through collaboration of nurses and epidemiologists. Public health surveillance capacity at the state and federal level can be enhanced by similar collaborations, assessment of new surveillance technologies, and integration into existing systems. Emphasis on and funding for public health professionals' training is needed so that they are proficient with the technology and are able to use it for routine and emergency situations. Further, additional equipment is needed for greater statewide impact and future implementation. Next steps include integrating the technology into existing programmatic areas as well as applying it during an actual event (e.g., a natural disaster or disease outbreak).

Acknowledgements

CDC
Mark Berndt
Cathy Chow
Carol Crawford
Patricia Drehobl
Ruth Jajosky
Leslie Lenert
Scott McNabb
Enrique Nieves
Rebecca Noe
Petra Wiersma

ASTDN
Mary Pat Couig

Bearing Point
Jim Tobias

GeoAge
Jeff Arnold
Ryan Ehlers
Bridget Green

Tek Systems
Diana Onweh

Georgia Division of Public Health
Cynthia Grant
Carole Jakeway
Susan Lance
Karl Soetbier

Tennessee Department of Health
Greg Galfano
Deborah Hardin
Erin Holt
Tim Jones

Kentucky Department for Public Health
Jeff Brock
Tim Cooper
James House
Kraig Humbaugh
David Jones
Sandy Kelly

This project is supported by a cooperative agreement from the Centers for Disease Control and Prevention with the Association of State and Territorial Health Officials #U50/CCU313903-08-12

The findings and conclusions in this report are those of the authors and do not necessarily represent the views of the Centers for Disease Control and Prevention.