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Assessing Electronic Death Registration and American Red Cross Systems for Mortality Surveillance During Hurricane Sandy, October 29–November 10, 2012, New York City

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Abstract

Objective—We briefly describe 2 systems that provided disaster-related mortality surveillance during and after Hurricane Sandy in New York City, namely, the New York City Health Department Electronic Death Registration System (EDRS) and the American Red Cross paper-based tracking system.

Methods—Red Cross fatality data were linked with New York City EDRS records by using decedent name and date of birth. We analyzed cases identified by both systems for completeness and agreement across selected variables and the time interval between death and reporting in the system.

Results—Red Cross captured 93% (41/44) of all Sandy-related deaths; the completeness and quality varied by item, and timeliness was difficult to determine. The circumstances leading to death captured by Red Cross were particularly useful for identifying reasons individuals stayed in evacuation zones. EDRS variables were nearly 100% complete, and the median interval between date of death and reporting was 6 days (range: 0–43 days).

Conclusions—Our findings indicate that a number of steps have the potential to improve disaster-related mortality surveillance, including updating Red Cross surveillance forms and electronic databases to enhance timeliness assessments, greater collaboration across agencies to share and use data for public health preparedness, and continued expansion of electronic death registration systems.

Keywords

hurricane; mortality; vital statistics; Red Cross; public health surveillance

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In October 29, 2012, Hurricane Sandy brought a record breaking storm surge to New York City (NYC), causing flooding and widespread power outages. Despite the mandatory evacuation order issued by Mayor Bloomberg for coastal residents, many individuals were injured or killed as a result of storm conditions.[1] After the hurricane made landfall, NYC's Health Department used its Electronic Death Registration System (EDRS) to conduct surveillance of Sandy-related deaths (R Howland, W Li, H Wong, et al, unpublished data).

Active surveillance was also carried out by the American Red Cross, a humanitarian agency that identifies fatalities in order to provide services to affected families and to provide nationwide disaster mortality information to the Centers for Disease Control and Prevention (CDC).[2–4] A 2008 evaluation of the Red Cross mortality surveillance system conducted after Hurricane Ike in Texas found that the system was simple, flexible, and stable; however, system timeliness, sensitivity, and data quality were areas of weakness.[5] Furthermore, whereas data were used for providing condolence services, they were not shared with local agencies or used effectively for preparedness planning. Our objectives were to examine how well the EDRS and Red Cross systems provided useful, timely, and accurate data to characterize Sandy-related deaths in NYC, including risk factors, causes, and circumstances leading to death.

METHODS

NYC's EDRS is maintained by the Health Department's Bureau of Vital Statistics and is a Web-based platform in which medical providers, funeral directors, and the Office of Chief Medical Examiner (OCME) enter decedent information. As deaths were discovered and investigated, the OCME provided the Bureau of Vital Statistics with case reference numbers via e-mail of Sandy-related deaths, defined as those deaths that were from injuries directly related to actual environmental forces of the hurricane or the direct consequences of these forces (eg, structural collapse). Once the OCME medically certified the death in EDRS and complete demographic information was entered by the funeral director, Sandy-related fatalities were coded by using the International Classification of Disease (ICD-10) code for a cataclysmic storm (X37).[6]

The OCME also provided a line list (name, contact information) of Sandy-related deaths to the Red Cross from October 29 to December 17, 2012. On the basis of the line list, Red Cross volunteers assigned to condolence teams contacted families to offer services. During visits to the families and neighbors of the decedent, volunteers obtained information on deaths and completed a 1-page mortality surveillance form. Scanned copies of the form were sent electronically to the National Center for Environmental Health at the CDC and were manually entered into a database.

For this study, Red Cross fatality data were linked with NYC EDRS records by using decedent name and date of birth. We analyzed cases identified by both systems for completeness and agreement across selected variables and the time interval between death and reporting in the system.

RESULTS

The EDRS captured 44 Sandy-related deaths during the period from October 29 to November 10, 2012 (Table 1). The Red Cross captured 93.2% of deaths (41/44) in the EDRS and identified 1 additional death; however, the OCME determined that this death was not directly related to Hurricane Sandy. The body of one of the missing Red Cross cases was not discovered until April 2013, after the Red Cross surveillance had ended. The reason the 2 additional cases were missing from the Red Cross data could not be determined.

The completeness of the Red Cross data varied by item (Figure 1). Decedent first and last name, age, sex, street address, city, and cause of death variables were >90% complete. Date of birth, race and ethnicity, and date of death ranged from 55% to 85% complete. EDRS variables were 100% complete, except for 2 records that were missing date of birth. Among the 41 cases present in both systems, high agreement existed across variables, particularly among cause of death and zip code (Figure 1). The median interval between date of death and reporting was 6 days (range: 0–43 days) in the EDRS and 19 days (range: 2–45 days) in the Red Cross system. Only one case was registered in the EDRS with a pending cause of death; the OCME updated the cause 82 days after the date of death. Finally, only the Red Cross provided additional information on circumstances leading to death from interviews with families and neighbors. Of the 33 decedents reported in both systems who reportedly drowned, the most common reasons recorded for staying in their home during the storm were that the decedent wanted to protect their belongings, thought previous hurricanes were mild, or were disabled or immobile.

DISCUSSION

The Red Cross effectively captured almost all NYC Sandy-related deaths identified by the OCME, with greater sensitivity than was found after Hurricane Ike in Texas, where only half of all hurricane deaths were captured (93% vs. 47%).[6] This difference is likely a result of the fact that the Red Cross received all case referrals directly from the NYC OCME, a highly centralized system, rather than through other information sources (eg, funeral homes, hospitals, media reports, disaster relief-shelters).[6] The improved case identification may also be the result of recent efforts to enhance training and dissemination of findings to volunteers and other disaster health nurses, through written guidelines, webinars, annual meetings, and newsletters. Missing cases likely were not captured because the family refused the condolence visit, the family did not respond to the team’s telephone call, or the Red Cross did not have a correct or active contact number. It is also possible that the OCME did not refer these cases; however, the Red Cross system does not keep documentation to determine the reason. The quality of the Red Cross data varied by item. Decedent name, address, and cause of death were higher quality than items such as race/ethnicity or date of birth, which may not have been available at the time the case was referred. The completion of paper forms was relatively timely; however, the date the data were electronically accessible at the CDC was not captured, making it difficult to determine timeliness for surveillance purposes. Revising the Red Cross forms and the CDC electronic database to capture both the date a case is first referred and the date it is received by the CDC is under consideration.

Red Cross data captured detailed circumstances surrounding deaths that are useful for disaster preparedness. In particular, circumstantial information allowed the NYC Health Department to identify reasons individuals did not evacuate their homes.[4] Red Cross data showed that decedents underestimated the storm's impact, were concerned about protecting their property, or were not physically able to leave. These findings are consistent with a post-storm survey of coastal residents and provide additional evidence of the possible benefits of improving pre-storm communications to increase disaster awareness and promote evacuation resources.[1] Resources to assist impaired individuals and other high-risk groups should be assessed. Greater collaboration and data sharing between the Red Cross and local health departments and death registration systems might improve the accuracy and timeliness of data collection and increase the usefulness of data to inform prevention efforts.

The NYC EDRS provided complete information and timely mortality estimates, which benefited from an electronic platform, from mandated timely and electronic registration, and from preexisting relationships with the OCME, who both identified cases and provided detailed cause of death information for coding Sandy-related deaths. As of April 2014, 39 states had implemented an EDRS; however, fully electronic reporting remains low, which slows surveillance at the local and national levels.[7,8] Our findings indicate that an EDRS can be used for disaster surveillance when there is timely electronic reporting, medical examiner involvement, and high-quality cause of death and injury information. Local health departments can utilize the EDRS to meet key preparedness capabilities, namely, the ability to track, collate, and report on incident-specific deaths.[9]

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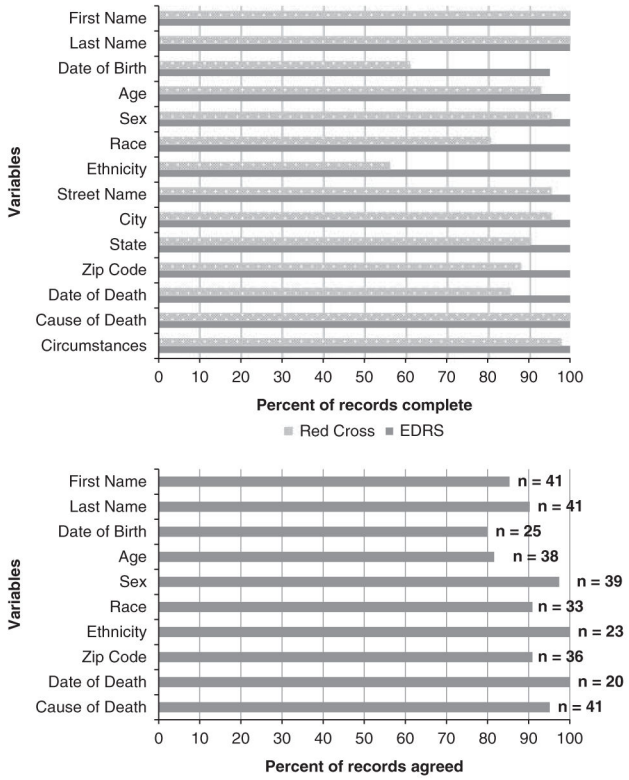

FIGURE 1.

Completeness and Concordance of Data Reporting in the Electronic Death Registration and Red Cross System on Key Variables Captured During Hurricane Sandy, New York City, 2012.

EDRS indicates Electronic Death Registration System; n is the number of records that were present in each system with complete information on that variable.

TABLE 1

Total Number of Deaths Related to Hurricane Sandy Captured by the Electronic Death Registration System and the Red Cross System During Hurricane Sandy, New York City, 2012

	Reported as Sandy-Related in Electronic Death Registration System		
Red Cross System	**Yes**	**No**	**Total**
Identified	41	1	42
Not Identified	3	0	3
Total	44	1	45