



CORONER PROJECT 2003: LOS ANGELES COUNTY UNUSUAL DEATH SURVEILLANCE

BACKGROUND

The Unusual Death Surveillance System began in 2001 as a joint project between the ACDC and the Los Angeles County Department of Coroner (DC). This project was developed in order to identify deaths possibly related to bioterrorism or emerging infectious diseases (e.g., SARS, West Nile virus, avian influenza, etc.) and is funded by the Centers for Disease Control (CDC) Bioterrorism Preparedness and Response Cooperative Agreement. Early detection of deaths due to bioterrorist or emerging infectious diseases may lead to earlier enactment of treatment and prevention strategies, which may in turn limit the number of residents negatively impacted by the situation. This report provides a detailed overview of the system and a descriptive summary and analysis of the death records in 2003.

METHODS

Data files are sent daily to ACDC from the DC encompassing more than 40 variables including demographic information and a brief synopsis of events prior to death. Of the more than 60,000 deaths that occur each year in LAC, approximately 18,000 become coroner cases (Table 1). ACDC receives data on all coroner deaths except those from automobile accidents, homicide and suicide due to the non-infectious disposition of these cases. Records are searched electronically for key words that might indicate that the death was due to an infectious disease. Deaths which are unexplainable by the ACDC investigator are subject to follow-up by gathering additional information from the medical examiner in charge of the case. Additional action may result from the investigation depending on the information gathered from the DC.

Table 1. Coroner Case Definition

The jurisdiction of the coroners in California is described in the California *Government Code* (Section 27491). The coroner is responsible for the following cases:

1. **Any homicide, suicide or accidental death, or any case in which the cause or mode of death cannot be determined.** An injury causing death may be either old or new.
2. **Therapeutic misadventures.** A patient who dies within 24 hours of surgery or anesthesia should be reported to the coroner because of the possibility of therapeutic misadventure. Patients who die as a consequence of therapy, such as those with drug reactions, or patients who die unexpectedly during minor procedures, should also be reported.
3. **Sudden or unusual death.** If the attending physician can certify the cause of death as natural disease, the case need not be reported. However, all cases of sudden unexpected death in infants (under 1 year of age) are coroner's cases.
4. **Any death related to self-induced or criminal abortion.**
5. **Deaths related to drug addiction or drug overdose.** A death from consequences of drug use, such as acquired immunodeficiency syndrome or endocarditis in an intravenous drug user, is a coroner's case. Death from acute alcohol poisoning is a coroner's case, but death from consequences of chronic alcoholism is not.
6. **Aspiration.** Deaths from terminal aspiration of gastric contents or aspiration pneumonia may be coroner's cases, depending on the underlying cause of the aspiration. Deaths from choking on food are coroner's cases.
7. **Deaths while in custody or under sentence.** Any person who dies in jail or while under arrest is a coroner's case; this includes deaths during involuntary 72 hour or 14 day psychiatric hospitalization.
8. **Deaths due to a possible undiagnosed contagious disease constituting a public health hazard.** Contagious diseases constituting a public health hazard are those diseases which are required to be reported to the health department. Cases where the contagious disease has been diagnosed need **not** be reported to the coroner.
9. **Deaths from occupational disease or occupational hazard.** Deaths which occur while at work should generally be reported to the coroner. A death due to consequences of an occupational disease, such as asbestosis, is an accidental death and should be reported.
10. **Deaths in state hospitals.** Any death which occurs in a hospital operated by the State Department of Mental Health or the State Department of Developmental Services is a coroner's case.
11. **Deaths due to criminal acts of another.** When there are reasonable grounds to suspect the death was due to the criminal acts of another person, the case should be reported.
12. **Deaths involving rape or sodomy.**
13. **Unattended fetal deaths.**
14. **Human remains discovered outside a dedicated cemetery.**



Death records with a date of death in 2003 were aggregated and included in the analysis. Basic demographic variables (e.g., age, race, sex, place of death, mode of death) were tallied and examined for trends.

Two methods were used to identify death records potentially due to a bioterrorist agent or an emerging infectious disease—a computer key-word search with occasional clinician review versus identification solely by clinician. In the computer-assisted method, an algorithm was designed to signal deaths records containing key words in the investigator notes that might indicate the death was due to an infectious agent. Reports containing specified key words were then coded into one of five “syndrome” categories: Fever, Gastrointestinal, Respiratory, Neurological and Rash (Table 2).

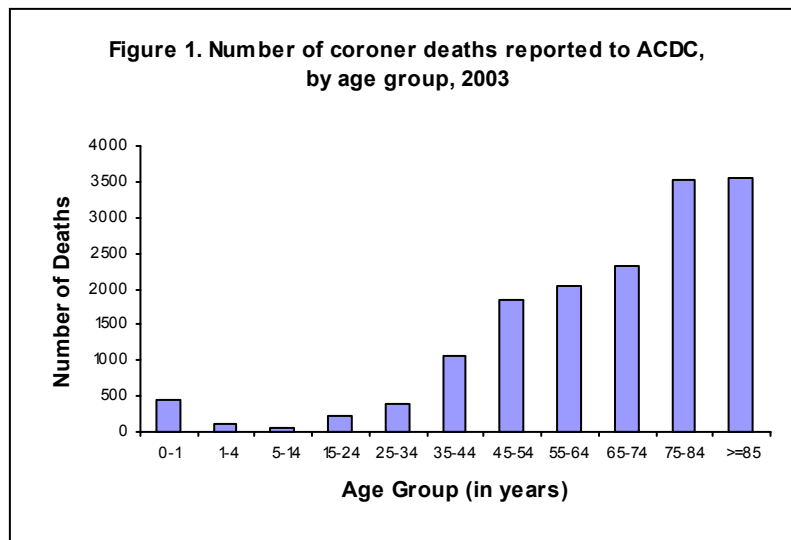
Table 2. Syndrome Categories and Associated Key Words Used to Electronically Identify Suspicious Coroner Deaths Based on Death Investigator Notes (2003)

Fever Syndrome	Gastrointestinal Syndrome	Neurological Syndrome	Rash Syndrome	Respiratory Syndrome	
fever	nausea	seizure	rash	respiratory	pharyngitis
high fever	vomit	paralysis	skin	flu	laryngitis
	diarrhea	facial paralysis	varicella	pneumonia	SARS
	gastritis	encephalitis	chicken pox	cough	
	gastroenteritis			difficulty breathing	
	abdomen pain			tightness chest	
	abdominal pain			asthma	
	food poisoning			bronchitis	

If cases fit more than one category, the syndrome most representative of the case description was used. Death records that were coded into one of the five syndrome categories were then reviewed by a clinician (a nurse or a physician). Suspicious deaths not explainable after the clinician’s review of the DC investigator notes were then followed-up with the DC. The second method utilized a clinician visual review of all death records sent to ACDC with suspicious cases being selected for follow-up with the DC. Death records selected by the clinician visual review, but not coded into one of the five syndrome categories by the computer program were listed as “Other” syndrome. Both methods were employed simultaneously in order to perfect the computer algorithm so that future cases identified by a clinician review would also be flagged using the electronic key word search.

RESULTS

Demographics—All Coroner Cases: ACDC received a total of 15,585 death records from DC with a date of death in 2003; Table 3 provides a summary of the demographic characteristics of these death records. Over half of the cases were male (53%), 44% were female and 3% of cases did not have a gender

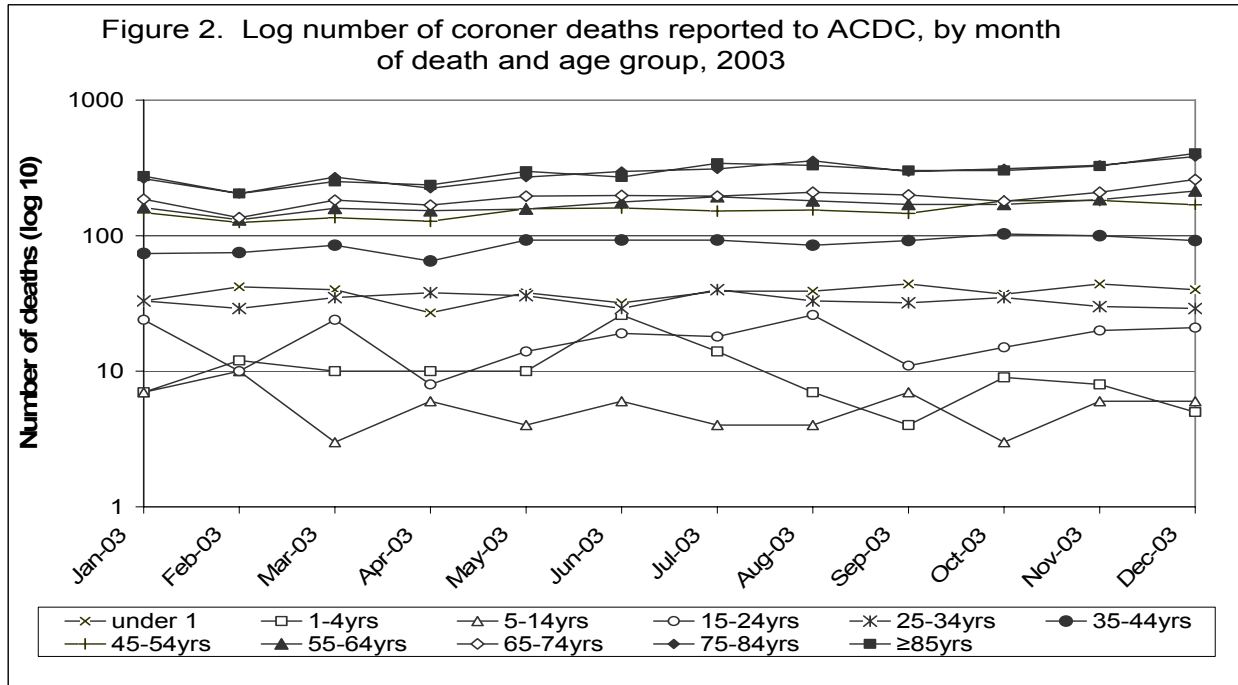


specified. Almost 60% of the cases were White, while Black and Hispanic cases made up 15% and 13% of the case total respectively. Approximately 5% of cases did not have a race or ethnicity specified.

Cases aged 14 years and under made up only 4% (643 deaths) of the death records received from DC. An increasing number of death records were received for each 10-year age group beginning at the 15-24 years category (Figure 1). The lowest number of death records received was for the 5–14 year age group (66 deaths). Within the

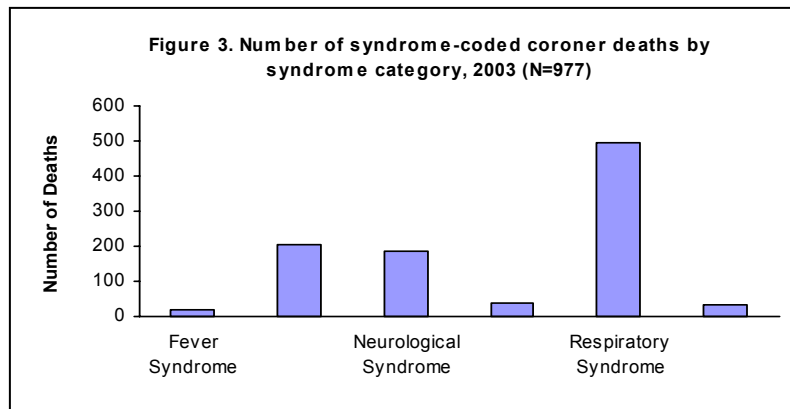


individual age categories, the number of deaths occurring each month appeared to remain consistent throughout the year with several exceptions (Figure 2). First, an artificial peak in deaths was seen in 1–4 year age group during June 2003 due to fetuses and embryos being sent to the coroner from a school science laboratory. Second, the two oldest age groups showed a large increase in deaths in November and December. This corresponds to a commonly observed increase in respiratory disease that occurs in the fall and winter months.



By definition, most of the death records received were described as death due to natural causes (84%) with an additional 14% of deaths due to a non-vehicular accident or a combination of accidental and natural causes. The cause of death was undetermined for 0.5% (n=77) of the cases. An autopsy was performed on less than half (43%) of the deaths reported to ACDC.

Syndrome-Coded Cases: A total of 977 death records (6%) were coded into one of the six syndrome categories (syndrome-coded cases) by either the computer key word search or the clinician review (Figure 3). Respiratory, gastrointestinal and fever syndromes captured the greatest number of cases (493, 205 and 186 cases respectively) while rash, neurological and other syndromes had very few cases (39, 33 and 21 cases respectively). Figure 4 shows the number of syndrome-coded death records for each syndrome by the month of death. Respiratory syndrome cases significantly increased at the end of 2003, starting in October. While gastrointestinal and neurological syndrome cases fluctuated throughout the year, no significant seasonal trends were found.



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Several interesting trends were noted for syndrome-coded death records. Approximately 95% had an autopsy performed compared to only 43% of the total cases reviewed (Table 3). In addition, the number of syndrome-coded cases in each age group varied considerably from the overall age distribution of cases (Table 3). The greatest proportion of syndrome-coded cases was seen in the 5–14 year age group with a decreasing proportion of deaths seen for both younger and older age groups. Within each age category, cases were most often respiratory syndrome except in the 15–24 and the 24–35 age groups (Figure 5). In these groups, cases most often had neurological syndrome, however, the percent of respiratory syndrome cases remained high.

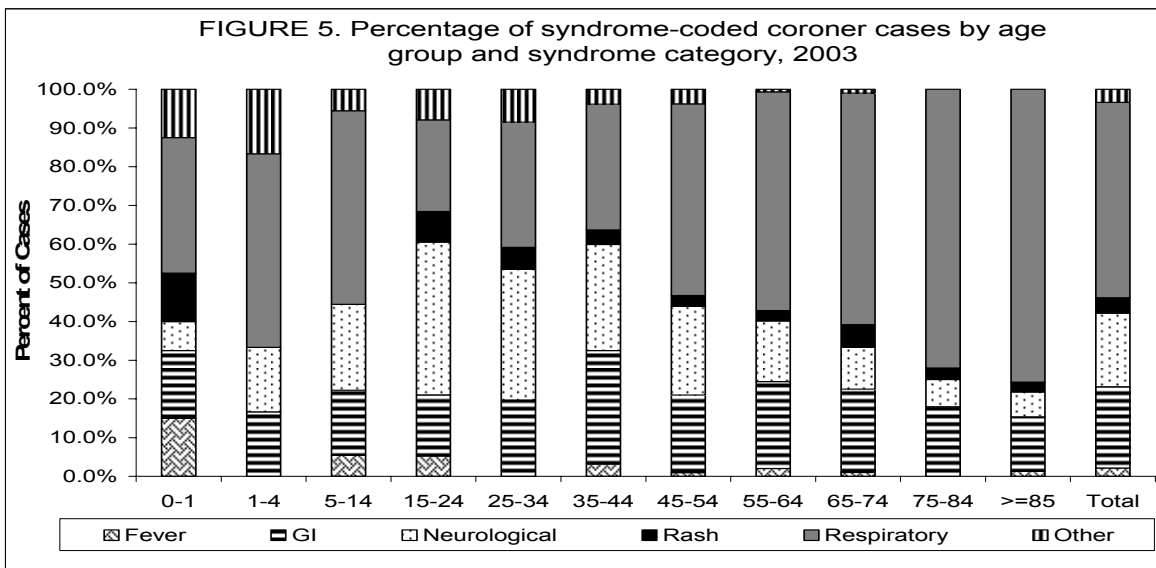
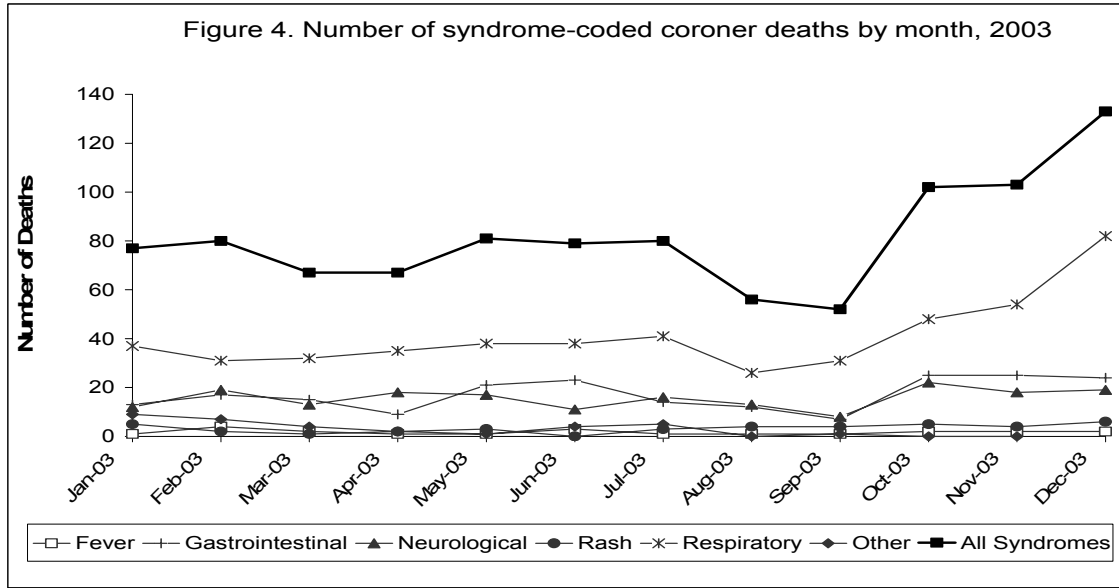
Table 3. Summary of Demographic Variables for Coroner Deaths* Reported to ACDC, 2003

	Coroner Deaths Reported to ACDC		Syndrome-coded Cases		Cases Requiring Follow-up	
	n	%	n	%	n	%
Total Number of Deaths	15,585	100.0	977	6.3	96	0.6
<u>Gender</u>						
Male	8,263	53.0	577	59.1	57	59.4
Female	6,859	44.0	397	40.6	39	40.6
Unknown	463	3.0	3	0.3	0	0.0
<u>Race/Ethnicity</u>						
White	9,281	59.5	432	44.2	32	33.3
Black	2,385	15.3	241	24.7	16	16.7
Hispanic	2,104	13.5	216	22.1	37	38.5
Asian/Pacific Islander	935	6.0	62	6.3	10	10.4
American Indian	43	0.3	3	0.3	1	1.0
Not stated/Unknown	837	5.4	23	2.4	0	0.0
<u>Age Group</u>						
Under 1 year	455	2.9	40	8.8**	15	37.5***
1-4 years	122	0.8	12	9.8	5	41.7
5-14 years	66	0.4	18	27.3	8	44.4
15-24 years	210	1.3	38	18.1	6	15.8
25-34 years	399	2.6	71	17.8	11	15.5
35-44 years	1,050	6.7	157	14.9	18	11.5
45-54 years	1,840	11.8	214	11.6	19	8.9
55-64 years	2,052	13.2	147	7.2	7	4.8
65-74 years	2,321	14.9	102	4.4	5	4.9
75-84 years	3,525	22.6	100	2.8	2	2.0
≥ 85 years	3,545	22.7	78	2.2	0	0.0
<u>Autopsy Performed</u>						
Yes	6,460	43.4	931	95.3	93	96.9
No	8,825	56.6	46	4.7	3	3.1
<u>Mode of Death</u>						
Natural	13,075	83.9	628	64.3	75	78.1
Accident	1,301	8.4	148	15.1	3	3.1
Accident/Natural	952	6.1	174	17.8	14	14.6
Natural/Homicide & Natural/Suicide	101	0.6	18	1.8	1	1.0
Accident/Suicide	79	0.5	5	0.1	0	0.0
Undetermined/Missing	77	0.5	4	0.4	3	3.1

* ACDC receives death records for all coroner cases *except* automobile accidents, suicides and homicides. The above summary of demographic data for coroner deaths excludes those records not reported to ACDC.

** Proportion based on the total number of cases in each age group (column 1).

*** Proportion based on the total number of syndrome-coded cases in each age group (column 3).



ACDC Follow-up Cases: Among the 977 syndrome-coded cases, additional follow-up with the DC was undertaken for 96 (9.8%) death records (follow-up cases). The majority of the follow-up cases were flagged by electronic coding into a syndrome category (63 cases, 66%). Of these cases, respiratory and gastrointestinal syndromes each accounted for one-third of those receiving follow-up review (22 cases each) with the remaining 19 cases coming from the other three syndrome categories. The remaining 33 follow-up cases were selected by manual review of the data (Table 4).

Approximately 97% of the follow-up cases had an autopsy performed, similar to the percentage of syndrome-coded cases receiving an autopsy. The trend in the distribution of follow-up cases by age group was similar to that seen with the syndrome-coded cases. The greatest proportion of follow-up cases was again in the 5–14 year age group with a decreasing proportion of deaths for younger and older age groups. The majority of deaths records selected for follow-up were under 55 years of age.



DISCUSSION

In 2003, ACDC reviewed 15,585 death records for signs of possible bioterrorism or new emerging infectious diseases. Only 6.3% were coded by algorithm into one of five constructed syndrome categories. This is in part due to the low percentage of cases that undergo an autopsy. Cases that do not undergo an autopsy often have very little descriptive information in the “Event Description” and “Synopsis” fields of the medical examiners’ reports. Since this information is used to decide whether or not the death is suspicious, a death will not be followed-up without adequate descriptive information in these fields.

The 96 death reports chosen for additional follow-up with the DC had a very different age distribution than the total 15,585 death records. Approximately 85% of the follow-up cases were less than 55 years of age, compared to only 25% of the total received death reports. It is expected to see an increasing number of deaths in older age categories as persons 50 years and older are more likely to have chronic conditions that could lead to death. However, it is less likely that persons under 50 years old would have underlying medical conditions that could explain a sudden death. Thus, when searching for suspicious deaths possibly due to bioterrorism or emerging infectious disease, cases among those less than 54 years are more likely to become follow-up cases than older cases.

None of the deaths reported to ACDC appeared to be due to an intentional bioterrorist event. In addition to accomplishing its primary objective of bioterrorism and emerging infectious disease surveillance, this project was also useful in fulfilling other state and nationwide disease surveillance activities. Several previously undetected cases of reportable public health conditions were identified from the coroner data files in 2003. While the total number of reportable disease cases identified in 2003 was not recorded, ACDC has developed a system for tracking such cases of reportable disease identified from the coroner data for 2004.

In late-2003 the CDC asked state and local health departments to report severe complications and deaths associated with influenza A in persons less than 18 years of age. Nine pediatric death reports received in ACDC had sufficient descriptive information to suggest possible influenza disease at the time of death and the DC was asked to perform influenza testing. Two of the nine cases (22%) were found to be positive for influenza A. Both cases were reported to the CDC for inclusion in their nationwide surveillance of pediatric influenza-associated complications and deaths.

Overall, this unusual death surveillance project is best used as a complimentary surveillance system in conjunction with other established forms of disease surveillance. While this project is still being tested and edited as needed, it has been helpful in identifying suspicious deaths that could be of public health concern. Additionally, the coroner project has been instrumental in increasing the communication and collaboration between Public Health and the DC, which will likely prove vital in the case of a real bioterrorism event.

Table 4. Summary of Syndrome-Coded Coroner Cases, 2003

Syndrome	Syndrome-coded Cases (N=977)		Cases Requiring Follow-up (N=96)	
	n	%	n	%
Fever	21	2.1	8	8.3
Gastrointestinal	205	21.0	22	22.9
Neurological	186	19.0	9	9.4
Rash	39	4.0	2	2.1
Respiratory	493	50.5	22	22.9
Other*	33	3.4	33	34.4

* Five syndrome categories were used to code cases, however, 33 cases investigated in 2003 did not fall into one of these categories. These cases were investigated based on clinical judgment alone, as they were not flagged during the electronic key word search.