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Katrina Cough

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KATRINA COUGH

1. Introduction

Following Hurricane Katrina, many residents of South Louisiana returned home to find an increased presence of dust, mold, debris, and particulates in the area. Some residents returning home experienced various respiratory symptoms which included coughs, sore throats, and runny noses similar to a cold, but with a persistent dry cough. The symptoms were believed to be caused by reactions to mold and dust left after the storm. These reported symptoms have been referred to as the "Katrina Cough". The questions to be answered from a public health point of view are:
1-Is there a higher incidence of upper /lower respiratory tract infection/ inflammation /irritation in the New Orleans area, and
2-Are exposure to environmental dust /mold responsible for a large proportion of these syndromes?

Answering question # 1 with serial population based surveys would be the best approach but was completely impractical given limitations in personnel, time and funding. Collecting data from emergency rooms could be done. It would provide reliable information on the most serious cases, which constitute the main concerns for public health.

To answer question # 2 a prospective cohort study would have been appropriate but also completely impractical due to the same limitations. A case control study methods was selected as the most doable study.

2. Syndromic Surveillance

2.1. Emergency room (ER) surveillance was carried out in the New Orleans area from 9/2/2006 to 10/13/2006. Teams of two Epidemic Intelligence Service Officers (EISO) from CDC visited 35 facilities, recording 23,798 emergency room visits, of which 16,560 (70%) were from the 5 major facilities left in the city. Cough was a cause of visit for 1,971 cases, (7.6%), upper respiratory infection for 1,469 cases (5.7%), lower respiratory infection for 183 cases (0.7%), wheeze for 183 cases (0.7%). From 9/2/2005 to 10/13/2005 the weekly proportions of cough were 5.9%, 13.8%, 9.9%, 9.1%, 8.1% and 7.7%. There was no specific trend over the weeks.

2.2. Electronic syndromic emergency room surveillance. After the CDC ER surveillance was discontinued, an electronic syndromic surveillance was initiated in the New Orleans area. The CDC Early Aberrations Reporting System (EARS) was put in place. The electronic chief complaints data is extracted and sent electronically to the Office of Public Health (OPH) Infectious Disease Epidemiology Section. The CDC EARS system analyzes the data through a complex algorithm to construct syndromes and then detects early aberrations. A weekly summary is prepared and used to monitor patterns of ER visits.

From 10/2/2005 to 3/25/2005 there were 56,161 ER visits, 650 for asthma (1.1%), 1,787 for lower respiratory infections (3.0%) and 3,108 (6.0%) upper respiratory infections. There were no obvious trends. Detailed data is presented in the following table.

2.3. Comparison data: The National Center for Health Statistics carries out annualy the National Hospital Ambulatory Medical Care Survey (NHAMCS). NHAMCS is part of the ambulatory care component of the National Health Care Survey that measures health care utilization across various types of providers. NHAMCS is a national probability sample survey of visits to emergency and outpatient departments of non-Federal, short-stay, and general hospitals in the United States. Sample data are weighted to produce annual national estimates. This data is the most appropriate for comparison with the data collected in these emergency room surveillance.

(Advance Data from Vital and Health Statistics, National Hospital 2003 Ambulatory Medical Care Survey, 2003 Emergency Department Summary, No. 358, May 26, 2005).

The following are the values used for comparison:

Asthma

ER-diagnosed Asthma (1.5%) (see Table 10 in *Advance Data* report)

Diarrhea

Chief complaint='Stomach pains, cramps, and spasms' (6.7%) (see Table 7 in *Advance Data* report)

LRS

Chief complaint='Shortness of breath' (2.6%) or 'Labored or difficult breathing (dyspnea)' (1.4%)' (see Table 7 in *Advance Data* report)

URS

Chief complaint='Cough' (3.2%) or 'Symptoms referable to throat' (2.1%) (see Table 7 in *Advance Data* report)

Table: New Orleans Emergency Room Syndromic Surveillance

	Number					Percent of Total Visits			
Week	ER Visits	Asthma	Diarrhea	Lower Respiratory Symptoms	Upper Respiratory Symptoms	Asthma (U.S.=1.5%)	Diarrhea (U.S.=6.7)	Lower Respiratory Symptoms (U.S.=4.0)	Upper Resipratory Symptoms (U.S.=5.3%)
03/19/06-03/25/06	1,617	28	50	36	137	1.7%	3.1%	2.2%	8.5%
03/12/06-03/18/06	2,041	42	76	81	151	2.1%	3.7%	4.0%	7.4%
03/05/06-03/11/06	2,621	33	130	99	206	1.3%	5.0%	3.8%	7.9%
02/26/06-03/04/06	2,445	35	113	118	177	1.4%	4.6%	4.8%	7.2%
02/19/06-02/25/06	2,217	23	104	73	126	1.0%	4.7%	3.3%	5.7%
02/12/06-02/18/06	2,296	15	86	85	138	0.7%	3.7%	3.7%	6.0%
02/05/06-02/11/06	2,448	36	109	99	217	1.5%	4.5%	4.0%	8.9%
01/29/06-02/04/06	1,756	43	73	66	153	2.4%	4.2%	3.8%	8.7%
01/22/06-01/28/06	2,411	22	94	92	151	0.9%	3.9%	3.8%	6.3%
01/15/06-01/21/06	2,514	44	97	115	134	1.8%	3.9%	4.6%	5.3%
01/08/08-01/14/06	2,307	22	80	90	136	1.0%	3.5%	3.9%	5.9%
01/01/06-01/07/06	2,470	31	69	81	159	1.3%	2.8%	3.3%	6.4%
12/25/05-12/31/05	2,681	39	103	102	211	1.5%	3.8%	3.8%	7.9%
12/18/05-12/24/05	2,466	24	101	94	138	1.0%	4.1%	3.8%	5.6%
12/11/05-12/17/05	2,701	34	83	88	144	1.3%	3.1%	3.3%	5.3%
12/04/05-12/10/05	2,421	16	109	64	104	0.7%	4.5%	2.6%	4.3%
11/27/05-12/03/05	2,711	28	81	67	123	1.0%	3.0%	2.5%	4.5%
11/20/05-11/26/05	2,516	27	97	72	121	1.1%	3.9%	2.9%	4.8%
11/13/05-11/19/05	2,433	19	83	57	90	0.8%	3.4%	2.3%	3.7%
11/06/05-11/12/05	2,744	25	94	64	85	0.9%	3.4%	2.3%	3.1%
10/30/05-11/05/05	2,460	45	84	67	119	1.8%	3.4%	2.7%	4.8%
10/23/05-10/29/05	1,964	10	41	40	59	0.5%	2.1%	2.0%	3.0%
10/16/05-10/22/05	1,659	6	54	34	20	0.4%	3.3%	2.0%	1.2%
10/09/05-10/15/05	1,222	3	3	2	2	0.2%	0.2%	0.2%	0.2%
10/02/05-10/08/05	1,040	0	7	1	7	0.0%	0.7%	0.1%	0.7%

Data from New Orleans does not differ from the National data.

3. Case Control Study

The case control study was carried out in a St. Bernard outpatient clinic and in several outpatient clinics in New Orleans in January and February 2006. The Office of Public Health (OPH) developed a questionnaire which was administered to patients presenting at each of the healthcare facilities. The goal was to determine if there was an association between upper/lower respiratory symptoms such as asthma, cough, sore throat, etc. among Orleans parish and St. Bernard parish residents and some definite exposure variables.

3.1. Data Collection

The questionnaires included the following types of questions: demographic information, the presence or absence of various respiratory symptoms, the presence or absence of other symptoms, medical history, the history and treatment of the health complaints, residential history, job history, exposure location history, and social history.

3.2. Case Control Study Population

A case definition was met if the patient reported to have exhibited any respiratory symptoms. Controls were those patients who reported other health complaints and exhibited no respiratory symptoms. There were a total of 62 cases and 34 controls (n = 96) from the St. Bernard health facility and a total of 60 cases and 45 controls (n = 105) from the New Orleans health facilities.

3.3. Statistical Analysis

The data were first analyzed separately but since the same instrument was used and the results were similar for the two locations, the variables from both areas were combined and analyzed together (122 cases/ 79 controls, n = 201).

The Epi Info statistical data package was used to analyze and estimate chi square, the odds ratio (OR), p value and confidence intervals (CI) of the reported respiratory symptoms, other symptoms, medical history, residential history, job location history, exposure history, social history and multiple risks history (See Table 2) in order to assess.

A note for the non-epidemiologist: Chi Square, Odds Ratio (OR), p value and Confidence Interval (CI)

In a case control study, the measure of association is the Odds Ratio (OR). The easiest way to explain OR is to present an hypothethical example:

In a clinic there are 100 persons with cough (cases). Among these persons 80 report being exposed to dust. One can say that 80% of the cases reported dust exposure. Another way to express the same result is to say that the odds of dust exposure among cases was 80/20.

The controls would be 100 persons who do not have cough (controls). Among these 10 report being exposed to dust. One can say that 10% of the controls are exposed to dust. Another way to express the same result is to say that the odds of dust exposure among controls was 10/90.

The measure of association between cough and dust in this hypothetical example is 80/20 divide by 10/90 that is 32. This may looks like a complicated to measure the association. It seems more intuitive to use the risk ratio or

relative risk which would be 80% divide by 10% but for excellent theoretical reasons it would be wrong to use the risk ration in a case control study. The OR is the measure that must be used. If there was no association at all between exposure and case, the OR would be 1.

The second question that comes up in case of an association different than 1 is: What is the probability that this association is due to chance alone? This question is answered by calculating the Chi square ($\chi 2$) and the corresponding p-value. It is commonly accepted that a probability less than 5% or 0.05 indicates that the association is real and not due to chance alone.

The confidence interval is another way to express the limits of confidence in the measure of association.

3.4. Results

3.4.1. Gender and Age

Of the total 201 complainants, 96 patients (48%) were females and 105 patients (52%) were males. Of the 96 females, there were 63 cases and 33 controls. Of the 105 males, there were 59 cases and 46 controls. The age range of all patients surveyed was 3 - 84 years of age. The mean age at diagnosis for cases was 42 years of age, the youngest was 3 years of age at diagnosis and the oldest was 79 years of age at diagnosis. The mean age of the controls at the time of the medical visit was 45 years of age, the youngest was 3 years of age and the oldest was 84 years of age. Four of the patients did not report an age. Forty-two percent of all patients were 45 – 64 yrs of age.

Table: Age of Person at Time of Medical Visit

Age Group	Case	Control	Total
0 - 14 yrs	8	1	9
15 – 24 yrs	10	7	17
25 – 44 yrs	44	31	75
45 – 64 yrs	53	32	85
> 65 yrs	7	8	15
Total	122	79	201

There was no significant difference in the age (χ^2=4.48, p=0.34) and gender (χ^2=1.86, p=0.30) distribution between cases and controls.

3.4.2. Residential History

Of the 201 patients surveyed, the majority (52%) resided in Orleans Parish and St. Bernard Parish (36%). The remaining resided in the following parishes: Jefferson (3%), St. Tammany (3%), Plaquemines (<1%), Tangipahoa (<1%), East Baton Rouge (<1%), Livingston (<1%), Rapides (<1%), Calcasieu (<1%), Lafourche (<1%), and Bossier (<1%). Three of the patients resided outside of Louisiana and one patient did not provide a city of residence.

3.4.3. Respiratory and Other Symptoms

Reported respiratory symptoms for the cases were cough (# 98 – 80.3%), sinus drip (# 90 – 73.7%), sore throat (# 67 – 54.9%), sputum production (# 67 – 54.9%), wheezing (# 38 – 31.1%), shortness of breath (# 28 – 22.9%), chest pain (# 20 – 16.4%), and laryngitis (#15 – 12.3%). Symptoms other than respiratory that were

reported were fever, headaches, abscess, blocked tear duct, drenching sweats, back pain, ear irritation, ear pain, epistaxis, left ear pain, pruritis, right eye crusting, rash, skin irritation, vomiting, and urinary incontinence.

Eighty-four percent of the total cases (103/122) reported an onset of symptoms occurring after returning to the area. Of these 122 cases, 39 patients (32%) sought medical care 1 – 4 days after the onset of symptoms. Twenty- one patients (17%) sought medical care 5 – 7 days after the onset of symptoms. The remaining 62 patients visited the health care centers greater than a week after the onset of symptoms. Only 6% (12/201) of the total 201 patients reported that they were returning for a repeat follow up medical visit.

3.4.4. Medical History

	% among		OR	Confidence Interval		$\chi 2$	P value
	Cases	Controls		Lower	Upper		
Asthma	19.7	11.4	1.90	0.83	4.35	2.38	0.12
COPD in Adult	9.9	3.9	2.70	0.76	12.4	2.37	0.12
Allergy	30.3	25.3	1.28	0.68	2.42	0.59	0.44
Immuno-compromission	2.5	7.6	0.31	0.07	1.26	2.94	0.08
Current smoker in Adult	36.9	26.0	1.67	0.88	3.16	2.47	0.11
Current or past smoker	49.5	36.4	1.71	0.94	3.11	3.18	0.07

Adult = Age >14

Although none of the association between case and medical histories reached statistical significance, the OR between asthma, COPD in adults, smoking (current or current and past) all are greater than 1 with p-values close to the cutoff point of 0.05. Past history of allergies was more equally distributed between cases and control.

The majority of immuno-compromission reported was diabetics on insulin. There were more diabetics among controls than among cases. This may be explained by the fact that diabetic will often come to a clinic only to refill their medications.

3.4.5. Family/ Coworkers Contact with similar medical history of respiratory symptoms

Cases were 4.51 times as likely to have had contact with family/coworkers with similar medical history than controls (OR = 4.51, CI=1.8-11.4) in the recent past.

3.4.6. Exposure data: Environmental exposures during two weeks preceding onset

	% among		OR	Confidence Interval		$\chi 2$	P value
	Cases	Controls		Lower	Upper		
Living in damaged home	23.8	20.3	1.22	0.61	2.44	0.34	0.55
Living in trailer	25.4	20.3	1.34	0.67	2.65	0.71	0.40
Living in moldy house	32.2	26.6	1.29	0.69	2.2	0.66	0.41
Construction Job (Adult)	11.7	13.0	0.88	0.36	2.14	0.06	0.79
Debris job (Adult)	17.1	31.2	0.45	0.22	0.91	5.06	0.02
Mold job (Adult)	35.1	33.8	1.06	0.57	1.96	0.04	0.84
Remediation job	33.3	29.9	1.17	0.62	2.32	0.24	0.62
Work outdoors	23.4	29.9	0.71	0.37	1.38	0.97	0.32

Adult = Age >14

Odds ratios for living conditions (damaged home, trailer, moldy house) are all slightly above 1 but none of them reaches the level of significance. On the other hand, odds ration for jobs that are associated with dust and mold

(construction job, remediation job and outdoors job) are mixed, some higher than 1, some lower than 1 and none reaches the level of significance. Workers in debris removal jobs had a significantly lower OR, this is interpreted as the result of a healthy worker effect.

3.5. Discussion

As expected there was strong association (above 1.5) between case and medical history of asthma, COPD and smoking although none has reached the level of significance. On the other hand there was very weak or no association between case and exposure in the job or in the living space.

There are numerous limitations to this type of study:
--This case control study only addresses the respiratory conditions that are serious enough to cause a person to seek medical care. It does not address the mild respiratory conditions that do not trigger a medical visit.
--This case control study was carried out during the winter months during which there are numerous viral upper respiratory infections. These infectious respiratory conditions affect all individuals, whether exposed to dust and mold or not. Therefore the effect of unhealthy environmental conditions may have been diluted by the infectious conditions.
--This study did not attempt to collect detailed data on the dwelling type, presence and extent of mold exposure. The reason for these limitations was to keep the study simple so that it could be feasible in a short time period.

4. Conclusion

Contrary to some perceptions, there is no increased proportion of respiratory conditions severe enough to cause consultations at emergency rooms. The proportions observed in New Orleans are similar to the national data.

A case control study did not show that exposure to dust or molds at the residence or at work were associated with visiting a medical facility. However, due to limitations inherent to this study, a weak association cannot be ruled out. On the other hand an association between personal history of respiratory conditions (asthma, COPD, smoking) and visit to a medical facility was detected.

It is well known that exposure to mold and damp environment cause upper respiratory tract irritation. The main question addressed by this case control study and the syndromic surveillance data is the association between exposure and symptoms severe enough to cause an emergency room visit.