JUVENILE H1N1 INFECTIONS IN PIMA COUNTY

A DESCRIPTIVE STUDY OF FREQUENTLY REPORTED SYMPTOMS

AND CO-MORBIDITIES FOR CHILDREN WITH CONFIRMED H1N1

INFECTIONS WITHIN PIMA COUNTY IN 2009

By

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Abstract

The study examined a random sample of juvenile H1N1 cases (ages 0 – 18 years) occurring within Pima County, Arizona from January 2009 through December 2009. The primary goal of the study was to develop a descriptive data set for the population, with an emphasis on data specific to the most common symptoms and co-morbidities of the children in the study. The second goal was to determine which co-morbidities, if any, led to a poorer outcome, or more severe case of flu in certain subjects. Data was gathered using the Pima County Health Department database. Interviews were conducted with the parents or guardians of the study subjects, as needed, to augment the data set. Data analysis revealed that the majority of H1N1 infections occurred in males. The most common ethnic origin of study subjects was Hispanic. The most common symptom of flu was fever and the most frequently observed co-morbidity was asthma. Co-morbidities, including asthma, seem to correlate with a more severe case of H1N1. On average, the most severe cases were observed in children with a mean age of 6.9 years. Due to difficulties collecting data from subjects that were not hospitalized, hospitalized cases may be over represented in the study. A follow-up study will be conducted throughout the summer in attempt to obtain additional data for the non-hospitalized sample.

Introduction

Seasonal influenza is caused by the orthomyxoviridae virus. The current pandemic influenza, H1N1 is a sub-type of Influenza A. According to the Centers for Disease Control & Prevention (CDC), the elderly population (individuals 65 years and older) are at the greatest risk from complications from a typical flu.[1] However, unlike a typical flu season, current data collected by the CDC suggests that "H1N1 flu has caused greater disease burden in people younger than 25 years of age."[1] Given the increased burden of disease in the younger population, this study will seek to determine what factors, place these individuals at greater risk during the current pandemic.

The study will target children (0-18 years) in Pima County, Arizona, who have had confirmed H1N1 infections. The study will examine factors common to all childhood H1N1 cases occurring during 2009. Subjects will be divided into one of three categories based on their hospitalization status: (1) Most Severe, (2) Severe, (3) Least Severe. A random sample of 50 hospitalized patients will be compared to a random sample of 100 non-hospitalized patients. From the random sample of hospitalized patients, those subjects that were admitted to the ICU will be identified as the most severe cases. The remaining hospitalized cases will be identified as severe and the non-hospitalized cases, composing the majority of H1N1 infections in children, will be identified as least severe.

Medical records will be obtained for all individuals in the study. The records will be obtained through the county health department's database or through phone interviews with the parents or guardians of the subjects in the study.

The information obtained through this study will be beneficial in identifying children at high risk for complications during future H1N1 pandemics. The data can be used by future studies to target children at greater risk. Then interventions can be put into place in schools and other sectors that can aid in the prevention of influenza spread and reduce the risk to the most vulnerable members of this age group. In particular, information gathered in the study will be of critical importance to the Pima County Health Department in the future, should another H1N1 pandemic occur. Using this data, the health department will be able locate children at the greatest risk of severe H1N1 infection and thus, allocate limited resources, such as vaccines, to the appropriate individuals.

Methods

The study was conducted as a case control study, which utilized data previously collected by the Pima County Health Department, as well as data gathered by proxy from the study subjects.

All confirmed cases of H1N1 infection were documented and filed in the Pima County Health Department's records as they were reported. Working as an intern for the Health Department, I was given access to the records of all confirmed H1N1 cases. Using an electronic database containing these record files, confirmed infections in children (0-18 years) were isolated from the total number of infections. The total number of children with H1N1 infections was then divided into two groups: (1) Hospitalized; (2) Non-Hospitalized. A random sample was obtained for each group, in a 2:1 ration of non-hospitalized to hospitalized subjects, given that non-hospitalized patients consisted of the majority of the total sample. The total sample size for hospitalized patients was 49, while the total sample size for non-hospitalized patients was 99.

A short survey form was used to isolate the subjects' data into specific categories. Data categories included the following descriptive fields: Pima County Health Department Database Identification; Last Name; First Name; Date of Birth; Sex; Race; Ethnicity; Age at the time of Illness; Hospitalization status, including ICU status and dates of admission and release; and duration of symptoms. Data regarding the subjects' prior health history included fields for the following: asthma; heart conditions; lung conditions; metabolic diseases; immune deficiencies; cancer; neurological problems; and learning disabilities. Health indicators included: low birth weight; BMI at the time of illness; infancy breast feeding status; and prior hospitalizations status. Data specific to the following H1N1 symptoms was also collected: fever; highest temperature of fever; sore throat; chills; nausea; vomiting; diarrhea; congestions; chest pain; and runny nose. All data for each subject was arranged in the appropriate fields in a spreadsheet. Data was obtained from both the electronic records system and paper interview records obtained by the county. The information on the electronic database was limited and the paper records were not available for each case. Only certain cases had been interviewed and documented using paper records, due to CDC regulations during the pandemic. As a result it was necessary to contact study subjects to obtain additional information.

Contact was made with the parents or guardians of study subjects, in cases where the subjects were minors on the date of contact. Subjects over 18 years of age, on the date of contact, were interviewed directly, without parental consent. For each parent or guardian contacted, a specific consent document was read to the individual, requesting their participation in the study on behalf of their child and stipulating that the study was not required and that neither they nor their child would experience any benefit or consequence based on their participation. The interviews were conducted with the permission of the Pima County Health Department for which Internal Review Board (IRB) approval was not required. All subjects with available contact information were called and asked to participate in the interview. Interviews were conducted in both English and Spanish. All data from the interviews was recorded with the other data in the spreadsheet. In cases where the interview data conflicted with the recorded data from the health department, the health department data was used preferentially.

All collected data was analyzed by a health department official using statistical software, specifically SPSS (Statistical Package for the Social Sciences). A descriptive set of statistics was obtained for each of the three categories of subjects.

Results

 The statistical data obtained from this study is descriptive in nature. More detailed analysis will be possible subsequent to a follow-up study. The following tables list the descriptive statics obtained from the study.

	Hospitalized & ICU		Hospitalized No ICU		Not Hospitalized	
	N	%	N	%	N	%
Total	20	14	29	20	99	66.90
Gender						
Female	9	45.00	7	24.00	48	48.48
Male	11	55.00	22	76.00	47	47.47
Unknown					4	4.04
Ethnicity						
Hispanic or Latino	13	65.00	17	59.00	40	40.4
Not Hispanic or Latino	1	5.00	3	10.00	6	6.06
Unknown	6	30.00	9	31.00	28	28.28

As list in the table on the previous page, there were a total of 148 confirmed juvenile H1N1 cases examined in this study. The majority of the cases were not hospitalized. Of the hospitalized cases 20% were admitted to the ICU. The majority of cases occurred in male children. 55% of the most severe cases occurred in males and 76% of severe cases occurred in males. Children of Hispanic or Latino origin composed the majority of the sample. 65% of the most severe infections occurred in Hispanic or Latino children.

The table below lists the ages of the subjects according to the severity of their illness as defined by their hospital status. The mean age of the most severe cases was 6.9 years, 45% of these cases were between 6 – 12 years old, while the mean age of the least severe cases was 3.7 years, with the majority of subjects being between 6 – 12 years old. The mean age of severe cases was 8.9 years, although 68.97% of subjects in this group were 0-5 years at the time of their illness. In each category, teenagers composed the smallest portion of cases.

	Hospitalized & ICU		Hospitalized No ICU		Not Hospitalized	
	N	%	N	%	N	%
Total	20	13.51	29	19.59	99	66.90
Age						
0 -5 years	7	35.00	20	68.97	35	35.40
6-12 years	9	45.00	6	20.69	36	36.40
13 - 18 years	4	20.00	3	10.35	28	28.30
Mean	6.9		8.9		3.7	

The table on the following page lists the most common flu-like symptoms experienced by the subjects in each category. Fever was the most common symptom for the severe cases followed by cough and sinus congestion. Fever, followed by cough, and an equal percentage of vomiting and rhinorrhea, were the most common symptoms for the severe hospitalized cases. The data set for the least severe, non-hospitalized cases was not complete; for the cases reporting symptoms, the most common was rhinorrhea.

	Hospitalized & ICU		Hospitalized No ICU		Not Hospitalized	
	N	%	N	%	N	%
Total	20	13.51	29	19.59	99	66.90
Symptoms						
Diarrhea	3	15.00	6	20.69	4	4.04
Nausea	3	15.00	4	13.79	1	1.01
Vomiting	5	25.00	9	31.03	2	2.02
Chills	0	0	2	6.90	0	0
Cough	7	35.00	12	41.38	4	4.04
Soar Throat	4	20.00	1	3.45	2	2.02
Fever	9	45.00	23	79.31	4	4.04
Chest Pain	1	5.00	4	13.79	0	0
Sinus Congestion	6	30.00	7	24.14	0	0
Rhinorrhea	3	15.00	9	31.03	5	5.05

The table below focuses on the co-morbidities of the subjects, including asthma. For the most severe cases, 50% of the subjects had one or more co-morbidities, while 41.38% of the severe cases reported one or more co-morbidities. 2.02% of the least severe cases reported one co-morbidity. Data regarding co-morbidities was largely obtained through phone interviews. The non-hospitalized cases were more difficult to contact via this method. As a result the extent of their co-morbidities was not fully discovered.

	Hospitalized & ICU		Hospitalized No ICU		Not Hospitalized	
	N	%	N	%	N	%
Total	20	13.51	29	19.59	99	66.90
Co-morbidities not Including Asthma						
3	0	0	1	3.45	0	0
2	4	20.00	0	0	0	0
1	10	50.00	12	41.38	2	2.02
0 or Unknown	6	30.00	16	55.17	97	98.00
Asthma						
Yes	7	35.00	7	24.14	6	6.06
No	12	60.00	21	72.41	9	9.09
Unknown	1	5.00	1	3.45	84	84.85

Discussion

Based on the descriptive statistics obtained through this study the Pima County Health Department now has an improved description of the children in Pima County that are most at risk during a pandemic flu outbreak. Data regarding this population can be utilized in the future, to ensure that the most vulnerable children receive treatments, like vaccinations prior to the rest of the population.

According to the data obtained by the health department, male children and children of Hispanic and Latino origin are at a greater risk than other children for experiencing a severe case of flu, or a poorer outcome as a result of H1N1 infection. There were a larger number of males than females with a severe or very severe case of H1N1. There were actually more females than males reporting the least severe, non-hospitalized, cases of flu. Furthermore, more Hispanics and Latino children were infected with H1N1 than any other ethnic origin combined.

It is not clear as to why males and children of Hispanic or Latino origin appear to have poorer outcomes when infected with H1N1. Several factors, including lifestyle, access to medical care, diet, and hygiene education could all play a role in the higher infection rate in these children.

Unlike the seasonal flu, CDC data suggests that H1N1 infection can pose a greater threat to younger individual, versus older individuals.[1] Based on this data, this study focused specifically on children. Children between the ages of 0 – 18 years were eligible for the study. There were very few numbers of teenagers in the samples of confirmed H1N1 infections and many children above the age of 12 (28.3%), experienced mild cases of H1N1, not requiring hospitalization. The data for the hospitalized patients, those not admitted to the ICU, reports that 68.97% of these cases occurred in children between the ages of 0 -5 years of age. However, this does not necessarily indicate that these children had a severe case of flu. Children under one year of age, with fever, are usually admitted to the hospital for a routine sepsis work-up, which is not indicative of severe H1N1 infection. Of the cases admitted to the ICU, only 35% were children younger than five. The majority of the most severe cases occurred in children between the ages of 6 – 12.

The symptoms for H1N1 infection are similar those of the seasonal flu, fever, coughing, sore throat, congestion, etc. The most frequently reported symptom for all categories combined, was fever. For several of the individuals that I interviewed, a fever was the only indicator that the child was ill. However, in many cases the children also had coughs, congestion, and a variety of other symptoms. The most common symptom, among the least severe cases, was a runny nose. The severity of the symptoms appears to increase in the children that were hospitalized. This does not necessarily mean that the hospitalized children contracted a more severe strain of H1N1, or were less capable of combating the virus, although this is one explanation. The increase in severity may also be due to a delay in treatment. If a child was not discovered to have H1N1 for a significant amount of time, or did not initially display severe symptoms, the infection

may have been allowed to amplify and anti-viral treatments might not have been as beneficial in these cases.

Other studies that have been preformed regarding H1N1, express the importance of considering an individual's co-morbidities as a determinative factor in the severity of their infection. In this study, all co-morbidities, even those seemingly unrelated to flu infections, were considered reportable co-morbidities. Co-morbidities in the children in the study ranged from severe conditions, such as Cerebral Palsy, Down's syndrome, and Sickle Cell Anemia, to less severe conditions, like ADHD or GERD. Co-morbidities were categorized based on their physiological affect. The data demonstrates that co-morbidities in general are closely linked with an increase in flu severity. A total of 70% of the children admitted to the ICU reported at least one co-morbidity. 50% reported one co-morbidity and 20% reported having two co-morbidities. 41.38% of the hospitalized cases, not including those admitted to the ICU reported having one co-morbidity.

Asthma was considered separately from all other co-morbidities, because other studies indicate that there is a direct link between asthma and severe flu infection.[2] The severity of the flu infection increases with the severity of the asthma.[2] The significance of asthma is evident in the data obtained in this study. 35% of children admitted to the ICU had a history of asthma and 24.17% of children admitted to the hospital, but not the ICU had a history of asthma. Only 6.06% of the non-hospitalized children were found to have asthma.

Based on all of the descriptive statistics collected, it appears that males, children of Hispanic or Latino origin, and children between the ages of 6-12 are at the greatest risk of H1N1 infection. These children should be a priority during vaccination efforts. Special attention should be paid to children in these groups that also have co-morbidities, because chronic conditions can negatively affect the outcome of their infection with H1N1. Asthma, as found by other studies, is an important factor in determining a child's risk of having a severe flu infection.[2] Children falling into these categories should be taken to seek medical treatment quickly, if there is any indication of flu. The most common indicator is fever. However, cough, sore throat, congestion, or a runny nose can all be signs of H1N1. If the infection is confirmed in its early stages anti-viral medications can be administered to fight the virus. Otherwise, treatments can be provided to lessen the symptoms and decrease the infection's severity. Postponing treatment could lead to a necessary hospitalization of the child.

The information obtained in this study provides a basis for future studies regarding H1N1 within this population. In order to more clearly delineate the differences between children with severe versus mild H1N1 infections, more information needs to be gathered from subjects that were not hospitalized. Unfortunately, this data is very difficult to obtain. First of all, not everyone with a mild flu infection will seek treatment or visit a doctor for a diagnosis. As a result, the number of confirmed H1N1 infections does not accurately describe the extent of H1N1 within the children of Pima County. Given that sicker children are more likely to have sought treatment for flu

symptoms, the sample of non-hospitalized children may contained a sample of children that were sicker than the rest of the children infected with H1N1 that did not seek medical treatment. Additionally, the Pima County Health Department does not have complete data or contact information for all of the confirmed, non-hospitalized, H1N1 cases. CDC procedures requiring detailed case follow-ups and interviews were only compulsory for certain populations with H1N1 infections and priority was given to hospitalized cases. As a result, accurate data for non-hospitalized individuals was difficult to acquire.

Part of the follow-up study will focus on collecting data from these children's primary care physicians or from the locations where they were diagnosed with H1N1. Further attempts to conduct phone interviews will also be made and for those without telephone information, letters requesting participation in a survey regarding flu will be sent to the listed addresses. The goal of the follow-up study will be to determine which co-morbidities play the greatest role in raising the severity of H1N1 infection in children.

Acknowledgments

References

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