

Efforts to Increase Influenza Testing in New Mexico

Influenza is an important cause of morbidity and mortality. Despite relatively poor sensitivity and specificity of rapid antigen tests, they provide a tool for timely diagnosis and clinical management of influenza patients while antiviral treatment can decrease complications of this disease. Other studies have shown a decrease in diagnostic tests, antibiotics prescribed, and hospital stays in populations with a positive influenza test.^{1,2,3} A 2007 study of New Mexico influenza testing practices identified hospitals which were less likely to use rapid influenza tests as a diagnostic tool in their emergency departments (ED).⁴ While 90% of NM respondents indicated that they had “ever” tested for influenza in the ED, only 8% indicated that an influenza testing policy was in place. Hospitals in one NM county reported that testing was rarely performed in the ED. This report describes the impact of providing rapid antigen influenza tests to one hospital shown in the past to rarely use such tests in the ED for diagnostic purposes.

Methods

In September 2007, one of two hospitals in a NM county where influenza testing rarely occurred in the ED was provided with 400 rapid influenza antigen tests (QuickView; Quidel) by the NM Department of Health (NMDOH). The tests were to be used during the 2007-2008 influenza season (roughly October 1, 2007 through April 30, 2008) in order to potentially increase case ascertainment and to assess the impact of increased testing by comparing the 2007-08 influenza season to the 2006-07 influenza season (October 1, 2006 through April 30, 2007).

After the 2007-08 season, hospital staff were interviewed to determine testing differences between the two flu seasons. An electronic chart review of all patients tested for influenza between October 1, 2006 through April 30, 2007 and October 1, 2007 through April 30, 2008 was performed to identify the following patient characteristics: gender; age; temperature; ICD

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code; length of emergency room stay; antibiotic/antiviral prescriptions; and additional diagnostic tests performed (i.e., urine analysis, blood tests, chest radiograph, and lumbar puncture).

Data are expressed as means for quantitative variables and numbers or percentages for categorical variables. Continuous data were compared using a Student t-test, while categorical data were examined using the chi-squared test or the Fisher's exact probability test. Statistical significance was defined as $p \leq 0.05$.

Results

Influenza testing practices 2006-07 and 2007-08. During the 2006-07 influenza season, 40 rapid influenza antigen tests were performed, with only two positive results (5%). During 2007-08, 160 tests were performed with 13% positive results. This represented a four-fold increase in number of tests performed, and a 2.5 times greater positivity rate. Interviews with hospital staff suggested that the increase in testing resulted from training provided by a new infectious disease physician at the hospital during the 2007-08 season and from the increased availability of the influenza tests during the season. There was not a formal influenza testing policy in place during either season at this NM hospital.

Comparison of patient characteristics 2006-2007 vs. 2007-08. Males and females were evenly distributed during both seasons (50-51% male) (Table 1). Sixty-five percent of those tested during the 2006-07 season were under age 18; none had positive tests. Eighty-five pediatric patients (53%) were tested in the subsequent season, with 13% testing positive. Patients with influenza tests during 2006-07 had a larger number of diag-

nostic tests performed than those tested in 2007-08 ($p \leq 0.05$), specifically urine culture, blood culture, and complete blood count (CBC) tests. During both influenza seasons, approximately 80% of patients received chest x-rays, while only 1% received a lumbar puncture and/or C-reactive protein analysis. Another area of difference between the two seasons was antibiotic use. Sixty percent of patients tested for influenza during 2006-07 received antibiotics, while only 43% of 2007-08 patients were treated with antibiotics ($p \leq 0.05$). The most frequently assigned ICD codes for patients tested for influenza during 2006-07 were 780.6 (fever), 382.9 (unspecified otitis media), and 465.9 (acute upper respiratory infection, unspecified), and during 2007-08, were: 486 (pneumonia, unspecified organism); 799.02 (hypoxemia); 487.1 (influenza with other respiratory manifestations).

Comparison of patient characteristics with a positive or negative influenza test. Twelve percent of the 200 rapid influenza antigen tests performed during the two seasons were positive. When influenza rapid test-positive patients during the two seasons were compared with rapid test-negative patients, some minor differences emerged. While the two groups were demographically similar by race and ethnicity, adult patients with positive tests were significantly younger (mean age of 40 versus 58 years) (Table 2). There were similar proportions of positive (35%) and negative patients (32%) who were admitted to the hospital.

There were differences between the positive and negative test groups with regard to antiviral usage. Twenty-two percent of test-positive patients received antiviral treatment while no test-negative patients received antiviral treatment. All antiviral medications were oseltamivir. Time between onset of symptoms and first antiviral use ranged from two to eight days, with a mean for those testing positive of 4.8 days. During season one only one case received antivirals which were started 6 days after symptom onset, during season 2 mean number of days between onset and antiviral use was 4.3 days (range: 2 – 8 days). All influenza positive patients were discharged alive, while 2% of influenza-negative patients died during hospitalization. The most frequently assigned ICD-9 codes for patients with a positive rapid antigen influenza test were: 487.1 (influenza with other respiratory manifestations), 487 (influenza) and 401.9 (unspecified hypertension); for influenza negative patients, they were 486 (pneumonia,

unspecified organism), 799.02 (hypoxemia) and 780.6 (fever).

Discussion

It is likely that clinician education regarding influenza testing, along with the availability of rapid diagnostic influenza tests, had a large impact on the increase in numbers of reported influenza cases. While testing statewide in NM increased 58%, testing increased 300% at this hospital.

Other than the large increase in diagnostic tests performed from the first influenza season to the second, there were some minor differences at this hospital between the two seasons: fewer patients received antibiotic treatment during the 2007-08 season and non-admitted patients spent slightly more time in the emergency room. It is unclear whether these differences were related to increased availability of rapid antigen tests; however, it is possible that a positive influenza test influenced treatment decisions as they related to use of antibiotics. There are many factors which lead to increased time in the ED; therefore, it was not possible to evaluate the difference found between the two influenza seasons. Only those who tested positive for influenza received antiviral medications. Antiviral treatment is considered most beneficial when initiated within the first two days of symptom onset; however, only 25% of cases received oseltamivir within that time period. ICD-9 codes suggest that influenza and related influenza diagnoses were the most frequent reason for the medical visit and that hypertension was a frequent underlying condition in patients testing positive for influenza.

One limitation to this analysis was the difference in influenza prevalence between the two seasons. The 2006-07 and 2007-08 influenza seasons were different in prevalence both nationally and in NM. Statewide, there was a 58% increase in the number of tests performed and a 15% increase in percent of tests which were positive for influenza virus. WHO/NREVSS collaborating laboratories showed a 26% increase in number of tests performed, with a 33% increase in the percent of samples which were positive for influenza. CDC reported that the 2007–08 influenza season was more severe than the previous three seasons in terms of influenza-like illness (ILI) reports and pneumonia and influenza mortality, and may have been related to a suboptimal match between the 2007- 08 vaccine strain

and the circulating strain of influenza.⁵ Another limitation was that individuals who were admitted had more complete medical charts when compared to those seen at the ED; however, medical information was not consistently found in the electronic medical chart for patients whether admitted or not. It is possible that paper medical records are more complete at this hospital; however, paper records were not reviewed.

This study showed few differences between the patients tested during the two seasons; however it did highlight an increase in influenza diagnostic testing from the first to the second year, likely encouraged by clinician education regarding influenza testing in addition to the availability of test kits. There was more use of antiviral treatment during the second season which could have impacted patient outcome. However, this is difficult to evaluate because of the small numbers in this study. The increase in antiviral treatment was likely a reflection of the increased influenza rapid antigen testing.

This pre-pandemic study assessed testing for influenza by rapid antigen tests. RT-PCR tests were used for confirmation and identification of influenza viruses, including the 2009 H1N1 virus, during the pandemic.

Table 2. Patient Characteristics by Influenza Test Result

Adult & Pediatric Patient Characteristics	Positive (N= 23)	Negative (N=177)	Both (N=200)	p
Total tests (%)	11.5	88.5	100.0	
Gender, male (%)	39.3	52.5	51.0	0.16
Ped Age, months (mean)	49.0	30.8	32.6	0.12
Adult Age, years (mean)	40.4	58.1	55.7	0.01*
Temperature, F (mean)	100.8	100.5	100.5	0.41
Diagnostic procedures (mean)	1.8	2.1	2.1	0.16
<i>Urine culture (%)</i>	17.4	25.4	24.5	0.29
<i>CBC (%)</i>	43.5	51.4	50.5	0.47
<i>Blood culture (%)</i>	39.1	44.1	43.5	0.41
<i>C-reactive protein (%)</i>	0.0	1.1	1.0	0.78
<i>Chest X-ray (%)</i>	69.6	80.8	79.5	0.16
<i>Lumbar puncture (%)</i>	0.0	1.1	1.0	0.78
Antimicrobial treatment (%)	30.4	48.0	46.0	0.08
Number antibiotics (mean)	2.0	1.5	1.6	0.17
Antiviral treatment (%)	21.7	0.0	2.5	0.00*
Days from onset to flu test (mean)	4.7	4.1	4.2	0.33
Hospital admission (%)	34.8	32.2	32.5	0.49
Length of ED stay (minutes, mean)	234.9	329.9	319.2	0.08
Days in hospital (mean)	4.6	4.8	4.8	0.46
Outcome, alive (%)	100.0	98.3	98.5	0.69

*p<=0.05

Since the 2009 H1N1 pandemic, influenza surveillance efforts again depend largely on the use of rapid antigen tests as a ‘point of care’ tool to identify the presence of influenza, although sensitivity and specificity remain poor. RT-PCR testing remains the ‘gold standard’ for identification and subtyping of influenza. During influenza season 2010–2011, the 2009 H1N1 influenza virus continued to spread, along with seasonal influenza viruses, across the country. NM influenza surveillance currently actively monitors all rapid antigen laboratory-confirmed influenza hospitalizations in seven counties. Submission of these specimens for RT-PCR confirmatory testing at the state public health laboratory continues to be solicited. Future study of hospital-based rapid influenza laboratory testing practices, outcomes and surveillance efforts are recommended.

References

1. Poehling KA Griffin MR, et al. Bedside diagnosis of influenza virus infections in hospitalized children. *Pediatrics*. 2002; 110(1 Pt 1): 83-88.
2. Benito-Fernandez J, Vazquez-Ronco MA, et al. Impact of rapid viral testing for influenza A and B viruses on management of febrile infants without signs of focal infection. *Pediatric Infectious Disease Journal*. 2006; 25(12): 1153-1157.
3. Bonner AB, Monroe KW, et al. Impact of the rapid diagnosis of influenza on physician decision-making and patient management in the pediatric emergency department: results of a randomized, prospective, controlled trial. *Pediatrics*. 2003; 112(2): 363-367.
4. Centers for Disease Control and Prevention (CDC). Influenza -testing and antiviral-agent prescribing practices--Connecticut, Minnesota, New Mexico, and New York, 2006-07 influenza season. *MMWR*. 2008; 57:(3): 61-65.
5. Centers for Disease Control and Prevention (CDC). Update: influenza activity--United States, September 30, 2007-April 5, 2008, and composition of the 2008-09 influenza vaccine. *MMWR*. 2008; 57:(15): 404-409.

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Table 1. Patient Characteristics by Season, 2006-07 and 2007-08

Patient Characteristics	06/07	07/08	Both	p
	(N=40)	(N=160)	(N=200)	
Total tests (%)	20.0	80.0	100.0	
Positive test (%)	5.0	13.1	11.5	0.11
Gender, male (%)	50.0	51.0	51.0	0.13
Ped Age, months (mean)	23.2	35.4	32.6	0.86
Adult Age, years (mean)	52.6	56.2	55.7	0.28
Temperature, F (mean)	100.2	100.6	100.5	0.97
Diagnostic procedures (mean)	2.4	2.0	2.1	0.03*
<i>Urine culture (%)</i>	40.0	20.6	25.0	0.01*
<i>CBC (%)</i>	62.5	47.5	51.0	0.09
<i>Blood culture (%)</i>	55.0	40.6	44.0	0.10
<i>C-reactive protein (%)</i>	2.5	0.6	1.0	0.36
<i>Chest X-ray (%)</i>	80.0	79.4	80.0	0.56
<i>Lumbar puncture (%)</i>	0.0	1.3	1.0	0.63
Antimicrobial treatment (%)	60.0	42.5	46.0	0.05*
Number antibiotics (mean)	1.5	1.6	1.6	0.35
Antiviral treatment (%)	2.5	2.5	2.5	0.67
Days from onset to flu test (mean)	4.4	4.1	4.2	0.41
Hospital admission (%)	40.0	30.6	33.0	0.25
Length of ED stay (minutes, mean)	282.5	327.3	319.2	0.22
Days in hospital (mean)	4.0	5.0	4.8	0.18
Outcome, alive	97.5	98.8	99.0	0.49

*p<=0.05