L-673

Frequency of Influenza Causing Hospital Admission in a Highly Vaccinated Adult Population

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Abstract:

Background: In Ontario, >75% older adults and 41% of all adults receive FLU vaccine annually. To describe the epidemiology of severe FLU in this population, we conducted active surveillance for FLU requiring hospital admission in 6 hospitals in Toronto/Peel, Canada during the 2007/8 season.
Methods: During the influenza season, all medical and ICU admissions (4 hospitals) and all ICU admissions (2 added hospitals) had nasopharyngeal swabs (NPSs) for FLU (direct antigen(DA), culture and PCR) recommended if they had fever, a respiratory or cardiac diagnosis, or unexplained sepsis.
Results: During FLU season (wk51-23), 9251patients (PTs) had 10348 admissions; 6179 (60%) were eligible for NPS, and 3930 (64%) had NPS submitted. 286/3930 (7.2%) of NPS yielded FLU (141 A, 141 B). Patients with FLU B were older than those with FLU A or without FLU (median ages 81.9, 77.6, 75.9, respectively, P<.001). In patients with NPSs, FLU was identified in 29/802 (3.6%) patients with triage T<36C, 110/1989(5.5%) with triage T=36.0-37.4C, 35/312 (11%) with triage T=37.5-37.9C and 96/517 (18.6%) with triage T>=38.0C. FLU was more common in PTs with respiratory symptoms (RSx) in the ED (224/2261, 9.9% vs 55/1406, P<.001), and in PTS admitted during peak FLU activity (see Table).

	No. Flu+/tot pts (%)	No. Flu +/tested pts (%)	No. Flu +/ pts with fever (%)	No. Flu+/tested pts with fever	No. Flu+/pts with fever+RSx	No Flu+/tested pts with fever+RSx
All season	282 (2.7%)	282 (7.2%)	96 (11.4%)	96 (18.6%)	82 (16.3%)	82 (20.9%)
Peak FLU activity (wk10-15)	176 (4.8%)	176 (12.4%)	63 (18.4%)	63 (29.2%)	57 (26.4%)	57 (34.8%)
Admitting Dx						
Respiratory Infection	148 (9.6%)	148 (13.2%)	58 (18.6%)	58 (22.7%)	52 (18.3%)	52 (26%)
1° pulmonary (non-inf)	11 (6%)	11 (5.6%)	4 (12.5%)	4 (18.2%)	4 (13.8%)	4 (20%)
1° cardiac diagnosis	39 (1%)	39 (2.9%)	6 (9.7%)	6 (14.6%)	3 (6.8%)	3 (9.1%)
Other	45 (1%)	45 (4.9%)	12 (13.9%)	12 (11.2%)	5 (6.4%)	5 (14.3%)

Conclusions: FLU is a common cause of hospital admission during the FLU season in years with significant vaccine/strain mismatch. During such seasons, consideration should be given to empiric FLU therapy for patients who require hospital admission for any respiratory condition, and testing considered for other patients with fever.

Introduction:

Influenza remains the most common infectious disease cause of death in Canada, and an estimated 1% of the population over 65 years of age requires hospitalization for influenza annually. Despite this, influenza is rarely recognized clinically as a cause hospitalization, because adults are rarely tested for respiratory viral pathogens.

In order to identify which adult patients being hospitalized during influenza season have influenza, we conducted active surveillance for influenza in adult admission to medical services in four acute care hospitals, and in adult admissions to medical or medical/surgical intensive care units in six intensive care units in Toronto, Canada, during the 2007/8 influenza season.

Methods:

Six (2 tertiary care and 4 community) acute-care hospitals who are part of the Toronto Invasive Bacterial Diseases Network participated of this study. In 2 community hospitals, only admissions to the intensive care unit were included; in the remaining four hospitals, all admissions to medical services, or to medical or combined medical/surgical intensive care units were included.

Prior to the season, attending physicians agreed that obtaining nasopharyngeal swabs was indicated as part of clinical care for patients presenting with acute respiratory or cardiac illness, and febrile illness without clear, non-respiratory etiology. During the season, study nurses screened all admissions daily, and suggested orders for NP swabs in eligible patients. Demographic and medical information was collected from each patient. Nasopharyngeal swabs were tested for the presence of influenza by DFA or EIA on site in 5 of 6 hospitals, and by PCR and culture at the Ontario Public Health Laboratory for all specimens.

The study was approved by the Research Ethics Boards of all participating hospitals.

Acknowledgements

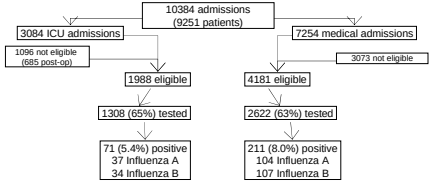
We are grateful to many staff from the emergency departments, medical units, intensive care units, and microbiology/virology laboratories at the Credit Valley Hospital, Mount Sinai Hospital, North York General Hospital, the Scarborough Hospital, Sunnybrook Health Sciences Centre, the Toronto East General Hospital, and the Ontario Public Health Laboratory without whose enthusiasm, dedication, and forbearance this study would not have been possible

Results:

During the influenza season, 6,179 of 10,384 (60%) of admissions were eligible for screening and 3930 (64% of eligibles) had a nasopharyngeal swab tested for influenza (Figure 1). Of the 3930 submitted specimens, 282 (7.2%) yielded influenza, including 45/1735 (2.6%) tested by EIA, 37/913 (4.0% tested by DFA), 174/3904 (4.5%) tested by culture, and 249/3585 (7.0%) tested by PCR*.

*345 (8.8%) specimens were not tested by PCR because they were not recognized as surveillance study specimens and processed as routine clinical specimens.

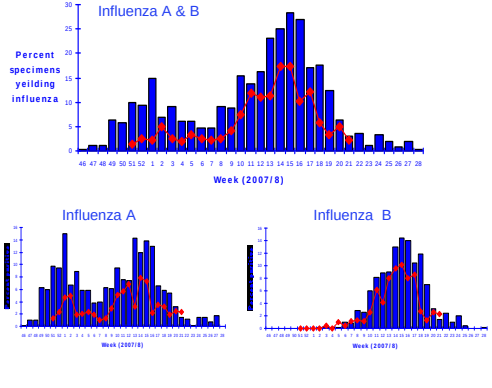
Figure 1: Flowchart of admissions to study hospitals/units and screening for influenza



As shown in Figure 2, the onset of the influenza season (>5% of specimens tested positive for 2 consecutive weeks) was week 51 (week beginning Dec 15/2007), and then end was at the end of week 20 (week ending May 23, 2008). Activity from week 47 (2007) to week 7 (2008) was predominantly A(H1N1), while activity from week 8 to week 20 was mixed A(H3N2) and B.

During the 2007/8 season, vaccine antigens were well-matched to major circulating A(H1N1) strain, but not the predominant A(H3N2) or influenza B strains.

Figure 2: Comparison of influenza activity by laboratory surveillance (blue bars), and percent of screened patient admissions positive for influenza



Results (cont'd):

Among patients eligible to be screened, 62% of those who had a triage temperature of >=38ºC had a specimen submitted, compared to 34% of those with a triage temperature of <375ºC (P<.0001). Similarly, 76% of eligible patients with a diagnosis of pneumonia had specimens submitted, compared to 68% of those with COPD/asthma, 55% of those with unexplained sepsis, 50% of those with another cardiac or respiratory diagnosis, and 18% of those with another diagnosis (P<.0001).

Table 1 shows the proportion of specimens positive for influenza in different groups of patients who had specimens submitted. Table 2 identifies patient characteristics at admission that were significant predictors of influenza in multivariable analysis.

Table 1: Proportion of patients with influenza, by patient characteristics

Characteristics	Number influenza positive/Total (%) Medical admissions N=2622	ICU Admissions N=1308
Gender: Male	99/1195 (8.3%)	36/675 (5.0%)
Female	112/1409 (8.0%)	36/571 (6.3%)
Agegroup : 14-44 years	**20/195 (10%)**	4/92 (4.4%)
45-64 years	29/440 (6.6%)	19/340 (5.4%)
65-84 years	78/1212 (6.4%)	34/639 (5.3%)
>=85 years	**84/770 (10.9%)**	14/169 (8.3%)
Temperature at triage		
<37.0	77/1685 (4.6%)	37/869 (4.3%)
37.0-37.9	28/322 (8.7%)	9/161 (5.7%)
38.0-38.5	**30/229 (13.1%)**	5.82 (6.2%)
>38.5	**76/280 (20%)**	**20/137 (14.6%)**
Respiratory symptoms in ED		
Yes	46/993 (4.6%)	9/413 (2.25)
No	**162/1521 (10.7%)**	62/740 (8.4%)
Admission diagnosis*		
Pneumonia/resp infection	**81/590 (13.8%)**	**21/173 (12.1%)**
Asthma/COPD	**30/239 (12.6%)**	**8/51 (15.7%)**
Respiratory failure NOS	-	**8/65 (12.3%)**
Sepsis NYD	**13/135 (10.3%)**	5/83 (6.0%)
Diabetes	**3/24 (12.5%)**	0/16
Febrile neutropenia	**5/41 (12.2%)**	-
Arrhythmia	7/127 (5.5%)	4/120 (3.3%)
Other respiratory diagnosis	6/141 (5.6%)	3/50 (6.0%)
Other cardiac diagnosis	13/565 (2.3%)	15/539 (3.3%)
Other diagnosis	33/739 (4.5%)	4/134 (3.0%)

Table 2: Predictors of influenza in multivariable analysis

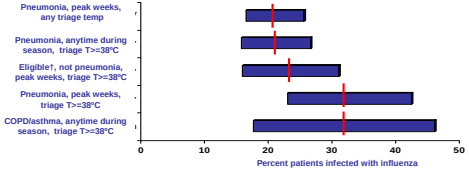
	Odds Ratio (95% CL)	P value
Triage temperature (per degree C)	1.5 (1.4,1.7)	<.0001
Respiratory symptoms in ED	1.5 (1.1,2.2)	.04
Week with >15% specimens positive	3.0 (2.3,4.0)	<.0001
Admitting diagnosis		
Pneumonia/other respiratory infection	1.8 (1.2,2.6)	.002
COPD/Asthma/Respiratory failure	2.2 (1.4,3.3)	.0008

Results (cont'd):

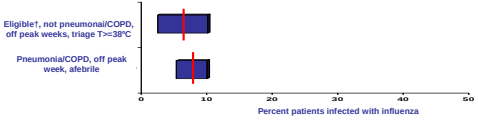
Variables significantly associated with influenza are shown in the Table below. Patient age, residence in long term care facility, whether admission was to ICU or a medical unit, maximum temperature in the first 24 hours of hospital stay, and which hospital the patient was admitted to were also included in the model..

Figure 3: Likelihood of influenza in different groups of screened patients

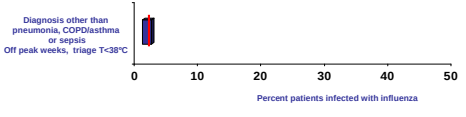
A. Patients in whom empiric antiviral therapy might be considered



B. Patients in whom testing might be considered, if disease severity warrants therapy



C. Patients in whom influenza need not be considered



Conclusions:

- During the 2007/8 influenza season in Toronto, influenza accounted for 2.8% of all admissions to medical and intensive care units in participating hospitals. Adult hospital admissions for influenza were equivalent to laboratory surveillance in labelling/grading influenza activity for B and A(H3N2) activity, but not as sensitive for detecting A(H1N1) activity. This may be because A(H1N1) less commonly causes severe infection in adults, or because better vaccine/infecting strain match resulted in fewer cases of severe illness.
- Temperature at triage is the best early predictor of influenza infection: of patients presenting with a triage temperature of >=38ºC and subsequently requiring admission, 11.4% had influenza.
- During the peak of an influenza season, consideration should be given to empiric therapy for influenza for patients with pneumonia, and for patients with a triage temperature of >=38C and any cardiac or respiratory diagnosis or suspected infection.