National Collaborating Centre for Infectious Diseases
Centre de collaboration nationale des maladies infectieuses

Purple Paper

2009 H1N1 Influenza Pandemic Debrief Series

Province: Ontario
Public Health Setting: Urban/rural

What would you do again in a similar public health emergency?

A) Educate and maintain frequent contact with area family MDs and relevant specialists. Have an open phone line policy for MDs to contact MOH or AMOH.
B) Utilize our Mass Immunization software specifically created for mass vaccinations, utilizing swipe card technology and enabling 25 vaccinations per nurse per hour with minimal admin support.
C) Partner with hospital system to set up Alternate Care sites.
D) Maintain frequent exchange of ideas and information with other provincial medical officers of health in an IT enabled environment.
E) Deploy staff from other departments to assist. 85% of our public health staff were involved in the pandemic response and found that working side by side was invaluable for camaraderie and learning about other people's work.
F) Utilize skill sets that are not traditionally in job descriptions. E.g. under medical directive, EMS vaccinated their own staff as well as other emergency responders
G) Use the IMS [*NCCID note: Incident Management System*] governance model.
H) Work with local media proactively.

What would you NOT do again in a similar public health emergency?

A) Would reflect seriously on not enforcing centrally driven "rules and regulations" that made no scientific sense and were not in the best interests of the citizens served by our health unit.
B) Would not leave creating the appropriate language in collective agreements that would allow for flexible, effective pandemic response until the final hour.

What was the most difficult situation your organization experienced?

There was lack of clarity around locus of decision making ability about vaccine release and we made local decisions that subsequently had to be reversed: e.g., after we had been told on a central teleconference that the age range for those who could receive the vaccine had been extended and we had sent out notices in the backpacks of every school child urging vaccination and detailing times of clinics in many municipalities, the eligible age cohort was very suddenly centrally changed and we were faced with rescinding all that advertising and trying to justify to a frustrated public the removal of an awaited service. There were many instances where the machinery of the health unit was expected to turn on a dime; this would have been acceptable if there had been a rational basis. Further, there was a serious mismatch in our ability to efficiently vaccinate (high), in the face of peak local disease and the central demand to keep 'lock step' with other PHDs and only vaccinate according to the daily centrally released targeted groups – totally untenable and inoperable in our community. We had vaccine supplies and high demand but had to delay 2 weeks, during which time demand fell substantially.

What was the most important lesson learned?

Our citizens are deserving of our utmost care and thoughtful attention; they were by and large patient, informed and desirous of taking care of themselves and their families. We have a strong and respected local public health team (at all levels) that rose to the challenge of providing the care required for [*our citizens*].

What were your most important sources of information?

Valuable time was saved through selfless sharing on the part of individual MOHs of statistical information gleaned through study of the international situation as well as Medical Directives and policies and procedures written for each of the 3 new vaccines that were used.

Province: Ontario
Public Health Setting: Rural

What would you do again in a similar public health emergency?

I would have the IMS structure with the managament at the health unit, regular daily media updates after the teleconferences. I would be quicker to get onto the internet for booking times in immunization clinics, have a separate info line or blog for community doctors and nurses. I would hold a community partners info session just before and make sure the communication lists were accurate and complete.

What would you NOT do again in a similar public health emergency?

I would not expect staff to transport the equipment to outlying area clinics (we would rent a trailer). I would monitor certain pieces of information rather than trying to read everything. I would book clinic times by the hour rather than just let people come any time- would do that online and by phone. I would not expect the HU [*NCCID note: Health Unit*) staff to find the information on our web site (they did not look it up) but have an info meeting every 3 or so days for the staff.

What was the most difficult situation your organization experienced?

Turning people away who wanted the vaccine but were not in the priority group especially since they heard on the radio that it was for everyone. Trying to keep up with the changing information regarding the vaccine(s).

What was the most important lesson learned?

Really important to have the communication lists up to date before the event , local surveillance systems were really important.

What were your most important sources of information?

Information from the province which came quite frequently, summary of materials regarding H1N1 from one of the other MOH's who did an awesome job of putting it together. Locally the ER syndromic surveillance system that we have and the school daily absentee surveillance system that we set up in Sept 09, daily conferences with the management group to update everyone and make decisions as the situation changed.

Pandemic pH1N1 Weekly Literature Synthesis (Week of January 24-30, 2010)

Mitigation Strategy Simulation Modelling

Vaccination against pandemic influenza A/H1N1v in England: A real-time economic evaluation.
Baguelin M et al. *Vaccine. Published online January 20, 2010.*

The authors of this study have developed a **real-time mathematical simulation model** to examine the effectiveness and cost-effectiveness of various vaccination strategies against pH1N1 during the second wave of the pandemic in a population of 51,446,400 individuals based on the demographic data of **England**.

To estimate the epidemiological scenarios for a second pandemic wave, the model was fitted to the weekly number of pH1N1 cases reported in real-time (from June 1 to October 18, 2009) to the Health Protection Agency. Key parameters (reproduction number, latent and infectious periods) of a wide range of values, overlapping estimates of the initial influenza epidemic, were sampled. The combinations of parameters that gave an optimal fit to the observed data were re-used to simulate future incidence of infection and disease to test different vaccination scenarios.

Major parameters pertinent to pH1N1 health outcomes (e.g. age-specific proportion of symptomatic cases, hospitalized cases, cases requiring intensive care and pH1N1-related death) were also estimated from real-time data collected from various sources. These sources included laboratory records of pH1N1 cases, records of anti-viral prescriptions from the National Pandemic Flu Service, FluSurvey (an internet-based cohort in which participants reported their occurrence of influenza-like illness [ILI], physician consultations and usage of medication), databases of hospital and intensive care admissions, and registries of pH1N1-associated deaths.

A two-dose vaccination strategy for children aged <10 years and one dose for all others were modelled. For individuals aged ≥10 years, pH1N1 vaccine efficacy of 70% and 85% were investigated. Because only a half-adult dose was administered to children

aged <10 years, a vaccine efficacy of 35% and 70% after the first and second dose, respectively, was modelled. For the more optimistic scenario, a vaccine efficacy of 42.5% and 85% was assumed after the first and second dose of the pH1N1 vaccine in children. The possibility of a single half-dose of vaccine in children providing the same efficacy as in older individuals (70% and 85%) was also considered.

Seven potential vaccination approaches were examined:

1. No vaccination
2. Vaccination of high-risk groups (of all ages) only
3. Vaccination of high-risk groups, followed by children aged 6 months to 4 years
4. Vaccination of high-risk groups, followed by children aged 5-14 years
5. Vaccination of high-risk groups, followed by children aged 6 months to 14 years
6. Vaccination of high-risk groups, followed by adults aged >64 years
7. Vaccination of high-risk groups, followed by children aged 6 months to 14 years and adults aged >64 years.

It was assumed that high-risk groups were vaccinated between October 26 and November 8, 2009, and vaccination of low-risk groups began on November 16, 2009. Children aged <10 years received their two-doses of the vaccine 3 weeks apart. Vaccine uptake was assumed to be 70% in high-risk groups and 40% in other groups.

This model suggested that although a substantial fraction of the population of England would have been infected during the first pandemic wave, the second wave that was anticipated to peak in autumn would likely be similar in magnitude. Compared to no pH1N1 vaccination, vaccinating only high-risk groups would avert 452,990 infections, 10,386 hospital admissions, and 45 deaths; gain 2,910 quality-adjusted life years (QALYs; a health status index that incorporates both life expectancy and the perceived impact of illness and disability on the quality of life [1]); and avoid treatment costs in the amount of £13.4 million. Although extending vaccination to low-risk groups would further augment the benefits gained, the overall incremental impact would be modest. Of the three low-risk age groups (6mo-4yrs, 5-14 yrs and >64 yrs), the greatest benefits would be attained by vaccinating children aged 5-14 years.

The authors also used guidelines established by the National Institute for Health and Clinical Excellence to assess the cost-effectiveness of each vaccination strategy. If a vaccination program costs less than £20,000 for every QALY gained, the intervention is likely to be cost-effective. Conversely, if the cost for every QALY gained is more than £30,000, the vaccination program is less likely to be cost-effective. The cost-effectiveness of a program whose cost falls between the two thresholds is less well-defined.

Compared to no vaccination, vaccinating high-risk groups against pH1N1 would be the most cost-effective; since under various conditions tested, the majority of cost estimates related to this vaccination approach were below the threshold of £20,000 per QALY gained. Extending vaccination to low-risk groups was less likely to be cost-effective, and would only achieve limited incremental benefits. Of the three low-risk age groups (6mo-4yrs, 5-14 yrs and >64 yrs), vaccinating the 5-14 years age group would be the next most cost-effective strategy, with a proportion of cost estimates below the threshold of £20,000 per QALY gained. Vaccinating children <5 years and adults >64 years showed intermediate and lowest levels of cost-effectiveness, respectively.

Immunizing different combinations of low-risk age groups (children aged 6mo- 4yrs and 5-14 yrs; children aged 6mo- 4yrs and 5-14 yrs, and adults aged >64 years) following vaccination of high-risk groups would further improve pH1N1 health outcomes at the population level, compared to vaccinating high-risk groups alone. However, these strategies were unlikely to be cost-effective.

All in all, this study suggested that vaccination of high-risk groups only during the second pandemic wave would probably be both effective and cost-effective in a population similar to that of England under the epidemic conditions modelled. This approach was also the most robust amongst other strategies – able to withstand uncertainty in epidemiological, outcome and economic parameters, and retain its effectiveness and cost-effectiveness. The results of this study corroborate findings of a recent Canadian study utilizing a similar

mathematical modelling methodology [2] (See Purple Paper Issue No. 8).

pH1N1 Outbreaks in Long-Term Care Settings

Outbreaks of 2009 Pandemic Influenza A (H1N1) Among Long-Term – Care Facility Residents – Three States, 2009.
CDC. *MMWR Morb Mortal Wkly Rep. 2010 Jan 29; 59(3):74-7.*

Since the emergence of pH1N1 in April 2009 in North America, a growing body of literature has indicated that, unlike seasonal influenza, the attack rate of pH1N1 among individuals aged ≥65 years is lower than in other age groups. The apparent lower susceptibility observed in older adults is believed to be due to pre-existing antibody responses detected in up to one-third of individuals born before 1957, who might have been infected naturally by an antigenically similar influenza virus. In spite of this, three outbreaks in long-term care facilities (LTCFs) in three different states (Colorado, Maine and New York) have been reported independently to the CDC in October and November 2009 during the second wave of the pandemic.

The three LTCFs in which pH1N1 outbreaks had occurred had a capacity of 39-, 125-, and 368-beds. The resident attack rates of the outbreaks varied between 6% and 28%. The staff attack rates ranged from 5% to 40%. In all incidents, only a limited number of severe cases were involved. In at least two of these outbreaks, pH1N1 appeared to have been introduced by health care personnel who continued to work while ill. In the third outbreak, health care personnel absenteeism increased from a baseline average of 2 employee absences per day to 7 employee absences per day in the week before the index resident's illness. This was followed by an increase to 11 employee absences per day in the week of the resident's illness onset. Mitigation measures employed by the three LTCFs included oseltamivir treatment for residents and staff with ILI, oseltamivir prophylaxis for unaffected residents and staff, droplet precautions, restriction of resident movement between care units, visitor restriction and exclusion of ill health care personnel from work. Although it is not possible to determine which interventions had the greatest impact, all three outbreaks halted after the initiation or reinforcement of infection control practices, demonstrating the effectiveness of the combination of all of these measures in mitigating influenza transmission.

In each of the three LTCFs, the pH1N1 vaccine was either not available or not offered to staff before the outbreaks. Thus, this report illustrates the importance of seasonal influenza and pH1N1 vaccination of all health care personnel, including those who work in LTCFs whose residents may have a lower susceptibility of pH1N1. In addition to immunizing LTCF residents against seasonal influenza, pH1N1 vaccination should also be considered.

pH1N1 in Vulnerable Populations

2009 H1N1 Influenza A and Pregnancy Outcomes in Victoria, Australia.
Hewagama S et al. *Clin Infect Dis. Published online January 25, 2010.*

Pregnant women are at increased risk of morbidity and mortality associated with pH1N1 infection. In this **case series study**, investigators described the demographic characteristics, and clinical features and outcomes of pregnant women with pH1N1, who were admitted to 6 hospitals in the state of **Victoria, Australia** during the first pandemic wave.

Cases were identified as women who were in any trimester of pregnancy hospitalized between May 20 and July 31, 2009, had a history of ILI, and received a positive laboratory result for pH1N1. Of 43 identified pregnant patients, 2 (5%) were in the first trimester, 13 (30%) in the second trimester, and 28 (65%) in the third trimester. The increased relative risk to more severe influenza illness and influenza-associated hospitalization with increased length of pregnancy was consistent with the findings of another study [3].

The cumulative incidence of hospitalization was estimated to be 0.46% (95% confidence interval [CI] 0.31%-66%) and 0.21% (95% CI 0.11%-0.36%) for women in the third and second trimester, respectively, during the study period. Other than pregnancy, 22 (51%) of 43 pregnant women had other underlying conditions that rendered them more susceptible to an increased risk of more severe

influenza illness. The most common condition was asthma (9 [21%] of 42), followed by obesity (8 [19%] of 43) and diabetes mellitus (6 [14%] of 42). The prevalence of these underlying co-morbid conditions was higher among the study subjects than that reported in the general Australia population (10%, 16% and 3%, respectively). Only 2 patients were smokers.

Of 33 (77% of 43) patients who were prescribed anti-virals, treatment commenced within 2 days of symptom onset in 12 patients. The remainder of patients received treatment ≥3 days (range 3-14 days) after onset of symptoms.

The median length of stay among the patients was 2 days (range <24 hours to 30 days). Ten (24% of 42) women were hospitalized for <24 hours, and 8 (19% of 42) women were hospitalized for >7 days. Eight women were admitted to an ICU.

Of 15 women who delivered during their stay in the hospital, 6 (40%) women delivered at <37 weeks and 9 (60%) women delivered at term (defined as >37 weeks). Of 24 neonates whose outcome data were known, 21 survived, 2 died in utero, and 1 died after delivery. Seven neonates, including the one who died, were tested for pH1N1 and all had a negative result. No neonates received anti-virals.

The findings of this study are in agreement with a recent case series study conducted in California, involving non-pregnant, pregnant and post-partum women of reproductive age who were hospitalized or died from laboratory-confirmed pH1N1 between April 23 and August 11, 2009 [4].

Notable Publications

Practical lessons from the first outbreaks: Clinical presentation, obstacles, and management strategies for severe pandemic (PH1N1) 2009 influenza pneumonitis.
Funk DJ et al. *Crit Care Med. Published online January 22, 2010.*

Influenza A/H1N1 2009 pneumonia in kidney transplant recipients: characteristics and outcomes following high-dose oseltamivir exposure.
Watcharananan SP et al. *Transpl Infect Dis. Published online January 20, 2010.*

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[2] Tuite A et al. Optimal Pandemic Influenza Vaccine Allocation Strategies for the Canadian Population. *PLoS Currents: Influenza. 2010 Jan 4:RRN1144.*

[3] Neuzil KM et al. Impact of influenza on acute cardiopulmonary hospitalizations in pregnant women. *Am J Epidemiol. 1998; 148:1094-1102.*

[4] Louie JK et al. Severe 2009 H1N1 influenza in pregnant and postpartum women in California. *N Engl J Med 2010; 362:27-35.*

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