Lessons from Queens

Ruth Lynfield
Minnesota Department of Health, St Paul

(See the article by France et al, on pages 984–992.)

On 23 April 2009, the nurse at a private high school in Queens, New York, contacted the New York City Department of Health and Mental Hygiene (NYC DOHMH) because >100 students presented to her office with fever and respiratory complaints, sore throat or headache. More than 100 additional students developed illness on the next day. By 26 April, a novel influenza virus (later called 2009 pandemic H1N1 influenza A) was identified by the Centers for Disease Control and Prevention in swab samples from students. Interestingly, on 24 April, Mexico reported a large outbreak of respiratory disease due to this virus. Six of the sick students from Queens had traveled to Mexico during spring vacation, which ended on 19 April. Approximately one-third of nearly 2000 students (74% response rate) from the school surveyed by NYC DOHMH, reported influenza-like illness (ILI), and >80% reported symptoms between 22 and 25 April [1].

France et al [2], as described in this issue of the Journal, surveyed household members of ill students from this high school to determine risk factors for ILI transmission. Because the investigators had the foresight to evaluate these quickly, they were able to assess ILI in household members before the virus was established in the community; thus, incident ILI was probably due to household transmission.

Planning for a novel influenza outbreak has been a priority for public health officials since the recognition of H5N1 influenza in Hong Kong in 1997, especially from 2003, when H5N1 outbreaks in birds and infections in people were detected in multiple geographic areas. The 2003 outbreak of severe acute respiratory syndrome taught us that new viruses can spread rapidly across continents. Indeed, the 2009 pandemic H1N1 virus spread globally within 6–8 weeks. Planning has included strategies to mitigate spread of a new virus; this was particularly crucial in the initial months when a vaccine was not yet available. It is important to determine protective and risk factors for infection in households, because a standard public health recommendation is that ill individuals stay isolated at home to decrease the spread of infection in the community.

Evaluating influenza virus transmission in households of school-aged children is important, because children are thought to play a major role in the spread of virus in early stages of an epidemic. Wallinga et al [3], using data on social contacts and estimating transmission parameters, found that when a respiratory virus is introduced into a completely susceptible population, school-aged children and young adults will initially experience the highest incidence of infection and be the principal spreaders of infection. Longini et al [4], evaluating data from seasonal influenza during 1974–1979 in Tecumseh, Michigan, and Seattle, Washington, determined that children were primarily responsible for introducing influenza into households. Pandemic H1N1 infection has significantly involved children. Clinical attack rates in children <15 years old (61%) in La Gloria, Mexico, were twice those in older individuals [5]. In the United States, it is estimated that approximately one-third of hospitalized cases between April 2009 and mid-January 2010 occurred in children aged <18 years [6]. A primary school in Birmingham, United Kingdom (students aged 4–12 years) reported a 30% clinical attack rate [7], similar to the attack rate in the high school in Queens.

What have we learned here about household transmission? France et al found that the overall ILI attack rate was 11%. Older age was protective; the highest secondary attack rate occurred among children ≤4 years of age, and the lowest among individuals ≥55 years of age [2]. Viboud et al [8] found that there was an increased risk of seasonal influenza transmission in preschool contacts compared with school-age or adult contacts. It has been generally observed that older adults have had fewer pandemic H1N1 infections, possibly because of preexisting im-
munity to an influenza strain providing cross-reactive antibodies in some individuals born before 1950 [9]. France et al [2] also found that antiviral prophylaxis was protective. Oseltamivir and zanamivir prophylaxis have each been found to decrease the risk of household transmission of seasonal influenza if implemented within 48 h after symptom onset in the index case patient [10–12]. However, given the development of antiviral resistance, including oseltamivir resistance in influenza strains in recent years (observed in seasonal H1N1 strains and in rare isolates of pandemic H1N1), promoting careful use of antivirals is important. It would be beneficial for patients at increased risk for severe influenza to develop a plan with their clinicians regarding whether to use antiviral prophylaxis after a close exposure or to opt instead for careful watching and early treatment, if necessary.

What is distinctive in the study by France et al [2] is the finding that having a household discussion about how to prevent transmission was protective. The NYC DOHMH sent recommendations, including advice about covering coughs and washing hands, to the Queens high school households. Although specifically what was discussed in these households is unknown, the findings of this study support the effectiveness of behavioral interventions. A recent cluster-randomized controlled study on household transmission of seasonal influenza in Hong Kong found that hand hygiene and face masks seemed to reduce influenza transmission, but only when implemented within 36 h of symptom onset in the index case patient [13]. Compliance with wearing masks was poor. Only one-half of index case patients assigned to the face mask plus hand hygiene group and only approximately one-quarter of household contacts wore masks. Approximately 45% of the control group (index case patients and contacts given lifestyle education) practiced good hand hygiene, as did about 62% of index case patients and 55% of contacts in the intervention groups (hand hygiene with or without face masks).

The behaviors in households that were found to increase the risk of acquiring ILI included parents’ providing care for the index case patient, particularly if the parent caregiver slept in the same room as the index case patient. Siblings who watched television or played video games with the index case patient were also at increased risk of illness [2]. Notably, a report from Japan on pandemic H1N1 influenza found that the attack rate among siblings was significantly higher than that for parents [14].

One-half of the secondary cases in the Queens high school households occurred within 3 days, and 87% occurred within a week of symptom onset in the index case patient. In the study from Japan, the median interval from symptom onset in the case to symptom onset in a household member was also 3 days (range, 1–5 days) [14].

These findings are useful in reinforcing public health recommendations for infection control within households of infected individuals. It is not surprising that behaviors can affect transmission risk; for example, young children engage in very close contact, are not adept at fastidious hand washing, frequently put fingers or objects in their mouths and noses, and have been found to be at higher risk than older individuals. However, implementing and adhering to changes in behavior, even for a brief period, can be difficult. Thus, it is very helpful to have data supporting simple household interventions that are important in preventing infection.

An effective vaccine is our best tool in controlling an influenza outbreak. Behavioral measures are especially important in the absence of an effective vaccine, as in the early stages of a pandemic. However, because vaccines are not 100% effective in preventing infection, it is prudent to advise infection control measures even when vaccination has occurred. Because transmission occurs early, as France and colleagues discuss, measures need to be put into place quickly and may not prevent transmission in up to half of potential cases [2]. It would be helpful to provide education as soon as influenza appears in the community, before cases occur in households. Public health officials, clinicians, and schools should partner in developing strategies to provide timely information.

When an infection occurs in a household member, households should be counseled to promptly discuss and review behaviors that could limit transmission of influenza during the first week after symptom onset in the index case patient, but particularly during the first 3 days. It is reasonable to advise that, if feasible, caregivers should not sleep in the same room as the patient, and that someone who is not at high risk for severe influenza should provide care. Other household members, especially siblings, should be counseled to avoid close contact with an infected individual, as can occur when playing video games or watching television or during other activities that expose household members to infectious secretions and droplets. France and colleagues have elegantly shown us that a few simple, common sense changes in behavior can be important in controlling influenza transmission in households. Additional studies evaluating modifiable behaviors that can prevent and control spread of influenza would help refine public health recommendations [15]. Former US President Jimmy Carter said, “The awareness that health is dependent upon habits that we control makes us the first generation in history that to a large extent determines its own destiny” [16, p 40]. As health care providers, we should encourage household members of individuals infected with influenza to be mindful of their behaviors and advise them that they have an active role in preventing and controlling infection.

References
1. New York City Department of Health and Mental Hygiene. St. Francis Prep update:


