Fighting flu: adopting routine molecular multiplex testing of respiratory pathogens during flu season

By Martin Crockard, PhD

As public health authorities around the world continue to work to contain the 2014 Ebola epidemic, the largest Ebola outbreak in history, concern over the spread of infectious diseases is a matter of intense public concern. Despite the Centers for Disease Control and Prevention’s (CDC) assurances earlier this year that Ebola is not an imminent threat to the Western world, the re-emergence of other contagious diseases that have been considered to be “eradicated” tends to trigger public alarm, particularly when the disease is not well understood or is unfamiliar.

Infectious diseases by their very nature remain a constant threat to public health. As we enter peak winter flu season, health experts are reminding us that the greatest threat we face to our health is one much closer to home than Ebola virus disease.

Significant vaccination and surveillance efforts have kept influenza in check in recent years. As our defenses against diseases have become increasingly sophisticated, however, so do the diseases we are trying to protect ourselves against. As the influenza pathogen mutates, antigenic shifts can cause a very severe flu epidemic such as the 2009 H1N1 influenza pandemic which infected approximately 60.8 million people in the United States, resulting in more than a quarter of a million hospitalizations and nearly 12,500 deaths.1

But the threat of an evolved, mutated strain of influenza this flu season should not be the only infection we guard against; commonly circulating flu strains can prove equally fatal to at-risk individuals.

The familiar face of flu

Influenza is a common infectious disease which typically affects 5 percent to 10 percent of adults and 20 percent to 30 percent of children globally each year, resulting annually in a quarter to half a million deaths.3 In the U.S., the CDC estimates that the average number of annual deaths from influenza can fall anywhere between 3,000 and 49,000.4

Multiple molecular testing for respiratory tract infections

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Aside from being potentially fatal, the influenza virus is often the underlying cause of associated respiratory tract infections (RTIs), which are present in approximately 5 percent and 15 percent of the population.5 RTIs can occur in the lower and upper respiratory tracts, with the World Health Organization (WHO) declaring lower respiratory tract infections the leading infectious cause of death and the third biggest killer globally (3.1 million deaths per year), behind only heart disease and stroke.6

The most common upper respiratory tract conditions seen worldwide include rhinitis, pharyngitis, and laryngitis. These infections occur more frequently in younger children, potentially leading to acute asthma exacerbations and lower respiratory tract infections, such as bronchitis and pneumonia.7

Pathogens most commonly implicated in cases of RTIs include influenza A&B, parainfluenza virus (PIV) type 1 (PIV1), PIV2, PIV3, respiratory syncytial virus (RSV), adenovirus, and rhinovirus. Other viruses, such as coronavirus, PIV4, bocavirus, and enterovirus also commonly occur, albeit less frequently. Indeed, in a study by Lepiller et al., human coronavirus (HuCoV) was shown to contribute to 52% of upper respiratory tract infections in immunosuppressed patients and was closely associated with multiple infections.8

Respiratory tract infections can be complex and multifaceted with underlying co-infections, often missed or overlooked once initial diagnosis is made, exacerbating serious illness. Since many respiratory viruses can present with similar signs and symptoms to influenza, differentiation between virus infection and accurate first-time diagnosis can be difficult to achieve clinically.

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Through molecular testing, accurate diagnoses and recording of all infections present will assist in surveillance of infection, allowing public health authorities to accurately monitor what viruses and bacteria are circulating in the community and adjust public health policy accordingly. Improved infection control measures, based on response to circulating pathogens, can also be relied upon to identify agents and track outbreaks.

Molecular testing applies equally, of course, to the detection of bacterial respiratory infections. Each year in the United States, at least two million people acquire serious bacterial infections that are resistant to one or more of typically prescribed antibiotics, and at least 23,000 people die as a direct result of these antibiotic-resistant infections. For both the patient and the wider public, the appropriate use of antibiotics will help curb the current problem of antimicrobial resistance, which the world now faces as a result of overprescribing and misuse of antibiotics in both humans and animals.

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Adopting routine use of molecular assays to test for respiratory infections at first presentation is a protective strategy to ensure appropriate treatment and control of infection in the community. In particular, a multiplex diagnostic assay which simultaneously tests for a wide range of viral and bacterial pathogens affecting both the upper and lower respiratory tracts is the optimal method for diagnosis and management of disease. Not only will the test results contribute to our understanding of the epidemiology of RTIs, but they will empower us with a wealth of new information on seasonality, geographical distribution, and risk groups to help better arm us against the threat of respiratory diseases, both old and new.

References