AIRCURRENTS

THE H1N1 INFLUENZA PANDEMIC: IMPLICATIONS FOR CATASTROPHE MODELING

06.2010

EDITOR'S NOTE: The 2009 H1N1 influenza pandemic has not been as severe as originally feared. This very fact demonstrates the uncertainties associated with assessing and managing pandemic risk and its impact on people, society—and on the insurance industry. If early fears of a 1918-type influenza pandemic—when 20 to 40 million people died worldwide—had manifested, the scale of disruption of everyday life would have been enormous. In this article, AIR Principal Research Analyst Nita Madhav describes the course of the 2009 H1N1 pandemic to date; explains why, according to epidemiologists' best understanding, the pandemic has been less severe than expected; and presents several "what if" scenarios to explore outcomes had the pandemic had different characteristics. Nita Madhav holds a graduate degree in Public Health in Epidemiology and worked in the Special Pathogens Branch of the U.S. Centers for Disease Control and Prevention before joining AIR.

By Nita Madhav

In June 2009, the World Health Organization (WHO) declared the first influenza pandemic since 1968. A year later, WHO's official position remains that the pandemic, though past its peak, is still underway. While the 2009 H1N1 influenza pandemic was not as severe as initially feared, it has increased both awareness of infectious disease risk and demand for adequate insurance coverage when a severe pandemic strikes.

A TRUE PANDEMIC?

A pandemic is an epidemic that affects a significant portion of a population over a large geographical area. There is little dispute that the 2009 H1N1 influenza event fits this definition. It is the specific characteristics of the pandemic pathogen, however, that will determine the range and severity of human and economic losses.

Over the past year a spectrum of attitudes about the pandemic has developed, stretching from those who believe health officials were justified in their response to the pandemic to those who believe the public was deliberately misled. The early findings of health officials showed that an H1N1 pandemic had the potential to be severe. With the benefit of hindsight, some have accused health officials of overreacting. However, with the information available at the time—and the real possibility of a severe event developing in which lives would be at risk—health officials reacted with appropriate caution. Had the pandemic developed for the worst, the same critics would undoubtedly be accusing health officials of being lax in their duties.

PANDEMIC H1N1'S TOLL

According to the latest data from WHO, over 214 countries and territories have reported cases of H1N1 and more than 18,300 laboratory-confirmed deaths have occurred. While 18,300 deaths worldwide may seem low compared to the 36,000 estimated annual deaths from seasonal flu in the US alone, that comparison is misleading because the 36,000 also includes deaths that are not laboratory confirmed.

The U.S. Centers for Disease Control and Prevention (CDC) recently completed an analysis with a more appropriate comparison of hospitalizations and deaths linked to pandemic H1N1. Its basic findings are presented in Table 1.

Table 1: Comparison of Pandemic H1N1 to Seasonal Flu in the U.S. (Source: U.S. CDC, U.S. Census)

	Typical Flu Season	H1N1 Pandemic
Percent of Population Infected	5% - 20%	14% - 29%
Number of Hospitalizations	200,000	274,000
Number of Deaths	36,000	12,470
Percent of Deaths in Those Less than 65 Years Old	10%	87%

The surprising finding that only about 13% of estimated deaths were in the over-65 age group suggests that this group has some pre-existing partial immunity. Indeed, the probability of experiencing serious effects from H1N1 was highest in young children, pregnant women, and individuals who had underlying conditions. Also of interest is that while seasonal flu typically affects 5–20% of the U.S. population, the latest CDC estimate of H1N1 infection is between 43 million and 89 million cases, or between roughly 14–29% of the U.S. population.

Another metric to gauge pandemic severity is the percentage of physician visits attributed to "influenza-like illness" (ILI), shown in Figure 1 below. First, there is a highly atypical bimodal pattern in ILI visits observed for 2009–2010. Second, the percent of ILI visits that year was the highest in a decade. While increased public awareness of H1N1 probably contributed to some increase in physician visits, this cannot explain the significant increase in ILI *percentage*; physician visits increased by only 17%, whereas the number of ILI visits increased by 88%, indicating a true clinical increase.

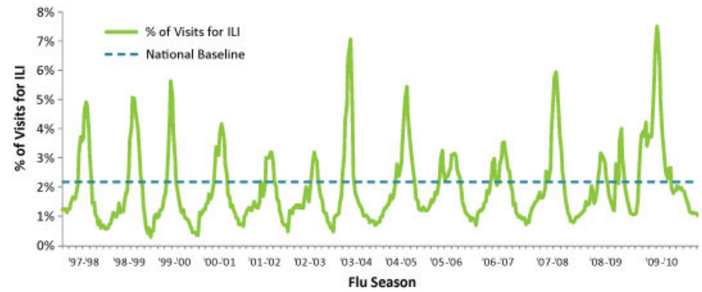

Figure 1. Weekly percentage of doctor visits for influenza-like illness (ILI) in U.S., 1997–2010 (Source: U.S. CDC)

EFFECTIVENESS OF MITIGATION

The impact of pandemic H1N1 could have been much worse. At least four things happened that caused the pandemic to take a less severe course. First, the virus did not mutate to become more virulent or transmissible. Second, although vaccine production had initial setbacks, the problems were overcome and the vaccine became widely available. Third, because of heightened awareness, people were more likely to engage in preventive behaviors such as hand washing, covering coughs and sneezes, wearing masks, and self-isolation. Finally, it appears that there was more pre-existing immunity in the community than was initially understood. Such immunity would arise in individuals who had been exposed to influenza viruses previously that were sufficiently similar to pandemic H1N1 to initiate an immune cross-reaction. At least one study has shown some degree of such pre-existing immunity specifically in people born before 1950.

H1N1'S LOW TRANSMISSIBILITY

H1N1's transmissibility appears to be fairly low to moderate. Its estimated R0 value, a standard epidemiologic measure of transmissibility, is about 1.4–1.6. This metric represents the average number of secondary cases that will be generated in a wholly susceptible population (a population with no immunity to the disease) by a single infectious case. This estimated R0 for pandemic H1N1 is only slightly higher than that of seasonal flu, which is 1.3–1.5. Past influenza pandemics (occurring in 1918, 1957, and 1968) have had estimated R0 values that were somewhat higher.

Using this estimate of H1N1's R0 value, researchers at the Robert Koch Institute in Germany have suggested that a pre-existing partial immunity to pandemic H1N1 in the German population attributable to the factors noted above—vaccination, exposure to the virus with successful recovery and cross protection from earlier flu exposures—could be as high as 38%, high enough to interrupt significant additional transmission.

While this finding is encouraging, it does not argue that pandemic H1N1 will die out. In areas where there still may be large pockets of susceptible individuals, pandemic H1N1 could still cause significant morbidity and mortality.

INSURANCE INDUSTRY IMPACTS

The 2009 H1N1 pandemic illustrates the uncertainty in pandemic and infectious disease risk for insurers and reinsurers. While the H1N1 experience has not caused extreme insurance losses to date, the next pandemic may have a different outcome. The H1N1 pandemic has, however, increased demand for pandemic-related insurance solutions. Several insurers have begun offering pandemic-specific business interruption (BI) coverage or extensions for "non-physical" BI coverage. These products have been developed to fill a gap in most BI policies, which traditionally require physical damage to a location before a payout is triggered.

For example, the Hays Company of Illinois has offered pandemic-specific business interruption coverage since 2008. The trigger in this specialty coverage is linked to the WHO pandemic alert level and the level of absenteeism related to a pandemic. The coverage is designed for large, generally well-insured industries such as education, manufacturing, hospitality, and health care, and the amount of cover provided ranges from $5 million to $100 million per policy. The demand for these offerings has increased in the course of the current H1N1 influenza pandemic.

Life insurers and reinsurers also have begun to respond to the threat of catastrophic losses from pandemics. In late 2009, the $75 million Vita Capital IV Ltd. life insurance securitization was issued. It covers losses from extreme mortality events in the U.S. and the UK over a five-year period ending in 2014. The current level of coverage provided by such mortality bonds, however, is much lower than the life insurance industry's level of exposure.

CATASTROPHE MODELING FOR PANDEMICS

As the level of insurance exposure to losses from pandemic and infectious disease increases, so does the utility of catastrophe modeling. For example, alternate pandemic outcomes could be explored through "what-if" scenarios in which key virus parameters—the pandemic start location and start date, the transmissibility and virulence of the virus, or the duration of the illness the virus causes—are changed.

Figures 2, 3, 4, and 5 below present examples of such "what if" scenarios, generated using AIR's in-house pandemic model. Scenario A, illustrated in Figure 2, describes the progression of a hypothetical pandemic virus having properties similar to the 2009 H1N1 virus. Other scenarios—"B," "C," and "D"—were then generated in which this hypothetical virus's transmissibility and start date characteristics were changed. The four scenarios start out similarly, but the evolution of the pandemic in each case is very different. (It should be kept in mind that these scenarios project the evolution of the hypothetical pandemics in the absence of mitigation efforts such as vaccination, school closures, etc.)

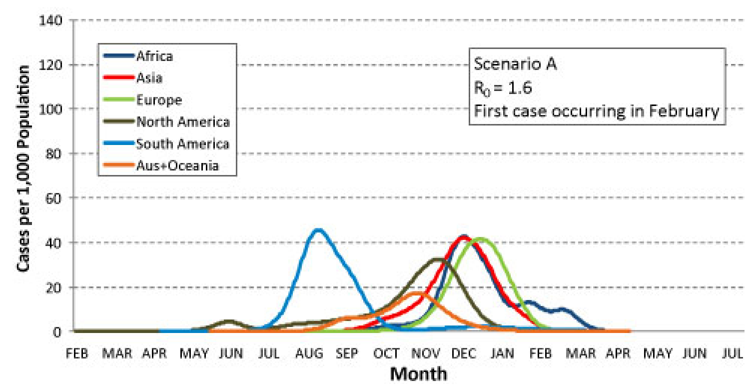

Figure 2. Progression of a hypothetical 2009 H1N1-like influenza pandemic (Source: AIR)

The effect of varying the transmissibility parameter, R0, can be seen in Figure 3. Transmissibility of the Scenario A virus was increased by 25%, from R0 = 1.6 in Scenario A to R0 = 2.0 in Scenario B. All other parameters were held constant.

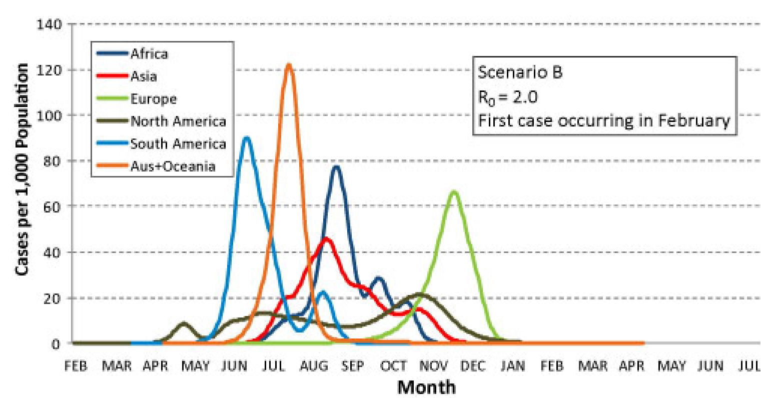

Figure 3. Effect of increasing transmissibility (R0) on the progression of an H1N1-like pandemic. (Source: AIR)

In Scenario B, the progression of the pandemic is faster and has more severe epidemic peaks (as measured by the number of cases per 1,000 population). Another effect is that because the virus is spreading faster, the pandemic reaches Australia earlier. Because this timing coincides more closely with winter in the Southern Hemisphere, it also leads to a much more severe pandemic experience there.

Figure 4 shows the effect of changing the pandemic's start date. In Scenario C, the start date has been shifted by four months, from February (as in Scenario A) to May. This delay in the start date shows a comparable delay in the timing of the epidemic peaks, as would be expected.

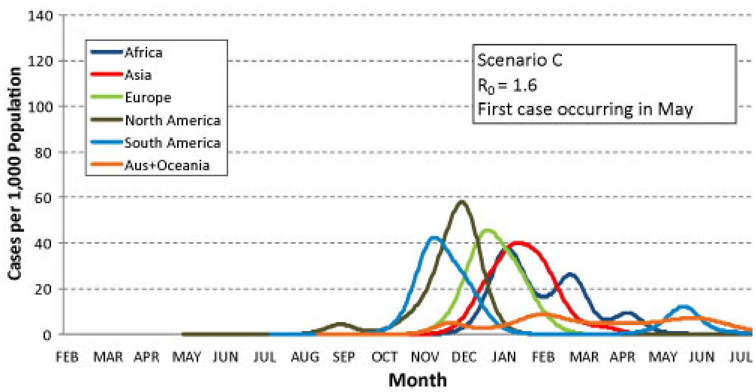

Figure 4. Effect of a delayed start date on the progression of an H1N1-like pandemic. (Source: AIR)

However, a potentially unexpected result is seen in the Northern Hemisphere. In Scenario A, the earlier start date allowed the pandemic virus to persist at low levels during the late spring and early summer, leading to a larger proportion of the population having acquired immunity by the time the winter peak arrived. In Scenario C, however, the North American and European peaks are somewhat higher and more acute because there was less low-level activity in late spring and early summer—and consequently less acquired immunity.

The effect of varying both transmissibility and start date simultaneously can be seen in Scenario D, shown in Figure 5. In this scenario, the peaks experience the greatest degree of synchronicity–that is, they occur at about the same time in all locations.

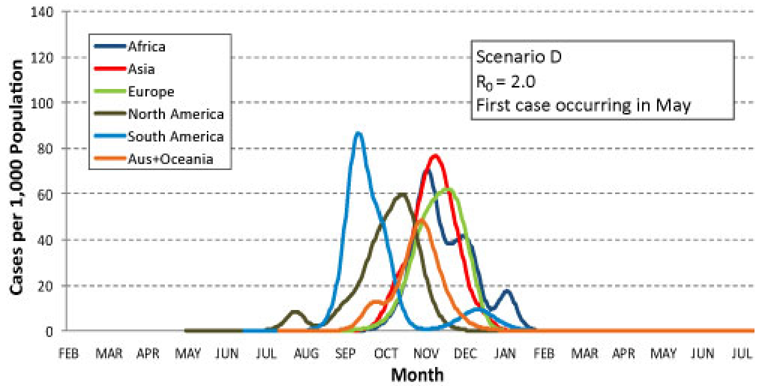

Figure 5. Effect of varying both transmissibility and start date on the progression of a 2009 H1N1-like influenza pandemic. (Source: AIR)

Synchronicity is a key parameter with respect to pandemic response. When there is an extended period of low-level activity and when pandemic peaks are asynchronous—staggered in their timing—hospitals and other healthcare facilities will be less likely to be overwhelmed and will be better able to handle the number of patients seeking care. In this instance, too, there may be fewer of the "worried well"—people who are not actually ill but who seek medical care out of fear or excess caution—which can put additional strain on the healthcare system.

CONCLUSION

The 2009 H1N1 influenza pandemic has not been as severe as had been feared initially. But things might have been very different, and it is incumbent on all stakeholders to prepare for the next event—which will undoubtedly come, and which may well be severe. The four scenarios presented in this article are a small subset of the many outcomes that are possible when one or another of the key parameters of a pandemic is even modestly altered. They do demonstrate, however, that seemingly small changes can have significant impacts on the geographic and temporal evolution of a pandemic—impacts that, in turn, affect the pandemic's final outcome and financial costs. This inherent uncertainty can be captured, estimated and, increasingly, managed through the use of probabilistic modeling.

Editor's Note: AIR is currently developing a pandemic model.

ABOUT AIR WORLDWIDE

AIR Worldwide (AIR) is the scientific leader and most respected provider of risk modeling software and consulting services. AIR founded the catastrophe modeling industry in 1987 and today models the risk from natural catastrophes and terrorism in more than 50 countries. More than 400 insurance, reinsurance, financial, corporate and government clients rely on AIR software and services for catastrophe risk management, insurance-linked securities, site-specific seismic engineering analysis, and property replacement cost valuation. AIR is a member of the ISO family of companies and is headquartered in Boston with additional offices in North America, Europe and Asia. For more information, please visit www. air-worldwide.com.

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