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Editorial

A Call for "Smart Surveillance": A Lesson Learned from H1N1

As we adjust to life within the H1N1 pandemic, we find ourselves asking the same questions posed about the global economic crisis: "How did this happen?" "Where did this begin?" and most importantly, "Why didn't we know this would happen?" Since the emergence of H5N1 avian flu in 1997, the USA alone has spent billions of dollars on pandemic prevention: expanding global surveillance, strengthening Homeland Security, stockpiling the two most effective antivirals (Oseltamivir and Zanamivir), and improving vaccine production capacity. The world seemed to act, for once, with appropriate urgency: Funds from intergovernmental agencies were targeted to bolster surveillance in regions where evidence of human-to-human transmission (the very origins of a new pandemic) were strongest. So, we all watched eagerly as one, then another, report discussed the possibility, probability, or impossibility of the Great H5N1 Pandemic.

Then, seemingly over the course of a weekend last May, we came face-to-face with the real foe—a new H1N1 virus with genes of bird, swine, and human origin, and an alarmingly high initial suspected mortality rate. Like so many of its ancestors, influenza A (H1N1) took us by surprise. While the world's attention (and billions of dollars) focused on the highly pathogenic H5N1 avian influenza bubbling over in Indonesia and Vietnam, this virus emerged and escaped any possibility of containment. What went wrong?

The truth is, despite our best efforts, pandemic preparedness failed to fully address the global problem. It is hard to argue that the chosen target, H5N1, was the correct strategy. This was, and continues to be, a significant threat to global health should it become truly pandemic, with mortality estimates in the tens to hundreds of millions, and an economic impact in the hundreds of billions of dollars. However, efforts to step up surveillance for this virus were unimaginative in strategy and fractionated in operation. Almost all the key international agencies targeted countries such as Indonesia and Vietnam because that was where the virus "spilled over" from birds to people most often. They assumed that if the first chains of human-to-human transmission were discovered, then perhaps the pandemic could be thwarted. But H5N1 has already spread to Europe and Africa, increasing the interface between bird and human dramatically over the past 5 years. Efforts to target surveillance to detect the introduction of these viruses into the Americas were also based on some simple assumptions, and easily challenged by analyses that brought data on bird migration and trade together (Kilpatrick et al., 2006).

But perhaps most important of all, our pandemic prevention strategy fails to take the broader view as it focuses so intensely on the machinations of each strain, and on the politics of surveillance, reporting, and trade regulation. Taking our mind off H5N1 for a minute, we can ask a simple question: "What are the key factors that drive the emergence of new diseases?" For zoonotic diseases, it's a combination of human changes to the environment, agriculture, and healthcare, and changes in demography, all against a background of a large pool of potential new zoonoses—Morse's "zoonotic pool" (Morse, 1993). Where do these factors coincide, overlap, or clash? The answer: In places with recent and rapid demographic changes, where livestock production has been recently intensified, and where wildlife is diverse. In short, our recent analyses show that parts of Mexico are as significant a hotspot for the next new zoonosis as parts of Indonesia or West Africa. Indeed, the proposed origin of the latest H1N1 outbreak, La Gloria, lies squarely on one of the "hottest" pixels in our predictive map for future zoonotic disease emergence (Jones et al., 2008). That article called for a priority-setting approach to global surveillance for pandemics that targets our limited

global resources to those regions most likely to foster the next new disease, and those activities most likely to pick it up—''Smart Surveillance.''

This ''Smart Surveillance'' approach means focusing not just on the backyard poultry operations of Indonesia and Vietnam, but also on livestock production facilities in all of the ''hotspots.'' It means targeting wildlife species known to harbor other zoonoses, and using new technologies to measure the depth of the zoonotic pool, and discover new zoonoses before they jump the gap to people. Most importantly, it means analyzing the pathways to emergence that viruses such as H1N1 travel along—a true fusion of the Social, Behavioral, Ecological, and Health Sciences, and addressed for influenza in the current issue (Leibler et al., 2009). A global effort to address this big vision would provide a dose of stimulus that, for a small up-front cost, may save billions in preventing the pandemic collapse we fear. This approach will be good for our global economy, and good for our health.

Of course, we do not yet know if this new H1N1 pandemic is the first wave harbinger of a second wave doom as appears to have happened in the lead up to the 1918–1919 pandemic. But, perhaps we can breathe a brief sigh of relief and ponder on a new approach to pandemic preparedness: one which brings together Human and Animal Medicine, Virology, Microbiology, Ecology, and the Social Sciences; one which analyzes the different types of farming strategies and how they foster pathogen spillover; one which takes on board people's perceptions of risk, of disease, and of the environment; one which truly fuses Ecology and Health. The name of this new approach can be summed up in a word well known to you, the readers of the journal: *EcoHealth*.

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