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Understanding H5N1 and Enzootic Influenza

How did you go as the "informed source of knowledge" when bird flu inevitably came up in round the barbecue conversations? Did you have trouble explaining how some migratory birds survive while carrying a disease so fatal to domestic birds? Do you feel you are sufficiently aware of the course of this virus to make informed assessments of the news now coming out of Turkey?

Those who have had the opportunity to read, ***H5N1 outbreaks and enzootic influenza***, a paper by Webster RG, Peiris M, Chen H, Guan Y., in the January issue of *Emerging Infectious Diseases* will accept that the latest developments are just another step along a seeming inevitable path. Webster et al believe the global spread of H5N1 in migratory birds and domestic poultry is inevitable. Their question is, "When will it acquire sustained human-to-human transmission?"

Influenza is an ancient disease that has infected humans at irregular intervals throughout recorded history. While the 1918 "Spanish" influenza is the best recorded catastrophic influenza pandemic, similarly severe pandemics occurred earlier, when the human population of the world was much smaller, and they will occur again. Our challenge is to understand all aspects of the influenza virus, the hosts and their response, and the virus' global impact so that we may be better prepared to face the inevitable next influenza pandemic.

The influenza virus that appears most threatening is the avian H5N1 strain that since 2003 has infected >150 persons in Vietnam, Thailand, Cambodia and Turkey. Nonetheless, the H5N1 influenza threat is viewed with disturbing complacency; a frequently heard statement is "since the virus has not adapted to continuing human-to-human transmission by now, it is unlikely to do so in the future." Such complacency is akin to living on a geologic fault line and failing to take precautions against earthquakes and tsunamis. (This comment by Webster et al may be a little dated. A New Zealand Herald poll reports 55% of New Zealanders regard an influenza pandemic as inevitable)

The Source

Influenza A viruses are perpetuated in the wild birds of the world, predominantly in waterfowl, in which the 16 subtypes (which differ by 30% in their hemagglutinin [HA] nucleotide homology) coexist in perfect harmony with their hosts. In these natural hosts, the viruses remain in evolutionary stasis, showing minimal evolution at the amino acid level over extended periods. This fact indicates that the influenza-bird association is ancient; this lack of change is surprising because influenza viruses are segmented, negative-stranded RNA viruses that have no quality-control mechanisms during replication and are highly prone to variation. After transfer to a new type of host, either avian or mammalian, influenza viruses undergo rapid evolution. However, all 16 HA subtypes, including H5 and H7, have until recently been considered to be benign in their natural hosts. This benign equilibrium between the influenza virus and its host may have changed.

Indonesian Bird Market

Genesis of the H5N1 Virus

Before 1997, no evidence had indicated that H5 influenza viruses could infect humans and cause fatal disease. The H7 influenza viruses were known to cause conjunctivitis in humans,

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and serologic studies provided evidence of sub-clinical human infection with the subtypes prevalent in avian live poultry markets. The precursor of the H5N1 influenza virus that spread to humans in 1997 was first detected in Guangdong, China, in 1996, when it caused a moderate number of deaths in geese and attracted very little attention. This goose virus acquired internal gene segments from influenza viruses later found in quail (A/Quail/HK/G1/97 [H9N2]) and also acquired the neuraminidase gene segment from a duck virus (A/Teal/HK/W312/97 [H6N1]) before the goose virus became widespread in live poultry markets in Hong Kong and killed 6 of 18 infected persons.

This H5N1 virus was eradicated by culling all domestic poultry in Hong Kong, and the genotype has not been detected since that time. However, different reassortants continued to emerge from goose and duck reservoirs that contained the same H5 HA glycoprotein but had various internal genes.

The H5N1 viruses continued to evolve, and in late 2002, a single genotype was responsible for killing most wild, domestic, and exotic waterfowl in Hong Kong nature parks. This genotype of H5N1 spread to humans in Hong Kong in February 2002, killing 1 of 2 infected persons, and was the precursor of the Z genotype that became dominant. The Z genotype spread in an unprecedented fashion across Southeast Asia, affecting Vietnam, Thailand, Indonesia, Cambodia, Laos, Korea, Japan, China, and later Malaysia. Further analysis showed that the H5N1 influenza viruses that caused outbreaks in poultry in Japan and Korea were genetically different from those in the other countries (the V genotype). The phylogeny of the recent Z genotype viruses showed that viruses isolated in Vietnam and Thailand formed a cluster that remained distinct from those isolated in Indonesia.

To date, >140 million domesticated birds have been killed by the virus or culled to stem its spread. These recent H5N1 influenza viruses have acquired the unprecedented and disturbing capability to infect humans; to cause neurotropic disease and a high proportion of deaths in waterfowl in nature; to cause death in and be transmitted among felid species, including domestic cats; and to cause neurotropic disease and death in ferrets and mice. These incremental changes intensify concern about this H5N1 virus' pandemic potential.

These traits are likely to have been acquired initially by reassortment in 2001 and 2002, when a plethora of different genotypes were detected in poultry markets and later in farms in Hong Kong.

These genes were presumably acquired from viruses found in waterfowl in Southeast Asia, but the actual gene donors have not yet been identified. Since late 2002, the Z genotype has become dominant, but phylogenetically distinguishable viruses have continued to co-circulate in Indonesia and western China.

A Turkish veterinary official in full protective gear runs after poultry in the snow-covered eastern city of Van in Turkey

The H5N1 viruses continue to evolve, initially by reassortment and more recently by mutation and deletion.

Thus, the H5N1 viruses continue to evolve, initially by reassortment and more recently by mutation and deletion. While most H5N1 influenza viruses isolated from avian species in Asia since 1997 are highly pathogenic in gallinaceous poultry, they show heterogeneous pathogenicity in other species. In domestic ducks, the pathogenicity of the H5N1 viruses varies from high to nonpathogenic. In ferrets, most avian isolates replicate and cause respiratory tract infection, while a few strains are highly pathogenic and neurotropic (causing hind leg paralysis), and the virus has been isolated from the brain. In contrast, all isolates from humans are highly pathogenic to ferrets. A similar pattern is found in experimental infection of mice, in which most avian isolates cause respiratory infection.

Mechanisms of Spread

In previous outbreaks of highly pathogenic H5 and H7 infection in multiple countries, the spread was directly attributable to humans. The main way influenza virus is spread in poultry is by movement of poultry and poultry products. Therefore, establishing good bio-security measures on poultry farms is an important defence. Nonetheless, the involvement of multiple lineages of H5N1 argues against human-mediated spread from a single source. Live poultry markets are an amplifier and reservoir of infection and probably play a role in the maintenance and spread of the virus in the region.

However, a number of other factors unique to affected Asian countries make control difficult. Backyard flocks are common in the region, and these domesticated birds are not subject to any biosecurity measures. Fighting cocks are prized possessions and are often transported long distances. Fighting cocks may also play a role in the spread of infection and in transmission to humans. Many of the affected countries have a weak veterinary infrastructure and are facing highly pathogenic avian influenza outbreaks for the first time. The migrant ducks that commonly wander through rice fields scavenging fallen rice seeds are another potent mechanism for the spread of infection.

Role of Domestic Ducks

After late 2002, when H5N1 viruses had killed waterfowl in Kowloon Park in Hong Kong, most avian H5N1 isolates isolated in Vietnam, Thailand, and Indonesia were highly pathogenic to chickens and domestic ducks.

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However, by late 2003 and early 2004, some avian isolates were non-pathogenic to ducks but retained their pathogenicity to chickens. Genetic analysis of these isolates showed evidence of multiple variants within single specimens. On Madin-Darby canine kidney (MDCK) cells, these viruses formed a mixture of small and large plaques that had different biologic properties. Viruses that formed large plaques were usually highly pathogenic to ducks and ferrets, whereas viruses that formed small plaques were usually nonpathogenic to both birds and ferrets. Some virus isolates formed small plaques that were pathogenic to ducks. Thus, plaque size was not a marker of pathogenicity. When ducks were orally infected with the original mixed population of H5N1 viruses, most birds died, but some excreted virus for an extended period (up to 17 days).

The viruses shed on day 17 had become non-pathogenic to ducks, although they remained highly pathogenic to chickens. Sequence analysis of the HA showed that these viruses differed from the original dominant virus at multiple amino acids and were antigenically distinguishable in HI tests.

Notably, this phenomenon has repeatedly been reported for other influenza viruses that are in the process of altering their interspecies transmission, including European avian H1N1 viruses that were transmitted to pigs, H9N2 viruses that were transmitted to pigs and humans, and now H5N1 viruses that are transmitted from ducks to humans.

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A subdominant population of H5N1 viruses is presumably selected in ducks after the immune response clears the dominant virus. The subdominant population appears to be uniformly non-pathogenic to ducks, as if this is the natural situation for influenza in the duck. These viruses' loss of pathogenicity to ducks, but retention of pathogenicity to chickens and presumably to humans, has been a problem associated with their eradication. In Vietnam, for example, disease signs were used as the criteria for identifying H5N1 infection in ducks. Thus, the duck has become the Trojan horse of highly pathogenic H5N1 influenza in Asia.

Role of Migratory Birds

Migratory waterfowl are generally believed to be the main reservoir of all 16 subtypes of influenza A viruses, including H5 and H7 subtypes. However, less agreement is found regarding the role of migratory waterfowl in the initial spread of highly pathogenic H5N1 viruses across eastern Asia in 2003. The isolation of highly pathogenic H5N1 from herons, egrets, and peregrine falcons in Hong Kong in 2003 and 2004 leaves no doubt that wild migratory birds can be infected and may spread disease to local poultry flocks. The outbreak in Qinghai Lake proves that these highly pathogenic H5N1 influenza viruses are transmissible among migratory waterfowl. The migration route of shorebirds in the east Asian-Australasian flyway does overlap the areas that have had H5N1 outbreaks, although the virus has been notably absent in Taiwan, Malaysia (except for occasional outbreaks near the Thai border), and western Australia. The role of migratory birds in the transmission and spread of highly pathogenic H5N1 viruses is still unclear.

Although culling domestic poultry to contain the spread of highly pathogenic H5N1 virus is considered an acceptable agricultural practice, culling migratory birds is not acceptable to any international authority (Food and Agriculture Organization of the United Nations [FAO], the World Organization for Animal Health [OIE], the World Health Organization [WHO]). The idea of culling migratory birds must be strongly discouraged, for it could have unknown ecologic consequences. Instead, since highly pathogenic H5N1 has been demonstrated in migratory birds, the poultry industries of the world must adapt measures such as increased bio-security, the use of vaccines, or both.

Early detection and aggressive control measures allowed Japan, South Korea, and Malaysia to eradicate H5N1 virus soon after its introduction into those countries' poultry flocks, demonstrating that rapid and determined responses can keep the virus from gaining a foothold. In other countries in Asia, delayed detection and response caused the virus to become entrenched across a wide region, and eradication at this stage has become a formidable undertaking.

Turkish Veterinarians culling geese

Agricultural Vaccines

The need for H5N1 vaccines for domestic poultry is increasing. Adopting a policy to use vaccines in poultry is an important decision for agricultural authorities in countries such as Thailand (a major poultry exporter) and Vietnam. Both countries are investigating their specific needs. While considerable data exist on the efficacy of influenza vaccines in domestic chickens, little comparable information is available regarding ducks. The pros and cons of the use of vaccines in poultry have been reviewed. Current technologies permit discrimination between vaccinated and naturally infected birds; however, vaccines are not standardized on the basis of antigen content. "Good" and "bad" agricultural vaccines are in use.

Good Agricultural Vaccines

Good agricultural vaccines provide protection from disease despite lack of a close antigenic match between the vaccine and circulating strain and reduce the virus load below the level of transmissibility. They do not provide

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sterilizing immunity: vaccinated birds may excrete low levels of virus after challenge infection. Sentinel unvaccinated birds are kept in each house to monitor for virus shedding, antigenic drift, or both.

Bad Agricultural Vaccines

Bad agricultural vaccines prevent disease signs but do not prevent shedding of transmissible levels of virus. They also promote undetected spread of virus on farms and to live poultry markets and promote antigenic drift. China and Indonesia have adopted poultry vaccination to control H5N1, and Vietnam has begun vaccine trials in poultry. However, the resurgence of H5N1 in Indonesian poultry and pigs and the detection of H5N1 in apparently healthy birds in live poultry markets in China suggest that some vaccines are of suboptimal quality or that co-infection masks disease. The adoption of a vaccine strategy for H5N2 virus in Mexico in the 1980s reduced disease signs but has not eliminated the H5N2 virus from the region; instead, vaccination may have contributed to the virus' widespread presence in Central America and to its antigenic drift.

H9N2 and Cross-protection

The clinical signs of infection with highly pathogenic H5N1 virus may be masked by cross-protection by other influenza subtypes, but this fact is often overlooked. During the initial outbreak of highly pathogenic H5N1 in Hong Kong in 1997, chickens in the live poultry markets exhibited no disease signs, yet samples from apparently healthy chickens, ducks, and quail showed highly pathogenic H5N1 in each of the poultry markets surveyed. Surveillance showed that multiple influenza subtypes were co-circulating, including 2 lineages of H9N2, the first represented by the G1 lineage (A/Quail/Hong Kong/G1/97 [H9N2]) and the other by G9 (A/Chicken/Hong Kong/G9/97 [H9N2]). The G1 lineage has the same 6 internal gene segments as the index H5N1 human isolate (A/Hong Kong/156/97 [H5N1]) and is believed to have been the donor of these genes during reassortment that produced the original H5N1 human strain in 1997. In laboratory studies, chickens previously infected with H9N2 were protected from disease signs and death when challenged with highly pathogenic H5N1, but the chickens shed H5N1 virus in their faeces. Further studies in inbred chickens established that the cross-protection was due to cell-mediated immunity and that it could be transferred by CD8+ T cells but not by antibodies.

Conclusion

Conventional wisdom about pandemic influenza holds that a pandemic is inevitable and that the only question remaining is "When?" The H5N1 virus continues to evolve and spread. Perhaps the most insidious threat comes from unobserved transmission through wild and domestic ducks. We cannot afford simply to hope that human-to-human spread of H5N1 will not happen and that, if it does, the pathogenicity of the virus will attenuate.

The precursor of the severe acute respiratory syndrome (SARS)–associated coronavirus repeatedly crossed species barriers, probably for many years, before it finally acquired the capacity for human-to-human transmission,

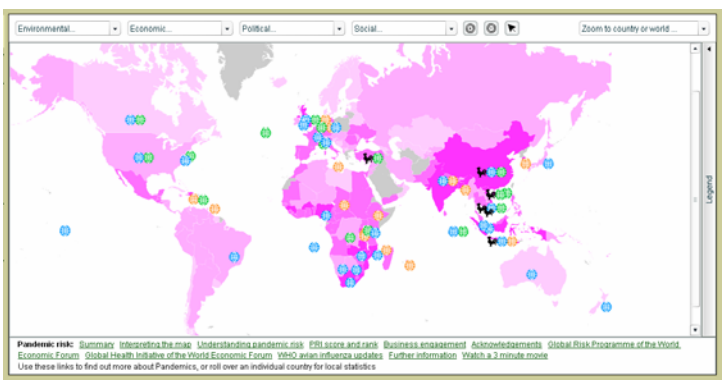
Notably, the precursor of the severe acute respiratory syndrome (SARS)–associated coronavirus repeatedly crossed species barriers, probably for many years, before it finally acquired the capacity for human-to-human transmission, and its pathogenicity to humans was not attenuated. SARS was interrupted by early case detection and isolation, but influenza is transmissible early in the course of the disease and cannot be controlled by similar means.

We cannot wait and allow nature to take its course. We must use this window of opportunity to prepare and to begin pre-pandemic implementation of prevention and control measures. **#**

Maplecroft Pandemic Risk Index

The Maplecroft Pandemic Risk Index (PRI) has been designed to be a tool for the assessment of risk posed to individual countries, and a conducive business environment within those countries, by the emergence of a new pandemic disease. Since, by definition, these diseases are unknown until they emerge in humans, the PRI is not specific to individual diseases but attempts to include as many potential new diseases as possible. Examples of past pandemics that give an indication of the type of diseases that the PRI is relevant to include: influenza, HIV/AIDS, BSE, malaria, Ebola, and SARS.

The Global map of pandemic risk provides a perspective of the risk from emerging diseases in 161 countries across the world. It explores the risk posed to human health and, by association, economic activity in each country by an outbreak of a pandemic disease. Levels of risk shown on the map have been determined based on Maplecroft's Pandemic Risk Index (PRI) which analyses three components of pandemic risk: (1) The risk of emergence of a new human disease in each country. (2) The risk of the spread of such a disease to and within each country. (3) The capacity of each country to contain an outbreak of disease.



Three regions of 'extreme' and 'high' pandemic risk are apparent from the Global map. These are; Southeast Asia, Western Europe, and Africa.

Many African countries fall into the 'high' and 'extreme' risk categories overall. densities. The only Western European country in the extreme group is the United Kingdom

Not comforting news for those planning a holiday in the UK later this year. **#**

Is Ring Fencing Viable?

Influenza pandemic strategies at both international and national levels include ring fencing as a tactic to try and contain the spread of the virus. Ring fencing is a well established and credible public health intervention yet many question its validity in the face of an expected rapid spread of a new virus. Henry Miller, a fellow with the Hoover Institution at Stanford University, an FDA official from 1979 to 1994 and a sometime member of the OECD Group of National Experts on Biotechnology, voiced his concerns in an opinion piece in the Korean Herald of 12 January.

"The issues surrounding the possibility of a pandemic of the H5N1 strain of avian flu are extraordinarily complex, encompassing medicine, epidemiology, virology, and even politics and ethics. It is thus hardly surprising that commentaries about avian flu often miss the mark. A recent New York Times editorial, for example, decried wealthy countries' "me first" attitude toward a possible H5N1 pandemic, because "the best hope of stopping a pandemic, or at least buying time to respond, is to improve surveillance and health practices in East Africa and Asia, where one would probably begin."

To be sure, good surveillance is needed in order to obtain early warning that a strain of H5N1 flu transmissible between humans has been detected, so that nations around the world can rapidly initiate a variety of public health measures, including a program to produce large amounts of vaccine against that strain. But the massive undertaking required to "improve health practices in the poorest countries of the world" plays better on the editorial page than on the ground.

Intensive animal husbandry procedures that place billions of poultry and swine in close proximity to humans, combined with unsanitary conditions, poverty, and grossly inadequate public health infrastructure of all kinds, make it unlikely that a pandemic can be prevented or contained at the source. It is noteworthy that China's chaotic effort to vaccinate 14 billion chickens has been compromised by counterfeit vaccines and the absence of protective gear for vaccination teams, which might actually spread disease by carrying faecal material on their shoes from one farm to another.

In theory, it is possible to contain a flu pandemic in its early stages by performing "ring prophylaxis" . . . . .

However, a strategy can be "cost-effective" only if it is feasible.

In theory, it is possible to contain a flu pandemic in its early stages by performing "ring prophylaxis" - using anti-flu drugs and quarantine aggressively to isolate relatively small outbreaks of a human-to-human transmissible strain of H5N1. According to Johns Hopkins University virologist Donald S. Burke, "it may be possible to identify a human outbreak at the earliest stage, while there are fewer than 100 cases, and deploy international resources - such as a WHO stockpile of antiviral drugs - to rapidly quench it. [The strategy the WHO is currently adopting in Turkey] This 'tipping point' strategy is highly cost-effective."

However, a strategy can be "cost-effective" only if it is feasible. Although ring prophylaxis might work in Minneapolis, Toronto, or Zurich, in the parts of the world where flu pandemics begin, the probability of success approaches zero. In places like Vietnam, Indonesia, and China - where the pandemic strain will likely originate - expertise, coordination, discipline, and infrastructure are lacking.

The response in Turkey - where as many as 50 possible cases have appeared in the eastern part of the country - is instructive. Officials in that region warned the government on December 16 of a surge in bird deaths, but it took 12 days for an investigation to begin. When a fourteen-year-old boy became Turkey's first avian flu mortality (soon followed by two siblings), a government spokesman criticized doctors for mentioning the disease because they were "damaging Turkey's reputation." This is ominously reminiscent of China's initial response to SARS in 2003.

For now, it seems that all of the human H5N1 infections have been contracted from contact with infected poultry. But the situation in Turkey is what the outbreak of a human to human pandemic could look like at its earliest stages: the rapid spread of confirmed cases (and deaths) from an initial site to nearby villages and cities. We would expect to see a large number of illnesses among both employees and patients in hospitals where the victims are treated, and soon someone (perhaps even a carrier who is not ill) would spread it to Ankara, Istanbul, Tbilisi, Damascus and beyond.

The anti-flu drugs Tamiflu and Relenza are extremely expensive and in short supply. History suggests that if we were to make these drugs available to poor countries for ring prophylaxis, they would often be administered improperly - such as in sub-optimal doses - in a way that would promote viral resistance and only intensify a pandemic. Or perhaps they would be sold on the black market to enrich corrupt government officials.

A politically incorrect but rational strategy would be for rich countries to devote resources to developing countries primarily for surveillance. They would obtain timely warning of the existence of an H5N1 strain that is transmissible from human to human, but would focus the vast majority of their funding on parallel, low- and high-tech approaches - vaccines, drugs, and other public health measures - that would primarily benefit themselves.

If the pandemic were to begin relatively soon - say, within a year or two - there would be little that could be done to attenuate significantly the first wave of infections. But, if we're ready to rush the pandemic strain into an emergency program to manufacture vaccine, we could possibly blunt the second wave.

A flu pandemic will require triage on many levels, including not only decisions about which patients are likely to benefit from scarce commodities but also broader public policy choices about how best - among, literally, a world of possibilities - to expend and allocate resources." #

Resilience – What is the bottom Line?

Robert Patton

The word 'resilience' has become commonplace in our vocabulary when we talk about emergencies and all that goes with it. We glibly talk of resilient communities, building resilient systems. A quick search of the internet, using 'resilience' as a search word, links it with phrases such as 'reducing risk' and 'mitigating impact'. It all sounds very reassuring and comforting. But what does resilience really mean?

A recent experience caused me to cogitate on what really is the essence of resilience. I was in a remote part of Kenya near the border with Tanzania in the shadow of Mt. Kilimanjaro visiting a Maasai village. Here were these people, who breathe and eat and sleep basically the same as I do to live. But that is where the similarity seemed to stop. There was no electricity, telephones, running water, sealed road, supermarket and so on. Leave me in their environment for one day and it would certainly be clear who was the most resilient.

Wait a minute! Is it really that much different to me in my environment? The Maasai face certain hazards; for example wild animals. To 'reduce the risk' and 'increase their resilience' their houses were collected in a circle with all entrances on the inner aspect of the circle. The houses were surrounded by a roll of spiky acacia branches that was closed at night. They had domestic dogs that acted as "alarms" for any approaching animal and as a last resort the Maasai male had his spear. There was an inner ring of acacia where the Maasai's most precious possession, their cows, were kept at night. Just like us, they were surrounded by all their protection devices, back-up systems and armed with their collective might.

But what happens if all this fails and we're on our own? I can still see and hear a woman's plea as she sat on the side of the road after hurricane Katrina: "I am starving and thirsty and the authorities still haven't delivered anything to me!" In contrast I recall people in the town of Meulaboh (Indonesia) after the tsunami of a year ago re-establishing basic food markets amongst debris in less than a week after the devastating event.

Many miles from the Maasai village my vehicle stops on the dusty track and the engine is cut. Not a sound is heard. As far as the eye can see the ground is flat and featureless, marked occasionally by the dark shadow of a tree or bush shimmering in the scorching heat. Small groups of animals can be seen searching for dry bits of grass and birds scratch and poke for seeds. Apart from this nothing else moves or appears to inhabit this huge space.

The stillness is broken as the driver toots the horn. Two children gradually appear from behind a tree. An exchange of voices and the children are running to the vehicle. What excitement as we shared uneaten portions of our safari lunch with these herders. Within minutes there were at least eight children surrounding the vehicle, all looking for something. Five minutes later we were alone again and I could have sworn there was no one for miles and that I had just experienced an illusion.

Here is the real key to the resilience of the Maasai. It is not their village and the associated risk reduction and protection systems. It is the training and experience of their people from a young age to survive on their own during the day.

In every emergency and disaster event I have been involved with the very reason why the event is labelled as such is because equipment and systems have failed, usually leaving only human resources. The key to resilience is ensuring people have the right information, training and experience to enable them to manage and get through the initial stages of an emergency. Think back to emergencies you have been involved with.

I can almost guarantee that in most instances the successful management and outcome was due to the resourcefulness, determination and grit of one or two people.

In all our planning and preparations let us not become too dependent on equipment and systems and procedures around us but build resilience into our people – the bottom line!

Footnote: By the way, my wife decided she didn't want to be a Maasai woman when she discovered that she is likely to share her husband with nine other wives, that she has responsibility for building and maintaining her house, that as a gesture of hospitality her husband might offer her to a male guest staying the night and that in value terms she comes after her husband's cows. In the light of that little revelation I don't look too bad after all! **#**

***Eds Note**

Resilience is now often described as "an ability to adapt (to the environment). Robert's account demonstrates the ability of the Maasai people to adapt to their harsh environment.

Avian Influenza: Communicating the Risk

As the bird flu spreads into Eastern Europe and inevitably brings the world nearer to a new flu pandemic, we need to continue and expand our communication of the risk to our population. But raising awareness about uncertain threats can itself be perilous. In Perspectives in Health Vol 10, 2, risk communication consultants Peter Sandman and Jody Lanard discuss the issue and offer their advice on how to sound the alarm.

Public health officials have a pandemic-size communication problem. H5N1 could disappear, as swine flu did in 1976; and "The Great Pandemic of 2xxx" could arise from a strain that doesn't even exist yet. Even if H5N1 does cause a human pandemic, it might weaken and produce only mild disease. So how hard do officials sound the alarm? They have to balance the need to keep the public fully informed without being accused of needlessly frightening. They also don't want to be accused later of leaving the public under-prepared for a disaster.

Communication would be easy if it were possible to get ready for the next pandemic without talking to the public. It isn't. The public needs to be aware of this grave threat for three fundamental reasons: So people will prepare themselves emotionally and logistically; So people will help their schools, businesses, hospitals, and other organizations prepare; And so people will support the preparedness efforts of their governments. There's a fourth more important reason: If and when a pandemic begins, people who have had time to get used to the idea are more likely to understand their risks, follow official advice, and take an active role in protecting themselves.

The challenge is to pitch the message at the right volume. Too soft a warning just won't get heard; it's not easy to pierce people's apathy and squeeze yet another problem onto our already crowded lists of concerns. But too loud a warning could overshoot, provoking needless (or at least premature) fear and economic damage. Hitting the middle ground can help build mutual trust: involve the public early, arouse an appropriate level of public apprehension, and help people bear it.

Risk communication is a set of skills and understandings that can help health officials find and hold this middle ground. The threat of bird flu presents a timely and urgent case for looking at how risk communication works.

A fundamental risk communication truth is that the factors that make a risk upsetting and the factors that make it dangerous are completely different. Mortality and morbidity statistics determine the technical seriousness of the risk. But they often have little impact on how worried, frightened, or angry people are. Think of that as "cultural seriousness," determined by factors like these: Is the risk voluntary or coerced? Familiar or exotic? Controlled by the people at risk or by others?

The annual flu season is a perfect paradigm of a risk that is serious technically but not so serious culturally; the sort of risk that kills people but doesn't much upset them. It is familiar rather than exotic, and anything but memorable (especially since it has been so long since the last pandemic).

Catching influenza isn't voluntary, but in developed countries getting vaccinated against it usually is. It is chronic rather than catastrophic, reappearing every year like clockwork. It's not especially dreaded. Except for striking too many old people, it is indiscriminatingly fair. And there aren't very many flu controversies in a typical year. No battles over control or fairness, no issues of morality or trust or responsiveness. It is very, very difficult to get people really worried about influenza.

There is plenty of information about the avian influenza threat publicly available. Most people have already heard a little about bird flu. But people face a host of other problems, and except for public health officials, few are gearing up for action about H5N1. Yet.

Enter risk communication. Although people have always tried to figure out how to communicate about risks, the

An Inman prays at the grave of a Turkish bird flu victim

field of risk communication dates back only to the 1980s, evolving from health education, public relations, psychology, risk perception, and risk assessment. There are at least three kinds of risk communication:

Precaution advocacy ("Watch out!"): How to alert people to serious hazards when they are unduly apathetic.

Outrage management ("Calm down!"): How to reassure people about minor hazards when they are unduly upset.

Crisis communication ("We'll get through it together!"): How to guide people through serious hazards when they are appropriately upset (or even in denial).

Bird flu risk communication is partly precaution advocacy and partly crisis communication. It's precaution advocacy if you're talking to Southeast Asian poultry farmers who haven't heard much yet about bird flu. It's crisis communication if you're talking to poultry farmers who are trying to figure out how to cope with this huge new threat to their flocks, their livelihoods, and potentially their lives. It will be crisis communication everywhere if and when the pandemic materializes.

Meanwhile, for most of us, it's precaution advocacy. Many infectious disease experts are as worried about H5N1 as they have ever been about any micro organism. They feel weirdly alienated when they try to explain their worry to spouses or friends, or the general public. They have convinced a few medical journalists, who then feel weirdly alien-

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ated when they try to explain their worry to their editors. Bird flu is way over there in Asia. H5N1 is still flu, and flu is still the sort of risk people don't take all that seriously.

The recommendations listed below are grounded in two convictions: that motivating people to start taking bird flu seriously should be a top priority for government health departments, and that risk communication principles provide the best guidance on how to do so. The world's governments will inevitably vary in the extent to which they agree. How aggressively will these recommendations be followed? How well will they work? Nobody knows yet.

1. Start where your audience starts

Telling people who believe X that they ought to believe Y naturally provokes resistance. You can't ignore X and just say Y-Y-Y-Y. You can't simply tell people they're wrong. You've got to start where they are, with X, and empathetically explain why X seems logical, why it's widely believed, why you used to believe it too ... and why, surprisingly, Y turns out to be closer to the truth.

Overconfident reassurance is terrible risk communication. Paradoxically, people usually find it alarming.

The biggest barrier to sounding the alarm about bird flu is that it's flu - usually seen as a ho-hum disease. It would help if people stopped calling every minor respiratory infection "a touch of the flu," but that's not going to happen. Empathy is the only answer. Instead of ignoring the fact that people think flu is minor, or berating people for thinking that flu is minor, acknowledge that even some public health authorities use the term "flu" in ways that minimize its seriousness. (A senior U.S. health official recently apologized for his wife's absence at an event by saying she was home with "a stomach flu" - a misnomer.) After making common cause with the public - "we have all ignored influenza for too long" - talk about how horrific the next flu pandemic may be compared with the annual flu.

2. Don't be afraid to frighten people

Fear appeals have had a bad press, but the research evidence that they work is overwhelming. Although people don't usually stay very frightened very long, getting them a little frightened for a little while motivates precautionary thinking and precautionary action (assuming some precautions are available).

There is one key exception. When people are already terrified, scaring them even more can push them into denial. For example, women sometimes avoid breast self-examination, not because breast cancer scares them too little but because it scares them too much. In places where bird flu is endemic, magical thinking and denial are already a problem. "I am not afraid of bird flu.... I would have been the first who died when the disease struck last year. But look, I am still healthy," a Thai chicken butcher from Roi Et province told the Bangkok Post in February 2005. The Post noted that the butcher wore "no protective gear except nylon gloves." For most of the world right now, though, apathy is the problem—not denial. We can't scare people enough about H5N1. WHO has been trying for over a year, with evermore-dramatic appeals to the media, the public, and Member States. Until a pandemic begins, there's little chance we'll scare people too much.

Research evidence won't protect you from criticism, of course. Fear appeals often provoke angry pushback from people questioning your motives or your competence, accusing you of "crying wolf" or provoking "warning fatigue" or panicking the public. That happened after WHO Western Pacific Regional Director Shigeru Omi said that, in a worst case, a bird flu pandemic could kill up to 100 million people (a well-justified estimate). Of course, there is a genuine downside to issuing warnings that turn out to be unnecessary. Although panic is unlikely and warning fatigue is temporary, there is some credibility loss, especially if the warnings were exaggerated or overconfident. But consider the alternative. Which is worse, being criticized for "unduly" frightening people or being criticized for failing to warn people?

3. Acknowledge uncertainty

When the first Thai bird flu outbreaks subsided in 2004, a senior public official said: "The first wave of bird flu outbreak has passed ... but we don't know when the second wave will come, and we don't trust the situation.... So the Public Health Ministry is being as careful as possible." This exemplifies two risk communication principles: acknowledge uncertainty and don't over reassure. During Malaysia's first outbreak, tests were pending regarding what strain of flu was killing the chickens. Senior veterinary official Hawari Hussein said, "We know it is H5, but we're hoping it won't be H5N1." This very brief comment not only acknowledges uncertainty; it also expresses wishes, another good crisis communication practice. Everyone shared Hussein's hope, but feared the worst.

Overconfident reassurance is terrible risk communication. Paradoxically, people usually find it alarming.

Overconfident over reassurance ("the situation is under control, everything is going to be fine") is terrible risk communication. Paradoxically, people usually find it alarming. They sense its insincerity and become mistrustful even before they know the outcome. But overconfident warnings are also unwise. There is so much we don't know about H5N1. Will it ever achieve efficient human-to-human transmission and ignite a pandemic? If that happens, will it become less lethal in the process or perhaps not lethal at all? How many people will it infect? How quickly will it spread? How long will it last? How much antiviral medication will be available in different parts of the world, and how well will it work? How long will it take for an effective vaccine to be available? Which countries and which people in those countries will get the vaccine first? How well will health care systems cope? How well will national and international economies cope? And how well will civil society cope?

Bird flu experts and risk communicators cannot answer these questions. But we can and should raise them, acknowledging our uncertainty at every turn.

4. Share dilemmas

Sharing dilemmas is a lot like acknowledging uncertainty. Not only are we unsure about what will happen; we're also unsure about what to do. Everyone finds this hard to admit. But dilemma-sharing has huge advantages:

It humanizes the organization by letting the pain of difficult decisions show.

It gives people a chance to make suggestions and be part of the process.

It moderates the conflict between op-

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posing recommendations.

It reduces the outrage if you turn out to be wrong.

Officials who make difficult, debatable decisions look easy and obvious are colluding with people's passive desire to be taken care of by an all-knowing government. They then feel entitled to blame the government if things go badly. Dilemma-sharing does raise some anxiety at first, but it allies with the public's resilient, resourceful, mature side. This leads to better buy-in and better coping down the road.

> The most important bird flu dilemma at the moment is stockpiling.
>
> Share the dilemma and let the public help you decide.

The most important bird flu dilemma at the moment is stockpiling. If we stockpile H5 antigen or an H5N1 vaccine (once it exists), that may save millions of lives if a pandemic materializes. But a vaccine is no magic solution. We probably can't make and distribute enough vaccine for most of the world. And what if there is no pandemic? Or what if the virus mutates or drifts a lot, and the vaccine proves minimally useful? Is this really a good use of scarce health dollars, especially in developing countries? Maybe we should stockpile antiviral drugs. But they're expensive, and who knows how well they will work against the actual pandemic strain that arises? The risk communication answer: Share the dilemma and let the public help you decide.

5. Give people things to do

One reason sometimes given for not alarming the public is that there's nothing for people to do anyway. A Jan. 13, 2005, Wall Street Journal article quoted Canadian infectious disease expert Richard Schabas as saying: "Scaring people about avian influenza accomplishes nothing, because we're not asking people to do anything about it." But the error isn't scaring people. The error is failing to realise and say how much they can do to prepare.

Helping resolve government policy dilemmas is just the beginning. Thailand, for example, has trained almost a million volunteers to reach out to every village in the country to inform people about the risks and signs of bird flu and how to try to protect themselves and their flocks. Many companies, hospitals, schools, and local governments around the world are starting to plan for "business continuity" in the event of a pandemic. Even cognitive and emotional rehearsal—learning about H5N1 and thinking about what a pandemic might be like and how you'd cope—is a kind of preparedness and a kind of involvement. The WHO outbreak guidelines say: "If possible, representatives of the public should be brought into the decision-making process.... Risk communication messages should include information about what the public can do to make themselves safer."

Here are some other recommendations in brief:

6. Be willing to speculate responsibly

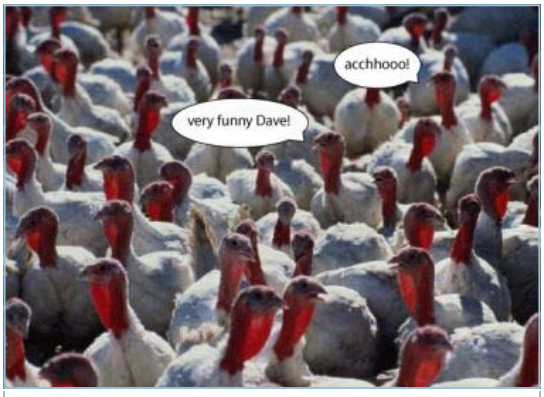
Warnings are intrinsically speculations. Like hurricane forecasters, we have to offer both worst-case scenarios and likelier scenarios, always acknowledging that we may turn out to be wrong.

7. Don't get caught in the numbers game

Battles over how many people an H5N1 pandemic might kill are pointless. What matters is that flu pandemics are horrific, and for the first time ever we can see one coming and start getting ready.

8. Stress magnitude more than probability

The rationale for H5N1 pandemic preparedness isn't that we're sure it's coming, but how bad it could get. Overconfidence about risk probability is a mistake. Dramatic warnings about risk magnitude are more justified. (There are times when it's best to stress probability. But the uncertain prospect of a catastrophe should be about magnitude.)



Is this black humour good risk communication?

9. Guide the adjustment reaction

Once people get past their apathy and start taking a new risk seriously, the normal response is an "adjustment reaction" - a temporary fearfulness, sometimes accompanied by misplaced or excessive caution. This is the teachable moment. Don't ignore it or ridicule it; guide it. Then we settle into the "new normal."

10. Inform the public early and aim for total candour and transparency

These are two of the hardest risk communication recommendations for governments to adopt. There are so many barriers - fear of damaging the economy, looking incompetent, turning out to be wrong, causing undue alarm. But the price of informing the public late, of covering up or minimizing the problem, is high: diminished credibility, just when you need it most to help your people through an influenza pandemic.

Most of these recommendations are counterintuitive. That's the toughest thing about risk communication: it contradicts what comes naturally to most authorities, especially when they're under pressure. And risk communication is itself an uncertain field. We think it improves the odds of a good outcome, but we can't guarantee a good outcome every time. Health officials face tough choices as they plan how to talk to people about a possible flu pandemic, and one of those choices is: how much to let risk communication guide their choices.

If you make a list of risks in order of how many people they kill each year, then list them in order of how upsetting they are to the general public, the two lists will be very different. There are risks that kill a lot of people without upsetting many; not just flu but food poisoning, smoking, overeating, not exercising, etc. And there are risks that upset a lot of people without killing very many.

Both problems frustrate risk experts and make them irritated with the public for being afraid of the "wrong risks." Risk communication experts can't completely cure this mismatch, but they can help the experts understand why the public so often seems to get it "wrong."

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The core problem is definition. To the experts, risk means expected annual mortality (or morbidity). To the public, risk means much more than that. Let's redefine terms: Call the death rate (what the experts mean by risk) "hazard." Gather together all the other factors that make people frightened, angry, or otherwise upset about a risk and label them, collectively, "outrage." Risk = Hazard + Outrage. The public pays too little attention to hazard; the experts pay absolutely no attention to outrage. Not surprisingly, the two groups rank risks differently. Risk perception scholars have identified more than 20 "outrage factors." Here are some of the main ones:

Voluntariness

A voluntary risk is much more acceptable to people than a coerced risk, because it generates no outrage. Consider the difference between getting pushed down a mountain on slippery sticks and deciding to go skiing.

Control

Almost everybody feels safer driving than riding in the passenger seat. When prevention and mitigation are in the individual's hands, the risk (though not the hazard) is much lower than when they are in the hands of a government agency.

Fairness

People who must endure greater risks than their neighbours, without access to greater benefits, are naturally outraged - especially if the differences are grounded in politics, poverty, or race. An unfair risk is a big risk. The same is true of countries that are forced to endure risks that other countries don't have to bear.

Trust

In a high-tech world, people often doubt their own ability to distinguish dangerous risks from insignificant ones. But we feel confident that we can tell trustworthy sources from those who distort or withhold information. So we use trust, credibility, and candour as stand-ins for hazard. Why "buy" a risk assessment from someone you wouldn't buy a used car from?

Responsiveness

Does the corporation or government agency that imposes the risk or tells you it's trivial seem concerned, or arrogant? Does it tell the community what's going on before decisions are made? Does it listen and respond to community concerns?

Morality

Some risks aren't just harmful; they're evil—and they remain evil even when they're not especially harmful. Talking about risk-benefit or risk-cost tradeoffs sounds very callous when the risk is morally relevant. Imagine a police chief insisting that an occasional child molester is an "acceptable risk."

Familiarity

Exotic, high-tech facilities provoke more outrage than familiar risks (your home, your car, your pot belly, the annual winter flu season).

Memorability

A memorable accident (Bhopal or Chernobyl, for example) can make some risks easy to imagine for decades - and that in turn makes those particular risks a bigger source of outrage and thus more risky as we have defined the term. A potent symbol can do the same thing: a drum of some chemical or, better yet, a leaking drum of chemical wastes.

Dread

Some illnesses are more dreaded than others; compare AIDS and cancer with, say, emphysema. The long latency of most cancers and the undetectability of most carcinogens add to the dread.

Diffusion in time and space

Hazard A kills 50 anonymous people a year across the country. Hazard B has one chance in 10 of wiping out a neighbourhood of 5,000 people sometime in the next decade. Risk assessment tells us the two have the same expected annual mortality: 50. "Outrage assessment" tells us that A is probably acceptable and B is certainly not. Catastrophic risks provoke a level of outrage that chronic risks just can't arouse.

These outrage factors are not distortions in the public's perception of risk; they are intrinsic parts of what we mean by risk. Since the public responds more to outrage than to hazard, risk managers must try to get people more outraged about serious hazards by appealing to outrage factors like the ones listed. Successful campaigns against drunk driving and passive smoking are two of many examples of raising public concern about serious hazards by feeding the outrage. Similarly, to decrease public concern about modest hazards, risk managers must work to diminish the outrage. When people are treated with honesty and respect for their right to make their own decisions, they are a lot less likely to overestimate small hazards.

There is a peculiar paradox here. Risk experts often resist the pressure to consider outrage when making risk management decisions, or even risk communication decisions. They disparage the "irrational" public and insist that "sound science" should wholly determine what they do and what they say. But we have decades of sound science indicating that voluntariness, control, fairness, and the rest are important components of people's definition of risk. When a risk manager continues to ignore these factors and continues to be surprised by the public's response, it is worth asking just whose behaviour is irrational.

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An interactive, self-taught course on risk communication is available at the website of the Pan American Centre for Sanitary Engineering and Environmental Sciences (CEPIS), one of 10 scientific and technical centres of the Pan American Health Organization (PAHO). The course covers the theory and methodology of risk communication and discusses strategies and effective interventions for target populations. It was developed by PAHO and the U.S. Agency for Toxic Substances and Disease Registry (ATSDR) with support from the U.S. Centres for Disease Control and Prevention (CDC). Students who finish the course successfully receive a certificate of completion. The course is available in English, Spanish, and Portuguese at www.bvsde.ops-oms.org/tutorial6/i/index.html

HEMNZ Bulletin

The HEMNZ Bulletin is published monthly by the Risk Management Unit of St John Northern Region for all those interested in emergency management in health care settings

Articles and comment on emergency management issues are welcomed

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Check out our Web site at www.hemnz.org.nz

Up coming Events

14 - 15 February 2006
Emergency Management Conference
Duxton Hotel, Wellington
Cost: $2195 + GST
More information from;
www.conferenz.co.nz

23 - 24 March 2006
HEMNZ2006
Novotel Hotel, Ellerslie, Auckland
Cost $650 incl GST
Brochure available from;
www.hemnz.org.nz

19 - 20 April 2006
Enterprise Wide Risk Management
Spencer on Byron, Takapuna,
Cost: $2195 + GST
More information from;
www.conferenz.co.nz

Innovations in the Clinical Management of Patients Involved in Disasters:

Request for abstracts

January 31 is the closing date for abstracts for those wanting to present at this seminar

This seminar will be held on 15-16 May 2006 at the **Carlton Crest, Brisbane.** More information from
www.changechampions.com.au

Editor's soapbox

Do you want a one stop reference source to help you along your influenza pandemic planning journey? While no such one source exists, the January issue of Emerging Infectious Diseases, produced from the CDC, is devoted to pandemic influenza and provides a wealth of material to help your understanding of this issue.

Our December lead, the Drongo scare in Malawi petered out as expected, but not before Malawi government officials had, through their own statements, confirmed their lack of understanding and preparedness for a bird flu outbreak in their country. As Turkey has shown, containment is difficult where there is an initial denial of the problem and a lack of prompt action.

Sun Tzu is credited with the statement, "one who knows the enemy and knows himself will not be endangered in one hundred engagements." Bird flu is currently our most visible enemy and this month' edition tries to shed a little more light on avian influenza and how to communicate the risk bird flu presents. The commentary in the two main articles, written just months apart, show how fast we are moving along the pandemic pathway.

The detailed collaborative work going on within regions, both within health and across other emergency organisations, is encouraging. At long last we are working hard to better 'know ourselves.'

The second and third stanzas of the Sun Tzu quote don't get so much air time.

"One who does not know the enemy but knows himself will sometimes be victorious."

"One who knows neither the enemy or himself will invariably be defeated in every engagement."

Lets make sure we fully understand our enemy and our capacity to overcome it.

Registrations are coming in for HEMNZ2006. Do try and take this chance to catch up and share information in what has become a rapidly changing emergency management environment. The theme for HEMNZ2006, is "capturing communication" - the key to the risk management cycle.

Bruce Parkes

American EDs get C– Rating

Health care in America is expensive but good, right? Seems that might not be so, especially if you have had some kind of mishap and are headed for emergency care. A report by the American College of Emergency Physicians assesses the support for emergency care and prevention in each state of the USA and has assigned the nation an average grade of C-. No states managed A or F grades.

The grades are based on 50 measures including availability of emergency care resources, training for emergency physicians and EMS personnel, patient access to ambulances and 911 services, injury prevention and safety programs.

The grades are not evaluations of physicians or hospital emergency departments, but they show the overall effort of states to support effective emergency medicine systems.

The full report is available at http://my.acep.org/site/DocServer/2006-NationalReportCard.pdf?docID=221

Before we get a little smug, lets not forget that the grading is based on standards well above that offering in most of the world.