

N. BEHRING-CHISHOLM/GETTY IMAGES

Time	Flight	Destination	Gate	Status
16:15	CX 872	San Francisco	1	Boarding
	AA 6118			Cancelled
16:15	JL 706	Nagoya		Cancelled
16:20	CX 828	Vancouver		Cancelled
		Toronto		Cancelled
16:25	CX 731	Dubai		Cancelled
16:25	CX 838	Vancouver		Cancelled
16:30	CX 903	Manila	28	
16:30	OX 2211	Phuket	27	
		Bangkok		
16:35	CX 737	Singapore		Cancelled
16:40	BR 856	Taipei	30	
16:45	KA 808	Shanghai/Pudong	18	
16:50	GA 859	Singapore	19	
		Jakarta		
16:55	CA 110	Beijing	17	
17:00	Z 3038	Changsha	34	
17:05	614	Taipei	25	
17:10	703	Bangkok	32	
		Karachi		
17:15	482	Taipei	26	
18:30	SQ 809	Vancouver		
18:40	AC 008	Toronto		
18:50	TG 633	Bangkok		Cancelled
19:05	KA 430	Kaohsiung		Cancelled
19:10	CX 111	Sydney		Cancelled
19:10	CX 135	Melbourne		Cancelled
19:15	MU 536	Shanghai/Pudong	16	
19:20	SQ 869	Singapore		Cancelled
19:35	QF 088	Melbourne		Cancelled
19:40	5J 119	Manila	31	
19:40	CX 468	Taipei	61	
19:40	CX 913	Manila		Cancelled
19:45	CI 642	Taipei	1	
19:55	UA 805	Singapore		Cancelled
20:00	CX 715	Singapore		Cancelled
20:10	QF 086	Brisbane		Cancelled
		Sydney		
20:15	TG 630	Taipei		Cancelled
20:25	CX 107	Auckland		Cancelled
20:40	SQ 010	Las Vegas		Cancelled
20:45	TG 607	Bangkok		

A weapon the world needs

Both bottom-up and top-down planning is needed to prevent a global economic disaster.

Michael T. Osterholm calls for action at all levels.

Influenza experts are more worried than ever about the next pandemic. It could be caused by H5N1, the avian flu strain of such concern in Asia; it could even rival the devastation of the 1918 Spanish flu pandemic. Whatever form it takes, it is sobering to realize that when the last pandemic emerged in 1968, in China, the nation's human population was 790 million and the poultry population 12.3 million; today those numbers are 1.3 billion and 13 billion, respectively. Similar changes have occurred in other Asian countries, creating an incredible mixing vessel for viruses. A pandemic could be unleashed tomorrow or in ten years from now, but the scene for a potential catastrophe is already set.

Every year, seasonal influenza A kills up to 1.5 million people around the world as the disease migrates between the Northern and Southern Hemispheres¹. Current efforts to reduce this global death toll largely involve the delivery of roughly 250 million to 300 million doses of influenza vaccine to the most vulnerable residents in a dozen or so industrial nations. Those fortunate enough to receive vaccines represent less than 5% of the world's current population of 6.5 billion people.

Vaccination is the only meaningful weapon to combat the next pandemic. But the egg-

produced influenza vaccine is based primarily on 1950s technology, which means production could not be immediately ramped up if a global flu pandemic became reality. The 20-year struggle by public-health officials in industrial nations to increase private-sector vaccine production for seasonal flu epidemics is a tale of 'two steps forward and one step back'. Overall, our poor vaccine manufacturing infrastructure, together with national and international failures to push for universal vaccinations, has left the masses vulnerable to annual flu and, worse, the next flu pandemic.

Plan for action

What should we do? The World Health Organization (WHO) recently issued a revised global influenza preparedness plan that provides recommendations for national measures before and during a pandemic². It is meant to help countries develop or update their national flu preparedness plans. The WHO's plan primarily targets public-health officials, although an executive summary has been produced for senior policy-makers who may have a public-health background. Although the WHO's document is a helpful tool for those responsible for preparedness at

the national level, it falls far short of what is needed at either the ground level (local day-to-day planning) or at the international level (long-term planning). But it is critical to consider all three perspectives when planning preparedness and response strategies. Unfortunately, all other national and state plans suffer from similar failings.

The WHO's national-level recommendations are non-specific in nature. For example, the 'Phase 2 health system response'² advises that countries "verify availability and distribution procedures for personal protective equipment and antivirals, and for vaccine, for the protection of persons at occupational risk"; and that they "consider measures to implement". But such recommendations assume that protective equipment, vaccines and antivirals will already be available. They also do not address the difficult ethical questions about allocation: who should get priority for receiving these potentially life-saving products if they exist in limited supply?

Such issues are central to the international and ground-level perspectives, both of which have been neglected in planning for pandemic flu in most countries. If we are really serious about preparing for a flu pandemic, regardless of whether it begins tonight, next

year or ten years from now, we must flesh out and act upon the critical needs at these other levels.

At the international level we must put the availability of a pandemic vaccine at the top of the list. Other priorities include making effective antivirals and protective masks available. Unfortunately, most industrial countries are looking at the vaccine issue through myopic lenses. The primary question seems to be: how do we get enough vaccine in the first months of the pandemic to protect our citizens?

For a classic public-health approach this perspective makes sense. Countries such as the United States, which have aggressive influenza vaccine research programmes, are to be commended. However, a purely national approach fails to consider the nature of the modern world — a world of globally distributed just-in-time inventories for almost all consumer products, including medical supplies. The world today is much more vulnerable to the collapse of trade than it was in 1918.

Wake-up call

The arrival of pandemic flu will trigger a reaction that will change the world overnight. There will be an immediate response from leaders to stop the virus entering their countries by greatly reducing and even ending foreign travel and trade — as was seen in parts of Asia in response to the severe acute respiratory syndrome (SARS) epidemic. These efforts are doomed to fail given the infectiousness of the virus and the volume of illegal crossings that occur at most borders. But government officials will feel compelled to do something to demonstrate leadership. Individual communities will also want to bar 'outsiders'. Global, national and regional economies will come to an abrupt halt.

A vaccine against the pandemic strain produced using current technology would not be available for at least six months after the pandemic starts. And even then, the supply would only be large enough to vaccinate 14% of the global population¹. Our limited stockpiles of antiviral drugs and medical ventilators will seem as inadequate as they did in 1918.

But the problem is not just one of death and disease; trade and economic dependency are also at risk. The global economy has never been measurably threatened by human immunodeficiency virus (HIV), malaria or tuberculosis despite the dramatic impact of these diseases on developing-world populations, particularly sub-Saharan Africa. The global panic created by flu will be different. Today, we have virtually no surge capacity for any consumer product or medical service that might be needed during the 12 to 36 months of a pandemic.

We must demand nothing less than an international effort to develop a new type of influenza vaccine that can be manufactured on a much shorter timescale. This global



The current practice of using eggs to make flu vaccine is too slow to cope with a pandemic.

vaccine will require a new method of production, surge capacity for crises and a detailed plan for distribution. One possibility is to move away from strain-specific vaccines towards generic vaccines that can respond to all virus strains.

A vaccine cannot be delivered fast enough to prevent a virus spreading in those countries where the pandemic first emerges. But by vaccinating people in many more countries we could minimize its impact: imagine if only 2% of the global population became infected instead of 50% (as is likely now). The world would recover much more quickly from the first pandemic wave, and be in a much better position to deal with any subsequent waves of infection.

So, although we cannot prevent a pandemic from happening, we might be able to change its course if we start acting now, and if the pandemic is still a few years away. But if industrial countries continue to develop vaccines for just themselves, they, and everyone else, will remain vulnerable to a global economic disaster. Even if nations vaccinate their entire populations, they cannot remain isolated from a pandemic shock.

Who should be taking the lead on the vaccine issue? We need bold leadership from the group of seven industrialized nations plus Russia (G8) and other developed-world governments. When the G8 leaders next meet in Scotland in July, avian flu will be on the agenda, but major commitments are unlikely. This is not good enough. These nations urgently need to recognize the economic, and security and health threat that the next flu pandemic poses, and invest accordingly.

As well as waking up to reality at the international level, we must also struggle with difficult issues at ground level. For example, there

are no detailed plans in place to staff or equip temporary hospitals, which might be installed in high-school gymnasiums or community centres for as long as one to two years. Nor are there detailed plans on how to handle the dead bodies whose numbers will soon outstrip our ability to process them.

Ethical questions also need to be tackled now, in a public forum. Who will get the extremely limited antiviral drugs that will be available? Any priority setting during the crisis will provoke further dissent and disruption. Both government-sponsored and private health-care delivery systems have conducted little planning around this issue.

We also cannot predict how many health-care workers will continue to place themselves at high risk of infection by taking care of influenza patients, if vaccine and protective equipment are not available. Health-care workers will become ill and die as quickly as the rest of the public, or even faster, particularly if they have limited protective equipment.

It is essential to think now about the possible use of lay volunteers in hospitals — especially of those who survive the first wave of infection. Such survivors may have gained immunity before a vaccine has become available, and may want to assist clinicians. The strong medical arguments against using lay volunteers — grounded in both liability concerns and professional hubris — must be addressed.

Time's up

Time is running out to prepare for the next pandemic. There is a critical need for comprehensive medical and non-medical pandemic planning at the ground level (involving many in the private sector), that goes beyond what has been considered so far. National, regional or local plans based on general statements of intent or action will be meaningless in the face of a pandemic. Specific operating blueprints to get through 12 to 36 months of a pandemic are essential. For example, determining how food might be supplied to local populations when transportation and food-processing plants shut down will require a level of planning not yet included in any national or regional plans.

At the international level, world leaders need urgently to consider what they can do now. When the pandemic hits close to home, leaders will do their best to react and cope. But real leadership, particularly by the G8, means making tough decisions now. We must act with decisiveness and purpose if we are to create a pandemic vaccine that has a chance of making a real difference. ■

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- Osterholm, M. T. *N. Engl. J. Med.* **352**, 1839–1842 (2005).
- http://www.who.int/csr/resources/publications/influenza/WHO_CDS_CSR_GIP_2005_5/en