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**Western Pacific Region**



# Influenza: Lessons Learnt

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## Western Pacific Surveillance and Response

*Open access journal with continuous publication*

Western Pacific Surveillance and Response (WPSAR) is an open access journal dedicated to the surveillance of and response to public health events. The goal of the journal is to create a platform for timely information sharing both within our region and globally to enhance surveillance and response activities. WPSAR is a continuous publication which means articles will be published online as soon as they have completed the review and editing process. Every three months articles will be batched for a print issue.



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# Western Pacific Surveillance and Response: a journal to reflect the needs of our Region

Emma Field<sup>a</sup> and Takeshi Kasai<sup>a</sup>

The *Western Pacific Surveillance and Response* (WPSAR) Journal was established to encourage countries in the Western Pacific Region to share information on the surveillance of and response to public health events specific to this Region. An important step in surveillance is the dissemination of results to stakeholders, and, in the current international environment, public health events in one country may be of interest to the Region or even globally. In recent years many countries in the Western Pacific Region have increased capacity in surveillance and response through the Asia Pacific Strategy for Emerging Diseases to meet the core capacity requirements of the International Health Regulations (2005), also known as IHR (2005).<sup>1,2</sup> There is now an opportunity to encourage sharing of information as a result of these improvements.

While IHR (2005) is a mechanism for confidentially sharing information on public health events of international concern, there is no mechanism for widely disseminating information on surveillance and response activities. Biomedical journals, which are the usual avenue for information dissemination, prefer to publish rigorous research studies. This tendency provides a challenge for publishing information useful for surveillance of and response to public health events such as surveillance reports. Recommendations from the meeting of the National Influenza Centres and the consultation of the technical advisory group for emerging diseases highlighted the need for improving information sharing in the Region and to develop a mechanism to facilitate this sharing.<sup>3,4</sup> Further evidence highlighting the need for a publication for the Western Pacific Region was demonstrated during the 2009 pandemic when authors in the Western Pacific Region published surveillance reports in the European-focused journal, *Eurosurveillance*.<sup>5</sup>

In addition to encouraging information sharing, WPSAR aims to engage the trainees of field epidemiology

programmes. In recent years, field epidemiology training programmes (FETPs) have been established or expanded in the Region. Critical analyses of surveillance data, evaluations of surveillance systems, outbreak investigations and evaluations of public health interventions are important parts of these programmes. WPSAR will be a platform for publishing such reports, therefore acting as a catalyst for building capacity in this area. Through the process of preparing a manuscript, and the subsequent peer review and editing of the manuscript, trainees will have an opportunity to improve their understanding of their work.

These goals of WPSAR differ from those of other biomedical journals and the editorial policy and structure of the journal reflect these goals. While the editorial team encourages research articles on routine public health events such as outbreak investigations, there is also an opportunity for more informal articles such as lessons from the field and risk assessments.

The “Lessons from the Field” style article was introduced into the *Bulletin of the World Health Organization* in 2005 to provide an avenue for publishing evaluations of public health interventions that do not meet the criteria of a research paper.<sup>6</sup> Similarly in WPSAR, “Lessons from the Field” articles are designed to document the solutions to problems identified in the field that would otherwise have limited opportunity for wide publication. Many countries in the Region face similar challenges and therefore can learn from the experiences of other countries.

WPSAR will also publish risk assessments. A risk assessment is the systematic organization of information to determine a risk from a threat. The Western Pacific Regional Office has identified building risk assessment capacity as a priority and recently conducted several training workshops in the Region. Risk assessments for public health events often have to be conducted in short time frames with limited information but are necessary

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to help guide decision-making for public health action. When countries are faced with a public health event that could spread internationally, publishing a risk assessment would be beneficial for the Region.

The WPSAR editorial team looks forward to working with readers, authors and reviewers to create a journal that is a hub for information sharing and is supportive of developing capacity for surveillance of and response to public health events. We welcome suggestions and feedback to assist with the evolution of WPSAR to ensure the journal always reflects the needs of our Region.

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# Influenza surveillance and control in the Western Pacific Region

Hitoshi Oshitani\*

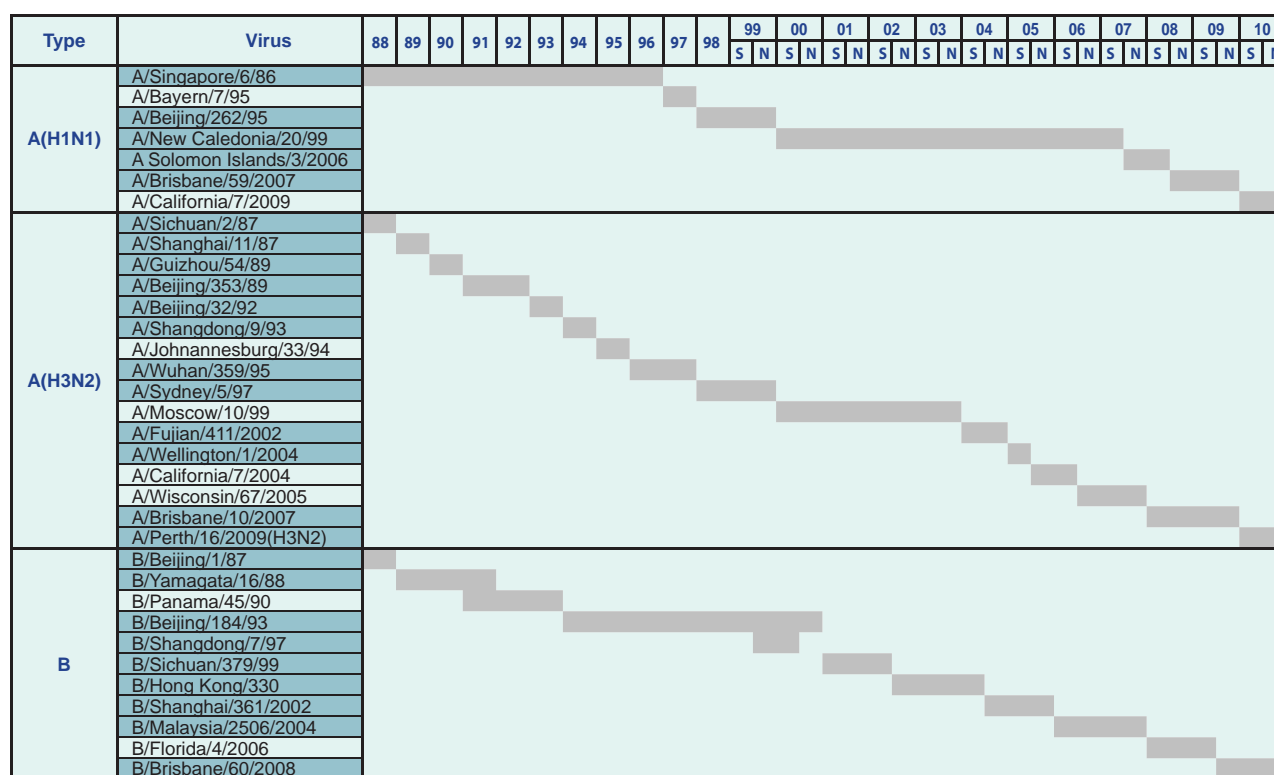
Influenza is one of the most common acute viral infections in humans. It is estimated that seasonal epidemics affect 10–20% of the population, resulting in 250,000 to 500,000 deaths every year.<sup>1</sup> In addition to seasonal influenza epidemics, antigenically distinct viruses originating from animal species tend to emerge in the human population every 10 to 40 years. Since most the human population does not have immunity to such viruses, global epidemics with significant impact, i.e. influenza pandemics, have occurred in the past.

Countries and areas in the Western Pacific Region are very diverse in terms of population size, climate, and social and cultural characteristics. Due to such diversity, the Region has special issues, challenges and global importance in influenza surveillance and control.

In particular, the Region is known as a ‘hotspot’ for influenza as East and South-East Asia are considered to be a source of new antigenic variants.<sup>2</sup>

Because seasonal influenza viruses are constantly changing, vaccine strains should be updated to ensure the closest possible match with circulating strains. The World Health Organization (WHO) has made recommendations on vaccine strains annually since 1972 and twice a year since 1999 (in February for the northern hemisphere and in September for the southern hemisphere).<sup>3</sup> Many viruses isolated in the Region have been recommended as vaccine strains by WHO. A total of 34 different viruses have been recommended for vaccine strains by WHO between 1988 and 2010, and 26 out of 34 (76.4%) were isolates from the Region (Figure 1).

Figure 1. Recommended viruses for influenza vaccines by World Health Organization between 1988 and 2010



Note: The virus names with shading indicates the viruses isolated from the Western Pacific Region.

Formal WHO recommendations first issued in 1973; beginning 1999 there have been two recommendations per year, one for the northern hemisphere (N) and the other for the southern hemisphere (S).

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The Region is also considered to be a potential source for pandemic influenza. At least two past pandemics, Asian Flu in 1957 and Hong Kong Flu in 1968, are believed to have been originated from the Region.<sup>4</sup> Therefore, influenza surveillance in the Region is critical in monitoring antigenic changes of seasonal influenza and detecting viruses with pandemic potential.

Despite regional and global importance, influenza surveillance in the Region was fragmented until recently. In developing countries, there are many competing priorities such as HIV/AIDS, tuberculosis, and malaria. Financial support from international organizations tends to be diverted to these other priority diseases.

Another important factor for low resource allocation for influenza is lack of disease burden data for influenza in the Region, especially in tropical developing countries. Epidemiological methods to estimate the mortality impact due to influenza have been established for countries with temperate climates, where the influenza season is clearly observed in winter or early spring. Estimating disease burden in the tropics and subtropics is more challenging because there is no clear seasonality of influenza; therefore, methods developed for temperate climates are difficult to apply. Recent studies conducted in Hong Kong (China) and Singapore indicated that influenza has a high disease burden in tropical and subtropical climates.<sup>5,6</sup> However, the disease burden in less developed countries in tropical and subtropical climates is still largely unknown due to a lack of data.

Influenza became a major public health agenda in most countries and areas in the Region, mainly because of the threat posed by highly pathogenic avian influenza A(H5N1). Human infections of H5N1 were confirmed in Hong Kong (China) for the first time in 1997. Since late 2003, there has been widespread transmission of H5N1 among poultry, starting in Asia and later spreading into other regions including Europe, the Middle East and Africa. This virus is highly pathogenic in chickens, but it also causes very severe infections in humans. Nearly 60% of confirmed human cases have died.<sup>7</sup> If this virus acquires transmissibility among humans and becomes a pandemic virus, it may have devastating health and social impacts.

Due to the global, regional and national concern about H5N1, influenza has become a major public health issue in the Region. With government commitment and international support, the influenza programmes in many countries have made remarkable progress in the past

decade. The quantity and quality of virological testing in National Influenza Centers (NICs) have been improved. Most countries have also developed their national pandemic preparedness plans.

In 2009, the world experienced the first influenza pandemic since 1968. It was caused by influenza A(H1N1) that originated from a swine virus. While it was not as severe as anticipated, the pandemic revealed that there are still many issues and challenges in influenza surveillance and control in the Region. The data generated by influenza surveillance in different countries were difficult to compare because surveillance systems varied between countries. Many NICs were completely overwhelmed by the rapid increase in the number of specimens for testing. Vaccines were either not available or in severe shortage during the epidemic peak in most countries. The supply of antiviral drugs was also not enough, especially in developing countries. These shortfalls revealed the need for strengthened capacity in surveillance and control for both seasonal and pandemic influenza in the Region.

It is necessary to standardize regional and global reporting for seasonal and pandemic influenza. More epidemiological data are required to improve control programmes for seasonal influenza, including increasing the use of seasonal influenza vaccines. Surveillance in each country and throughout the Region also needs to be further strengthened to achieve the ultimate goal of better control and prevention of seasonal and pandemic influenza.

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# Epidemiological characteristics of the influenza A(H1N1) 2009 pandemic in the Western Pacific Region

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The first laboratory-confirmed cases of infection with pandemic influenza A(H1N1) 2009 in the Western Pacific Region were reported on 28 April 2009. By 11 June 2009, the day the pandemic was declared by the World Health Organization, nine Western Pacific Region countries and areas had reported laboratory confirmed pandemic influenza A(H1N1) 2009 cases. From April 2009 to July 2010, more than 250 000 cases and 1800 deaths from laboratory-confirmed pandemic influenza A(H1N1) 2009 were reported from 34 countries and areas in the Region. By age group region-wide, 8.6%, 41.9%, 48.3%, and 1.2% of cases were in the < 5 years, 5–14 years, 15–64 years, and 65+ years age groups, respectively; the overall crude case fatality ratio in the Western Pacific Region was 0.5%. The pandemic demonstrated that region-wide disease reporting was possible. Countries and areas of the Western Pacific Region should take this opportunity to strengthen the systems established during the pandemic to develop routine disease reporting.

In mid-March 2009, the Mexico Ministry of Health identified an unusual increase in influenza-like illness (ILI). In mid-April 2009, the United States of America's Centers for Disease Control and Prevention identified a novel influenza A(H1N1) virus from two people in California. By the end of the third week in April, patients with influenza-like or pneumonia-like symptoms in Texas and Mexico were confirmed as cases of infection with the same novel influenza A(H1N1) virus.<sup>1</sup> Within days, cases of novel influenza A(H1N1) infections were reported from Canada, Spain, the United Kingdom, Israel, and New Zealand. Thus began the event that on 11 June 2009 was declared a pandemic by the World Health Organization (WHO).

The Western Pacific Region of WHO includes 37 countries and areas that span from the Northern Hemisphere, through the tropics and subtropics, to the Southern Hemisphere, and contain approximately 3.5 billion people, nearly half of the world's population. From April 2009 to July 2010, more than 250 000 cases and 1800 deaths from laboratory-confirmed pandemic influenza A(H1N1) 2009 were reported from 34 countries and areas in the Region.<sup>2</sup> This paper summarizes the available epidemiological and virological data on the influenza A(H1N1) 2009 pandemic from the Western Pacific Region.

## METHODS

A descriptive epidemiological study was conducted using data from multiple sources. Countries and areas included in the study were those with available data as of 31 October 2010. ILI and severe acute respiratory infection (SARI) case and death data were obtained from WHO.<sup>3</sup> The date of first reported case for each of the Western Pacific Region countries and areas was determined from the WHO Western Pacific Regional Office media releases.<sup>4</sup> Media reports included data reported to WHO by countries and data abstracted from Ministry of Health web sites.

Virological data were extracted from the Global Influenza Surveillance Network's (GISN) database, FluNet.<sup>5</sup> FluNet was created in 1996 and has been used since then as a global tool for influenza virological surveillance. The data are provided remotely by National Influenza Centres of the GISN and other national influenza reference laboratories collaborating actively with GISN, or are uploaded from WHO regional databases. Systematic sampling of ILI or SARI cases identified from country surveillance systems can approximate influenza disease trends.

Dates were reported as the first day of the corresponding epidemiological week where specific

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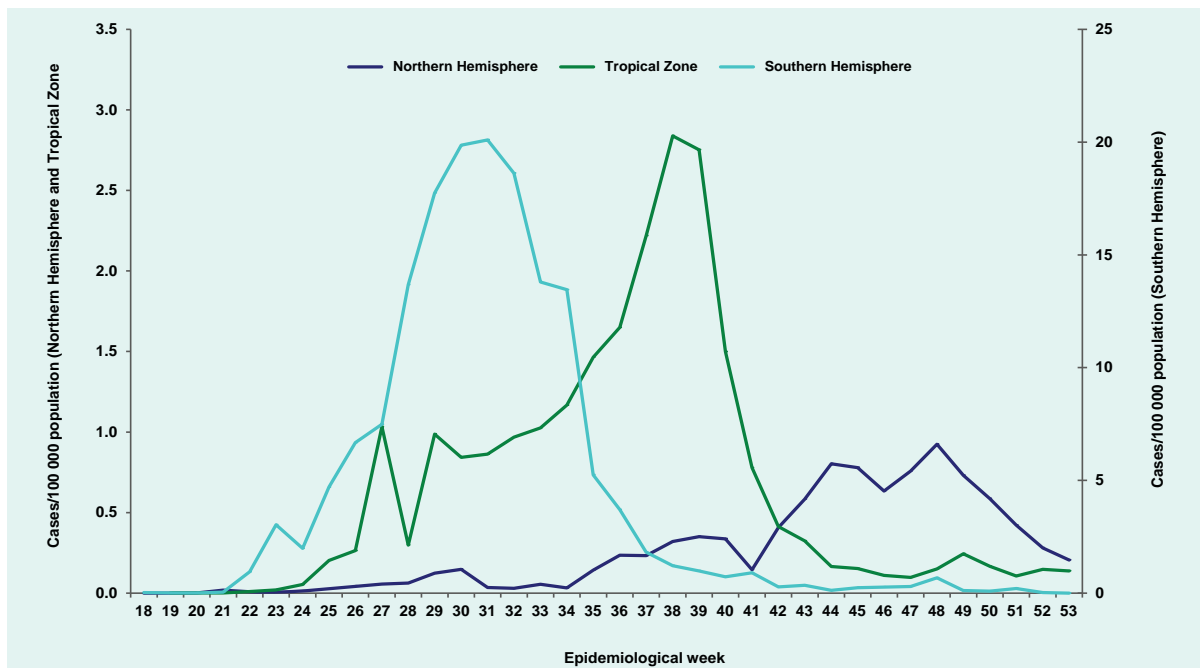


Overall, peak activity corresponded to the winter season (June to September 2009) in the Southern Hemisphere and fall/winter seasons (October to December 2009) in the Northern Hemisphere (Figure 2). Peak activity was less defined across the Tropical Zone, and ranged from July through October 2009. In the Pacific Islands, sporadic case identification or reporting was observed from June to

August 2009 with peak activity only well defined in Samoa. There was a median of 13 weeks (mean of 16 weeks) from first reported confirmed cases to pandemic peak in 13 Western Pacific Region countries and areas. The shortest time from first confirmed case to peak (7 weeks) was reported by the Lao People’s Democratic Republic, while the longest period (30 weeks) was reported by Japan (Figure 1).

Figure 2. Epidemic curves of pandemic influenza A(H1N1) 2009 confirmed cases from ILI/SARI surveillance (A) and virological (B) by geographic and climate area, 2009 Western Pacific Region

A. ILI/SARI Surveillance



B. Virological Surveillance

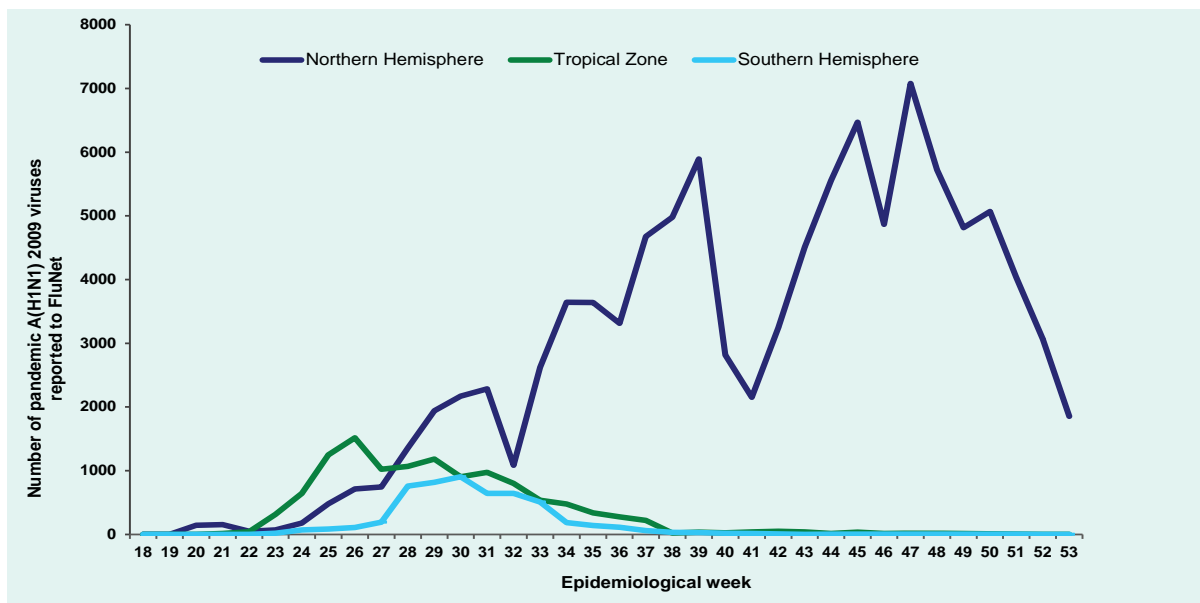


Table 1. Distribution of pandemic influenza A(H1N1) 2009 cases and deaths by age group and geographic zone in countries and areas with available data, epidemiological weeks 18 through 53, 2009, Western Pacific Region

Country/Area	Cases					Deaths					Crude CFR (%)				Over all
	<5 y	5–14y	15–64y	65+y	No. cases	<5y	5–14y	15–64y	65+y	No. deaths	<5y	5–14y	15–64y	65+y	
<b>Northern Hemisphere</b>															
China	6 325	49 287	61 450	1 034	118 096	59	46	434	58	597	0.9	0.1	0.7	5.6	0.5
Japan	3 266	8 388	1 566	564	13 784	14	15	62	37	128	0.4	0.2	4.0	6.6	0.9
Mongolia	226	301	641	7	1 175	8	0	18	0	26	3.5	0	2.8	0	2.2
<b>Subregion total</b>	<b>9 817</b>	<b>57 976</b>	<b>63 657</b>	<b>1 605</b>	<b>133 055</b>	<b>81</b>	<b>61</b>	<b>514</b>	<b>95</b>	<b>751</b>	<b>0.8</b>	<b>0.1</b>	<b>0.8</b>	<b>6.4</b>	<b>0.5</b>
<b>Tropical Zone</b>															
Brunei Darussalam	117	327	683	19	1 206	0	1	0	0	1	0	0.3	0	0	0.1
Cambodia	72	210	258	5	545	1	0	5	0	6	1.4	0	1.9	0	1.1
Hong Kong (China)	4 392	13 743	15 390	432	33 957	0	2	36	14	52	0	0	0.2	3.2	0.2
Macao (China)	348	1 300	1 267	14	2 929	0	0	1	1	2	0	0	0.1	7.1	0.1
Lao PDR	22	96	169	3	290	1	0	1	0	2	4.6	0	0.59	0	0.7
Philippines	194	1 615	3 229	33	5 071	4	3	21	2	30	2.1	0.2	0.7	6.1	0.6
Singapore	4	11	74	13	102	0	2	11	5	18	0	18.2	14.9	38.5	17.7
<b>Subregion total</b>	<b>5 209</b>	<b>17 302</b>	<b>21 070</b>	<b>519</b>	<b>44 100</b>	<b>6</b>	<b>8</b>	<b>75</b>	<b>22</b>	<b>111</b>	<b>0.12</b>	<b>0.1</b>	<b>0.4</b>	<b>4.2</b>	<b>0.3</b>
<b>Pacific Islands</b>															
Cook Islands	0	28	52	0	80	0	0	1	0	1	0	0	1.9	0	1.3
Guam	78	78	178	4	338	0	1	1	0	2	0	1.3	0.6	0	0.6
Samoa	24	25	85	4	138	0	0	2	0	2	0	0	2.4	0	1.5
<b>Subregion total</b>	<b>102</b>	<b>131</b>	<b>315</b>	<b>8</b>	<b>556</b>	<b>0</b>	<b>1</b>	<b>4</b>	<b>0</b>	<b>5</b>	<b>0</b>	<b>0.8</b>	<b>1.3</b>	<b>0</b>	<b>0.9</b>
<b>Southern Hemisphere</b>															
New Zealand	363	511	2 211	82	3 167	1	1	16	2	20	0.3	0.2	0.7	2.4	0.6
<b>Subregion total</b>	<b>363</b>	<b>511</b>	<b>2 211</b>	<b>82</b>	<b>3 167</b>	<b>1</b>	<b>1</b>	<b>16</b>	<b>2</b>	<b>20</b>	<b>0.3</b>	<b>0.2</b>	<b>0.7</b>	<b>2.4</b>	<b>0.6</b>
<b>Region-wide</b>	<b>15 491</b>	<b>75 920</b>	<b>87 253</b>	<b>2 214</b>	<b>180 878</b>	<b>88</b>	<b>71</b>	<b>609</b>	<b>119</b>	<b>887</b>	<b>0.6</b>	<b>0.1</b>	<b>0.7</b>	<b>5.7</b>	<b>0.5</b>

CFR - case fatality ratio

## Age groups

Detailed reported case and death data stratified by age group were available from 14 countries and areas of the Region for the period that included epidemiological week 18 (3 to 9 May) through week 53 (27 to 31 December) of 2009. During that period, a total of 181 219 laboratory-confirmed cases were reported region-wide, with slightly more than 90% of the cases occurring in people 5–64 years of age (Table 1). By age group region-wide, 8.6%, 41.9%, 48.2%, and 1.2% of cases were in the < 5 years, 5–14 years, 15–64 years, and 65+ years age groups, respectively. The distribution of cases across age groups followed a similar pattern in each geographic or climate area; however, the proportion of cases belonging to the 15–64 years age group was higher in the Pacific Islands (56.6%) and the Southern Hemisphere (69.8%) in comparison to the Tropical Zone (47.8%) and the Northern Hemisphere (47.8%).

## Case fatality ratios

Based upon data from selected countries and areas from epidemiological weeks 18 to 53 of 2009, the

overall crude case fatality ratio (CFR) in the Region was 0.5%, and by age group it was 0.6%, 0.1%, 0.7%, and 5.4% for cases < 5 years, 5–14 years, 15–64 years and 65+ years age groups, respectively (Table 1). By geographic and climate areas, the overall CFR was 0.6% in the Northern Hemisphere, 0.3% in the Tropical Zone, 0.9% in the Pacific Islands, and 0.6% in the Southern Hemisphere.

## Virological surveillance

From epidemiological weeks 18 to 53 of 2009, corresponding to 9 May through 31 December, 262 721 clinical specimens from ILI or SARI cases were reported to FluNet from the National Influenza Centres in 10 countries of the Region (Australia, Cambodia, China, Japan, Malaysia, Mongolia, New Zealand, the Philippines, the Republic of Korea and Singapore). Out of the total specimens, 156 517 (60%) were influenza positive. Of these, 118 704 (76%) were reported as pandemic influenza A(H1N1) 2009 viruses. Reporting of pandemic influenza A(H1N1) 2009 viruses peaked during epidemiological week 26 (28 June to 4 July) in the Tropical Zone, week 30 (26 July to 1 August)

Table 2. Seroprevalence of naturally acquired antibodies to pandemic influenza A(H1N1) 2009, New Zealand and Singapore, 2009

Country	Sample Size	Study Population	% Seropositive
New Zealand <sup>4</sup>	1696	1–4 years old	29.5
	171	5–19 years old	46.7
	148	20–39 years old	22.2
	206	40–59 years old	20.2
	221	60+ years old	24.8
	258	Primary HCWs	29.6
Singapore <sup>5</sup>	838	Community (21–75 years)	13.5
	1213	Military personnel (males 18–19 years)	29.4
	558	Acute care hospital staff	6.5
	300	Staff and residents of long-term care facility	1.2

\*HI titres > 40, HCWs = health care workers

in the Southern Hemisphere, and week 47 (22 to 28 November) in the Northern Hemisphere (Figure 2).

### Seroprevalence

Results from two seroprevalence studies conducted in the Region were identified from the literature search (Table 2). In New Zealand, the seroprevalence of naturally acquired antibodies to pandemic influenza A(H1N1) 2009 varied with age and ranged from 20.2% for the 40–59 year age group to 46.7% in the 5–19 year age group.<sup>8</sup> In Singapore, seroprevalence ranged from 1.2% for staff and residents of a long-term care facility to 29.4% for a sample of military recruits.<sup>9</sup>

## DISCUSSION

The first pandemic influenza A(H1N1) 2009 cases in the world were laboratory-confirmed in the United States of America and Mexico on 15 and 23 April 2009, respectively.<sup>10,11</sup> The first cases reported in the Region were confirmed on 28 April 2009 among a group of students returning to New Zealand from Mexico.<sup>12</sup> By 11 June 2009, the day the pandemic was declared by WHO, nine countries and areas had reported laboratory-confirmed pandemic influenza A(H1N1) 2009 cases. Because countries and areas in the Region are spread across both the Northern and Southern Hemispheres and across all climate zones, the time course of the pandemic varied across the Region. Dates of reported peak influenza activity ranged across the second half of 2009 from July to December. This is consistent with

what has been reported on the differing patterns of seasonal influenza across the Region.<sup>13,14</sup>

Although more than 250 000 laboratory-confirmed cases of pandemic influenza A(H1N1) 2009 were reported from April 2009 to July 2010, these figures certainly represent an underestimate of the number of individuals infected due to limitations in surveillance systems, the resources available to health care providers, health-seeking behaviours, specimen collection and testing policies and the sensitivity and specificity of laboratory tests. However, efforts to strengthen surveillance systems (including laboratory confirmation capacity) as part of pandemic preparedness, heightened awareness of influenza in the public and with medical professionals and the implementation of International Health Regulations (2005) by countries likely contributed to increased identification, confirmation and reporting of influenza cases during the pandemic.

The estimation of CFR is dependent on the data or case definition used for the denominator (total number of cases) and the numerator (number of deaths). A crude CFR can be calculated using confirmed cases as the denominator and confirmed deaths as the numerator; however, this approach is likely to overestimate the CFR. A potentially more meaningful CFR can be calculated using symptomatic cases as the denominator.<sup>15</sup> The crude CFR calculated from Western Pacific Regional data is similar to that reported in published studies internationally with crude CFR estimates at 0.2% to 0.9%.<sup>16–19</sup> Studies from Singapore,<sup>20</sup> Australia<sup>21</sup> and

New Zealand<sup>22</sup> have estimated the symptomatic CFR to be two orders of magnitude lower than crude estimates at 5–9 confirmed pandemic influenza A(H1N1) 2009 deaths for every 100 000 symptomatic cases. These estimates are similar to that found in the United States of America (symptomatic CFR 0.007%).<sup>23</sup> Therefore, although the CFR estimates presented may be useful for tracking severity over time and making comparisons across countries, they certainly overestimate actual case fatalities.

The reported virological data roughly track the ILI/SARI disease trends in the Region (**Figure 2**). The extended and increased peak in the Tropical Zone ILI data that is not occurring in the virological data is likely due to the inclusion of Hong Kong (China) data for ILI, but Hong Kong (China) is not included in the presented virological data. Availability of virological data for this study was dependent upon active participation in the GISN FluNet reporting system by countries and areas. Although during the pandemic period there were 20 National Influenza Centres in the Region, only 10 Centres submitted reports through FluNet, limiting interpretation of virus data across the Region due to the lack of data from several countries and areas. Interpretation of data across time was also constrained by changes in specimen collection and laboratory testing policies during the pandemic period.

Seroprevalence studies have determined levels of immunity to pandemic influenza A(H1N1) 2009 in various population groups around the world. Of particular interest are seroprevalence studies that measure only naturally acquired immunity (i.e. conducted before vaccine availability or excluded vaccinated individuals) since these can give an indication of natural infection rates in the community. There are limited data available on naturally acquired immunity from countries in the Region. The studies from both New Zealand and Singapore reported that seropositivity proportions varied by age, and the New Zealand study particularly reported the highest seropositivity proportion in school-age children (46.7%), which is consistent with studies conducted in the United States of America<sup>24</sup> and the United Kingdom,<sup>25</sup> possibly reflecting higher contact rates and subsequent higher infection rates for this age group.

In conclusion, the availability of data from most of the countries and areas in the Region is a testament

to the great strides made across the Region in terms of strengthening surveillance systems, including the establishment of laboratory facilities for case confirmation. The pandemic demonstrated that region-wide disease reporting was possible. Countries and areas of the Region should take this opportunity to strengthen the systems established during the pandemic to develop routine disease reporting.

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# Field exercises are useful for improving public health emergency responses

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**Problem:** Emergencies resulting from disease outbreaks and extreme environmental events present significant challenges for health services.

**Context:** Preparing to effectively manage emergencies is a core activity in public health units. Field exercises support consolidation of biopreparedness by testing plans, identifying weaknesses, providing training opportunities and developing surge capacity.

**Action:** An extended field exercise to test response to a novel influenza strain was conducted in New South Wales, Australia in September 2008, eight months before the influenza A(H1N1) 2009 pandemic emerged. Lasting four days and involving over 300 participants, the exercise was set in the early response phase with the staggered presentation of 41 cases to 36 emergency departments in the health area. An additional 150 contacts were written into a complex scenario to test the public health response.

**Outcome:** The subsequent pandemic emergence in mid-2009 offered a unique opportunity to assess the field exercise format for disaster preparedness. Most roles were adequately tested with recognized benefit during the actual pandemic response. However, the exercise did not adequately challenge the public health planning team that synthesizes surveillance data and forecasts risk, nor did it identify planning issues that became evident during the subsequent pandemic.

**Discussion:** Field exercises offer the opportunity to rigorously test public health emergency preparedness but can be expensive and labour-intensive. Our exercise provided effective and timely preparation for the influenza A(H1N1) 2009 pandemic but showed that more emphasis needs to be placed on the role and training of the public health planning team.

## PROBLEM

Health emergencies such as large communicable disease outbreaks and severe environmental events often require lengthy responses and a sustained work effort across the health sector. Maintaining a heightened response over weeks or months presents a major challenge for which many health services are ill prepared. One likely scenario is the emergence of a novel disease agent, for example an antigenic shift that results in a pandemic influenza strain. This occurs on average every 20–30 years, placing a major burden on health services and society due to the increased morbidity and mortality.<sup>1</sup>

Early in a pandemic, public health activities aim to delay transmission using various containment measures including: identifying and isolating cases and contacts; encouraging household infection control; adopting social

distancing measures; providing health advice; and using antiviral medication.

## CONTEXT

The Commonwealth government provides overarching policy and direction to the eight Australian states and territories; at the state/territory level there is further subdivision into regional health services that are responsible for community response and individual care. Like many federated countries, Australia's three layers of governance potentially complicate communications during health emergencies.<sup>2</sup> Australia has invested in pandemic planning and exercises at a national and state level to test border control, inter- and intra-government decision-making, deployment of the National Medical Stockpile, national health emergency response and public communications,<sup>3,4</sup> but extended exercises at a regional level are uncommon.

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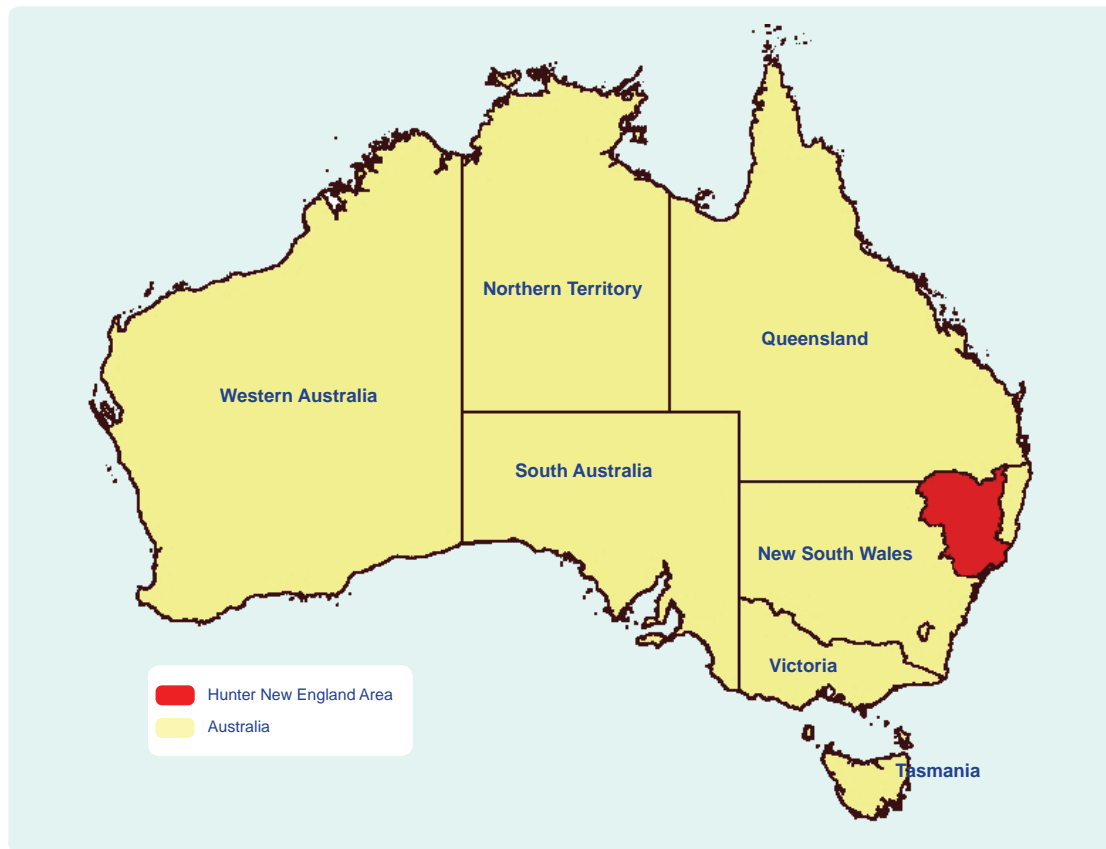
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Figure 1. The Hunter New England Health Area of New South Wales, Australia



On 7 May 2009, just eight months after the conclusion of our field exercise, the first case of pandemic influenza was detected in Australia.<sup>5</sup> The Commonwealth government instituted aggressive containment measures to reduce disease transmission according to the national plan.<sup>6</sup> Cases and contacts were requested to stay in home isolation/quarantine for up to seven days and take antiviral medication, as had been practised during the exercise. This placed us in a unique situation to assess the effectiveness of our field exercise in preparing for an actual pandemic event.

## ACTION

A regional New South Wales (NSW) health service conducted a four-day field exercise to simulate the range, complexity and work intensity during the early response to a large disease outbreak. Many exercises use virtual or desktop formats, but given the relatively large geographic area with a dispersed population, 36 Emergency Departments (EDs) and the varied resource capacity across the area, a field exercise was chosen to ensure participants and plans were suitably challenged. Public health staff and surge staff completed

activities in exactly the same way expected of them in a true health emergency. The exercise control team regulated the 'injects' but allowed the scenario to flow naturally using actors trained to provide plausible input. Independent facilitators ensured the exercise was kept within pre-determined guidelines and avoided risk to players and the public.

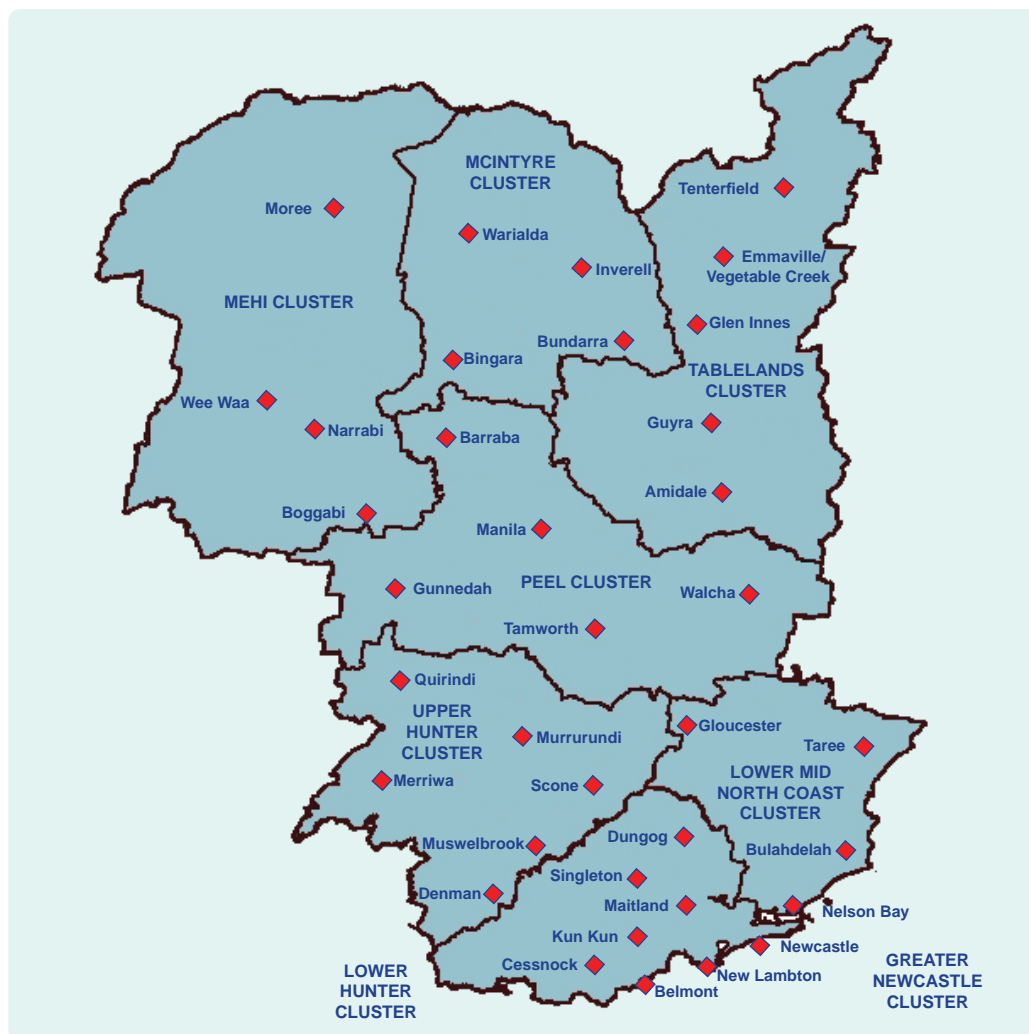
The Hunter New England Health Research Ethics and Governance Unit did not require ethics approval since the study was regarded as a training exercise.

## Field exercise setting

The exercise was conducted from 21 to 24 September 2008 in the Hunter New England Health Area, a region covering 130 000 km<sup>2</sup> (Figure 1).

The population of approximately 865 000 is concentrated on the eastern coastline, with public health offices located in Newcastle, Tamworth and Taree (Figure 2). The area also includes large inland towns and remote outback Aboriginal communities as far as 500 km from the coast.<sup>7</sup>

Figure 2. Map of the Hunter New England Area Health Service showing the location of emergency departments involved in the exercise



## EXERCISE TEAM AND SCENARIO

The scenario was designed by an independent team over a period of six months with the support of a part time project officer. Twenty external facilitators and umpires provided input through teleconferences held before the exercise. Surge staff, actors and public health personnel provided their time without charge against the exercise cost centre.

The exercise included:

- regular changes to case and contact definitions as anticipated in the early stages of a disease outbreak;
- visits to each ED by at least one actor (41 in total) with an influenza-compatible history for assessment against current case definitions and management according to accepted infection

control practices and public health protocols (ED staff were required to provide initial case notification to the public health unit [PHU]);

- 150 exposed people (contacts) who were identified during interview with the cases;
- two ambulance transfers to test infection control and transport logistics;
- the exercise team monitoring and adapting the scenario in real time to maintain pressure and authenticity;
- media interviews, community concerns and political injects; and
- trained staff using detailed scripts to build the 'epidemiological story' (information from many sources to provide insights into transmission pathways).

## Exercise Response Structure

A full Incident Command System (ICS) hierarchy was activated from the emergency operations centre. ICS staff included an incident controller and operations, planning, logistics and finance teams. Surge staff were recruited before the exercise, including 60 operations personnel. The operations team consisted of five separately located units of four people (an experienced team leader and three new nurses in each shift). Daily situation reports were prepared by the public health planning team and distributed to response personnel.

There were other significant exercise features.

- A local call centre was used to manage approximately 120 public enquiries per day and was supported onsite by an experienced public health nurse to provide technical assistance.
- Fourteen days before the exercise started, training was provided for surge staff through eight online modules. Orientation and additional training was offered at the beginning of each shift, with on-the-job support provided by experienced team leaders.
- An emergency operations centre was established in Newcastle and operational teams were located at the three public health campuses.
- Operations staff traced contacts, provided information and requested that they comply with current Australian containment protocols, including home quarantine, household infection control and antiviral prophylaxis.<sup>6</sup>
- An online database (NetEpi),<sup>8</sup> administered by the State, was used to maintain records of cases and contacts.
- Adequate data were provided for the public health planning team to conduct epidemiological analyses, prepare daily situation updates, support operational planning and forecast resource requirements.

## Debriefings and evaluation

The umpires and facilitators used a structured evaluation sheet to record their observations. They received training before the exercise began and provided comments on four areas: team-work, communications, documents/materials and decision-making.<sup>9</sup> At the conclusion

of each day's activities, structured debriefings were conducted with all players, to record aspects that worked well and identify weaknesses in plans and operations.<sup>10</sup>

## OUTCOME

### Key findings identified during the field exercise

The following shortcomings were identified during the exercise evaluation with most being addressed in a revised disaster plan before emergence of the 2009 influenza pandemic.

- (1) Emergency Departments: minor infection control irregularities.
- (2) Public Health Staff: counsellors to support those affected by stress; staff to provide orientation; surge staff engagement during the intra-pandemic period.
- (3) Public Health Operations Team: delays in rapidly disseminating key event information and new policy directions (e.g. weblogs); strategies to assist staff with personal and family-related concerns.
- (4) Public Health Planning Team: inadequate 'epidemiological story' development and data management; poor use of incident action plans. A planning workshop was recommended following evaluators' observations that the focus was on short-term response rather than using data to forecast future resource requirements and deployment.
- (5) Public Health Logistics Team: inability of the telephone system to cope with large numbers of enquiries, lack of a rostering officer and integrated staff roster system.

### Implementing the revised response plan during the 2009 influenza pandemic

During the early response to the 2009 pandemic (the Containment Phase), the disaster response team was activated using our updated regional disaster plan and revised ICS public health staffing structure. The operations and logistics teams principally comprised public health and surge staff who had been involved in the field exercise. The efficiency of emergency operations centre telecommunications, videoconferencing and information technology services and the functions of the



Identifying surge capacity may be problematic for some health services. We employed clinical nurse consultants from non-acute areas such as the sexual health unit and stomal therapy and found them to have excellent skills. Data managers and statisticians were seconded from the area's performance planning unit and readily adapted to their roles. Three Master of Applied Epidemiology graduates (from the Commonwealth's field epidemiology training programme) and a National Centre of Epidemiology and Population Health lecturer were principal contributors to the exercise and other graduates were involved to a lesser extent. This programme provides surge response to public health emergencies in Australia and the Region but is currently under threat of closure.

There are few detailed published reports of pandemic exercises, although parallels can be drawn from bioterrorism drills.<sup>12,13</sup> It appears that field exercises are only rarely deployed due to cost and resource implications,<sup>12</sup> but they often identify fundamental issues that are unlikely to be recognized using desktop exercises.<sup>4,14,15</sup>

### Lessons for planning

The pandemic response highlighted unresolved planning issues that had either not been identified during the exercise, or were inadequately addressed.

Our observations suggest that the full range of public health planning duties is poorly understood and this is likely to be reflected in preparedness, an observation recognized by others.<sup>14</sup> We interpret this role to include the following:

- providing assistance to the operations team to fulfil their duties through developing task lists and monitoring database quality assurance;
- mapping cases, contacts and transmission pathways;
- collating data to extract the 'epidemiological story' so that resources can be targeted towards effective public health interventions;
- performing regular risk analysis to ensure the response covers all contingencies;
- forecasting needs through workload trends and resource usage; and
- preparing incident action plans and situation reports.

Many of these priorities did not fully emerge during the field exercise possibly because the case-load and relatively short period of four days were insufficient to reveal these deficiencies. It was only during the extended pandemic response and when the database became larger and more complex that these became evident. Thus, while the field exercise provided an adequate opportunity for testing case and contact management it did not go far enough in meeting planning team needs. This could have been addressed through providing more hypothetical cases and contacts in the exercise database, or possibly telescoping the pandemic scenario's time-frame. Investment in testing the role of planning is important and may be best achieved through realistic desktop exercising, perhaps nested within a field exercise.

### CONCLUSION

An extended and realistic pandemic field exercise provided major benefits in preparing for the actual 2009 pandemic response and for generic public health disaster planning. It was particularly suited for the operations team in testing surge capacity. The principal exercise weakness was that it failed to adequately challenge the public health planning team. Our experiences indicate the importance of clarifying the scope of planning in disaster response, identifying the expertise required for the team and providing them appropriate exercise and training opportunities.

#### *Conflicts of interest:*

None declared.

#### *Funding:*

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# Western Pacific Surveillance and Response

## Instructions to Authors

### Aim of Western Pacific Surveillance and Response

To create a platform for sharing information to improve surveillance of and response to public health events in the Western Pacific Region.

### Objectives

- To produce a web-based publication on surveillance and response activities in the region that has high exposure and is freely accessible.
- To promote information sharing on experiences and lessons learnt in surveillance and response for public health events in the Western Pacific Region and globally.
- To build capacity in communicating epidemiological findings in the Western Pacific Region.
- To highlight new and relevant technical or guidance documents and meeting reports published by the World Health Organization, Western Pacific Regional Office.

### Audience

Western Pacific Surveillance and Response (WPSAR) is aimed at people studying, conducting research or working in surveillance of and response to public health events both within the region and globally.

### Scope

WPSAR covers all activities related to the surveillance of and response to public health events. Such activities may be implementation or evaluation of surveillance systems, investigations of public health events, risk assessments both in rapid responses and policy development, outbreak investigations and research on routine public health activities. Public health events may be in any of the following areas; communicable diseases, natural disasters, bioterrorism and chemical and radiological events.

### Frequency

Journal articles will be published an article at a time building up to an issue every quarter. This means that

articles will be uploaded onto the website after the review and editing process therefore allowing timely dissemination. Printed copies of the journal are available for areas with limited internet access on request after the end of each quarter.

### Instructions to authors for manuscript writing and submission

WPSAR follows the guidelines from the Uniform Requirements for Manuscripts Submitted to Biomedical Journals by the International Committee for Medical Journal Editors (ICMJE, <http://www.icmje.org/>).

### Format for Manuscripts

Please submit all articles in double spaced 12 point Arial font in a Microsoft® Office Word file or a compatible file in English.

The format of the article will depend on the type. There are letters to the editor, perspectives, case reports/case series, lessons from the field, surveillance reports, surveillance system implementation/evaluation, risk assessments, original research, news items and meeting/conference reports.

### *Letters to the Editor*

A letter commenting on a previously published article OR a letter commenting on the theme of the issue.

- Word limit: ≤500 words
- ≤5 references
- ≤1 illustration

### *Perspectives*

An unstructured article discussing an issue regarding surveillance of and response to public health events. The scope of the discussion must be clearly defined.

- Word limit: ≤1000 words
- ≤10 references
- ≤1 illustration

### *Case Report/Case Series*

An unstructured article describing an unusual case or series of cases of public health significance. Sub-

headings may be used to increase the readability of the article.

- Unstructured abstract of  $\leq 250$  words
- Word limit:  $\leq 2000$  words
- $\leq 15$  references
- $\leq 3$  figures/graphs/pictures

### *Lessons from the Field*

An article describing an issue faced in field epidemiology and the experience in trying to overcome the issue.

- Structured article with an abstract of  $\leq 250$  words and sections for problem, context, action, outcome and discussion
- The abstract should also be structured with problem, context, action, outcome, and discussion
- Word limit:  $\leq 2000$  words
- $\leq 15$  references
- $\leq 3$  figures/graphs/pictures

### *Surveillance Reports*

An article of a summary and interpretation of surveillance data for a given period of time. A description of the surveillance system and the limitations of the data collected must be included.

- Unstructured abstract of  $\leq 250$  words
- Word limit:  $\leq 2000$  words
- $\leq 15$  references
- $\leq 10$  figures/graphs/pictures

### *Surveillance System Implementation/Evaluation*

An article describing the implementation of a new surveillance system or an evaluation of an existing surveillance system used to detect public health events.

- Unstructured abstract of  $\leq 250$  words
- Word limit:  $\leq 2000$  words
- $\leq 15$  references
- $\leq 3$  figures/graphs/pictures

### *Risk Assessments*

An article detailing a risk assessment of a public health threat or event. The risk assessment may be planned and formal or rapid and informal. The scope and methods of the risk assessment must be clearly defined.

- Structured article with an abstract of  $\leq 250$  words, introduction, methods, results and discussion
- The abstract should also be structured with objective, methods, results, and discussion

- Word limit:  $\leq 2000$  words
- $\leq 15$  references
- $\leq 3$  figures/graphs/pictures

### *Original Research*

Original research articles may include epidemiological studies including outbreak investigations.

- Structured article with an abstract of  $\leq 250$  words, introduction, methods, results and discussion
- The abstract should also be structured with introduction, methods, results, discussion
- Word limit:  $\leq 3000$  words
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### *References*

Reference the most recent and relevant publications. Please use Vancouver style referencing. Sample references can be viewed online: [http://www.nlm.nih.gov/bsd/uniform\\_requirements.html](http://www.nlm.nih.gov/bsd/uniform_requirements.html).

Place the bibliography at the end of the article text and not as footnotes. Write journal names in full. Use superscript sequential numbering in the text. Place the number after any punctuation. For example:

These results are consistent with the original study.<sup>11</sup>

Reference personal communication in the text only and include the person's full name and institution.

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### Authorship

All authors should have contributed significantly to the article through one or more of the following in each category A, B and C:

#### A

- Study design
- Data collection
- Data analysis
- Data interpretation
- Writing the article

#### B

- Drafting the manuscript
- Critically revising the manuscript

#### C

- Final approval of the manuscript for submission

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