Response to A (H1N1) Pandemic: Strategy, Epidemiological and Virological study in Mainland China

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National Emergency Response Management Organization System

The joint emergency response system features unified command, graded responsibility, and is coordinated, orderly, and highly efficient.
A joint prevention and control working mechanism has been established for influenza A/H1N1 response, led by Ministry of Health and joined by 33 departments.

Science-based Prevention & Control —— Timely Adjustment of Strategy (1)

1. Establish joint prevention and control working mechanism, implement management in accordance with the law
2. Strengthen exit-entry port inspection & quarantine
3. Intensify epidemic surveillance, conduct background study of domestic outbreak
4. Step up prevention and control education campaign
5. Carry out R&D of diagnostic reagents and drugs
6. Conduct international exchange and cooperation, collect global outbreak information and tackle foreign-related matters.
7. Enhance preparedness to outbreaks, increase material stockpile for emergency response
Science-based Prevention & Control ——
Timely Adjustment of Strategy (2)

Confirming first case
Apr 25

Receiving WHO report
May 11

First domestic transmission
May 29

WHO Announcement of pandemic
Jun 11

Domestic case with unidentified cause
Jun 19

Cluster cases in school

First severe case
Aug 8

Key measures
① Intensify tracking and management of close contacts
② Designate hospitals to treat flu patients, enhance in-hospital infection control
③ Expand sentinel hospitals and network labs for flu surveillance

Science-based Prevention & Control ——
Timely Adjustment of Strategy (3)

Confirming first case
Apr 25

Receiving WHO report
May 11

First domestic transmission
May 29

WHO Announcement of pandemic
Jun 11

Domestic case with unidentified cause
Jun 19

Cluster cases in school

First severe case
Aug 8

Key measures
• Strengthen clinical case and lab etiological monitoring
• Improve tracking and management of close contacts
• Implement emergency response research projects, accelerate vaccine development
CHINESE CENTER FOR DISEASE CONTROL AND PREVENTION

**Science-based Prevention & Control ——
Timely Adjustment of Strategy (4)**

- Confirming first case: Apr 25 - May 11
- Receiving WHO report: May 29 - Jun 11
- First domestic transmission: Jun 11 - Jun 19
- WHO Announcement of pandemic
- Domestic case with unidentified cause of pandemic: Aug 8 - Jun 19
- Cluster cases in school
- First severe case

**Key measures**
- Reduce domestic transmission, prevent community outbreak
- Treat serious cases, respond to epidemic dynamics

1. Contain and reduce domestic transmission
2. Improve prevention and control work plans, enhance capacity of treating severe cases
3. Train prevention and control techniques and make stockpiling of vaccines, effective anti-viral drugs, etc.
4. Strengthen risk communication and properly guide public opinion

**CHINESE CENTER FOR DISEASE CONTROL AND PREVENTION**

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**Science-based Prevention & Control ——
Timely Adjustment of Strategy (5)**

- Confirming first case: Apr 25 - May 11
- Receiving WHO report: May 29 - Jun 11
- First domestic transmission: Jun 11 - Jun 19
- WHO Announcement of pandemic
- Domestic case with unidentified cause of pandemic: Aug 8 - Jun 19
- Cluster cases in school
- First severe case

**Key measures**
- Reduce domestic transmission, prevent community outbreak
- Treat serious cases, respond to epidemic dynamics

1. Improve and adjust port inspection and quarantine measures
2. Strengthen prevention and control work in schools, communities, townships, hospitals and other key public places
3. Carry out vaccine clinical trials

**CHINESE CENTER FOR DISEASE CONTROL AND PREVENTION**
Science-based Prevention & Control——
Enhance surveillance

Before May 2009

63 network labs
197 sentinel hospitals

Science-based Prevention & Control——
Enhance surveillance

Present

411 network labs
556 sentinel hospitals
Exert intensive care for serious cases and high risk population in order to lower incidence and mortality rate of severe cases

Treat mild cases under quarantine, intensify follow-up visits and guidance and ensure safe and effective home quarantine as well as treatment

Science-based Prevention & Control——Take Full Advantage of Traditional Chinese Medicine

Traditional Chinese medicine theory on epidemics:
Syndrome differentiated treatment based on reaction state of individual patient

Clinical trials indication:
Studies of the 2 / 3 clinical A/H1N1 influenza cases in mainland China which accepted the treatment of traditional Chinese medicine alone or involved in traditional medicine treatment indicate that Chinese medicine only is a safe and effective method for mild cases while Chinese medicine in combination with Tamiflu poses potential value for severe cases
Science-based Prevention & Control——R&D of Vaccines and Drugs (1)

Vaccine development

- Rapidly initiate 10 seasonal influenza vaccine manufacturers to carry out the R & D of influenza A/H1N1 vaccines
- State FDA accelerates review and approval procedures, China CDC coordinated the clinical trails in mainland of china
- 10 vaccine companies involved, including whole inactive vaccine, and split vaccine with/without adjuvant, 2 doses immunization
- Clinical trials of 3 vaccine types have been done in 10 enterprises since July 22, 13,383 people were vaccinated the first dose with mild adverse reactions
- Domestic production capacity is expected to produce enough vaccines for 5% Chinese population by the end of 2009.

Science-based Prevention & Control——R&D of Vaccines and Drugs (2)

- Start emergency supply procedure to increase stockpiling and output of Tamiflu, and reserve certain amount of zanamivir. Besides, support new anti-viral drugs research and development

- Diagnostic reagents:
  Provide testing reagent kits to 411 domestic flu surveillance network labs, port inspection and quarantine labs, and 12 states, including Cuba, Mongolia and some ASEAN nations
Science-based Prevention & Control——
Enhance Risk Communication（1）

- Timely release epidemic information and prevention and control progress
- Monitor public opinions, make real-time analysis and adjust media policy in time
- Clarify facts timely to avoid public panic
- News media helps guide public opinions and protect social harmony and stability

Science-based Prevention & Control——
Step up Health Promotion Activities（2）

- Organize experts to give lectures on influenza prevention and control in residential communities, schools, and working places
- Formulate and disseminate materials, broadcast public commercials and TV lectures, publish flu column and send short messages of flu knowledge to mobile subscribers
**Prevention and Control in Accordance with Law**

- Clarify responsibilities, implement measures in accordance with the plans.
- Incorporate into the management of "Communicable Disease Prevention Act" and "Frontier Health and Quarantine Law".
- Earnestly implementing the relevant provisions of "International Health Regulations (2005)".

Carry out prevention and control work in stringent compliance to domestic and international laws, regulations and provisions of preparedness plans.

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**Prevention and Control in Accordance with Law—Duly Adjust Statutory Management Categories**

**April 30**
- Take Category A infectious diseases prevention and control measures for Category B infectious diseases.
- Manage as a quarantine infectious disease according to "Frontier Health and Quarantine Act".

**July 10**
- Take Category B infectious diseases prevention and control measures for Category B infectious diseases.
- Manage as a surveillance infectious disease according to "Frontier Health and Quarantine Act".
Updated Surveillance Information System for Influenza

Sentinel Hospitals

- Samples Collection
- Fill the Original Form For Delivery and Examination

Network Laboratories

- Samples Identification
- Print the Delivery and Examination Form of Flu Virus Strain

CNIC

- Confirmation & Feedback

China Information System for Disease Control and Prevention

Surveillance Information System for Influenza

Information Management System for A (H1N1)

The Expand of A(H1N1) Influenza

End of May, N=8
End of Jun, N=23
End of Jul, N=26
End of Aug, N=27

Till Sep 6, all the 31 provinces/autonomous region/municipals reported confirmed cases

CHINESE CENTER FOR DISEASE CONTROL AND PREVENTION
Distribution of notified cases of Pandemic A(H1N1) by onset date (as of Sep 18)

Distribution of A(H1N1) cases at City/District Level (As of Sep 27)
Distribution of A(H1N1) Outbreaks (As of Sep, 27)

Distribution of A(H1N1) Cases by Age (As of Sep 27, N=19981)

- Median of Age: 17 (1M – 80Y)
- <18: 8316 (66%)
- ≥60: 45 (0.4%)
- Male: 7532 (60%)
Source of Infection (N=3392)

- Domestic infected cases with unknown cause
- Second generation of imported cases
- Imported cases

Outbreaks of A(H1N1)

- No. of Outbreaks
- No. of related Cases
Percentage of ILI Reported by Sentinel Hospitals during 2006—2009 in Southern Area

Percentage of ILI Reported by Sentinel Hospitals during 2006—2009 in North Area
Composition of the type/subtype of influenza virus from ILI Surveillance

Composition of the type/subtype of influenza virus of Outbreaks
Hemagglutination inhibition (HI) tests of pandemic H1N1 virus with post-infection ferret and chicken antiserum

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Novel A(H1N1) isolates

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<th>HA</th>
<th>NA</th>
<th>NP</th>
<th>NS</th>
<th>MP</th>
<th>PA</th>
<th>PB1</th>
<th>PB2</th>
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Phylogenetic Analysis

● Isolates from China

Novel A(H1N1)
Seasonal H1N1
Evolutionary Relationships Among Pandemic A (H1N1) Hemagglutinin Genes, 2009

**Vaccine strain:** *H274Y* Oseltamivir Resistant  
*: E Egg Passage

**June 2009**
- A/Hunan/6/2009 Jun
- A/Hunan/9/2009 Jun
- A/Shanghai/7/2009 Jun
- A/Guangdong/27/2009 Jun
- A/Guangdong/28/2009 Aug
- A/Guangdong/30/2009 Aug

- A/Tianjin/2/2009 Jun
- A/Shanghai/4/2009 May
- A/Guangdong/2/2009 May
- A/Guizhou/1/2009 Jun
- A/Hainan/1/2009 Jun
- A/Guangdong/4/2009 May
- A/Hainan/2/2009 Jun
- A/Zhejiang/1/2009 May
- A/Shanghai/2/2009 May
- A/Shanghai/6/2009 May
- A/Hunan/5/2009 Jun
- A/Shaanxi/1/2009 Jun
- A/Hunan/12/2009 Jun
- A/Shanghai/121/2009 Aug
- A/Hainan/6/2009 Jun
- A/Heilongjiang/1/2009 Jul
- A/Hainan/14/2009 Jul
- A/Hunan/18/2009 Jul
- A/Hebei/1/2009 Jun
- A/Shanghai/3/2009 May
- A/Zhejiang/2/2009 May
- A/Shanghai/1/2009 May
- A/Chongqing/1/2009 Jun
- A/Hainan/5/2009 Jun
- A/Fujian/1/2009 May
- A/Liaoning/1/2009 Jun
- A/Tianjin/4/2009 Jun
- A/Hunan/4/2009 Jun
- A/Hainan/2/2009 Jun
- A/Fujian/5/2009 May
- A/Fujian/9/2009 Jun
- A/Fujian/10/2009 Jun
- A/Fujian/7/2009 Jun
- A/Fujian/11/2009 Jun
- A/Fujian/6/2009 May
- A/Fujian/4/2009 May
- A/Fujian/8/2009 Jun
- A/Shanxi/1/2009 Jun
- A/Jiangxi/1/2009 Jun
- A/Yunnan/1/2009 Jun
- A/Shandong/1/2009 May
- A/Shanghai/5/2009 Jun
- A/Jilin/2/2009 Jun
- A/Jilin/1/2009 Jun
- A/Beijing/3/2009 May
- A/Hunan/3/2009 Jun
- A/Anhui/1/2009 Jun
- A/Hubei/1/2009 May
- A/Jiangsu/1/2009 Jun
- A/Tianjin/1/2009 Jun
- A/Shanghai/119/2009 Aug
- A/Fujian/3/2009 May
- A/Beijing/5/2009 May
- A/Beijing/4/2009 May
- A/Beijing/6/2009 May
- A/Guangdong/1/2009 May
- A/Sichuan/1/2009 May
- A/Shanghai/120/2009 Aug
- A/Beijing/1/2009 May

**July 2009**
- A/California/07/2009
- A/California/04/2009

**August 2009**
- A/Beijing/1/2009 May

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Evolutionary Relationships Among Pandemic A (H1N1) Neuraminidase Genes, 2009

**Vaccine strain:** *H274Y* Oseltamivir Resistant  
*: E Egg Passage

**June 2009**
- A/Hunan/6/2009 Jun
- A/Hunan/9/2009 Jun
- A/Fujian/10/2009 Jun
- A/Guangdong/30/2009 Aug
- A/Shanghai/7/2009 Jun
- A/Hainan/5/2009 Jun
- A/Tianjin/2/2009 Jun
- A/Jiangxi/2/2009 Jul
- A/Jiangxi/8/2009 Jul
- A/Fujian/9/2009 Jun
- A/Shanghai/1/2009 May
- A/Jiangxi/1/2009 Jun
- A/Shanghai/2/2009 May
- A/Shanghai/5/2009 Jun
- A/Fujian/7/2009 Jun
- A/Guangdong/3/2009 May
- A/Shanghai/4/2009 May
- A/Guangdong/2/2009 May
- A/Guangxi/1/2009 Jun
- A/Guizhou/1/2009 Jun
- A/Hainan/1/2009 Jun
- A/Shanghai/6/2009 May
- A/Jilin/1/2009 Jun
- A/Yunnan/1/2009 Jun
- A/Hainan/6/2009 Jun
- A/Henan/14/2009 Jul
- A/Guangdong/4/2009 May
- A/Guangdong/28/2009 Aug
- A/Fujian/8/2009 Jun
- A/Hunan/6/2009 Jun
- A/Hunan/9/2009 Jun
- A/Heilongjiang/1/2009 Jul
- A/Fujian/6/2009 May
- A/Fujian/11/2009 Jun
- A/Tianjin/4/2009 Jun
- A/Hainan/2/2009 Jun
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- A/Beijing/5/2009 May
- A/Hubei/1/2009 May
- A/Shanghai/119/2009 Aug
- A/Guangdong/1/2009 May
- A/Jiangsu/1/2009 Jun
- A/Tianjin/1/2009 Jun
- A/Shanghai/2/2009 May
- A/Shanghai/6/2009 May
- A/Hunan/5/2009 Jun
- A/Shaanxi/1/2009 Jun
- A/Hunan/12/2009 Jun
- A/Shanghai/121/2009 Aug
- A/Zhejiang/2/2009 May
- A/Sichuan/1/2009 May
- A/Shanghai/120/2009 Aug
- A/Beijing/1/2009 May

**July 2009**
- A/California/07/2009
- A/California/04/2009

**August 2009**
- A/Beijing/1/2009 May
Antiviral Resistance Surveillance of A(H1N1)---(Cont.)

- A/Hunan/SWL3/2009(H1N1) had histamine to tyrosine mutation at residue 274 of the NA (N2 Numbering; residue 275 by N1 numbering), which confers a high level of resistance to Oseltamivir, no evidence of onward transmission was found yet.

- The other viruses were sensitive to Oseltamivir.

- All the viruses isolated were resistant to adamantane.