http://wwwnc.cdc.gov/EID/article/21/4/14-1545-Techapp1. pdf). The absence of correlation between the IgG statuses of mothers and children suggests that vertical transmission is probably not a major contributor to new infections, although it remains plausible that it may sometimes occur.

Data from Europe that suggest an association between PARV4 infection and progression to Centers for Disease Control and Prevention B-syndromes in HIV-positive persons are problematic because of confounding high rates of HCV infection and injection drug use in the PARV4-positive group (8). We sought evidence for this effect in our cohort, in which rates of HCV infection and injection drug use were likely to be negligible. We found no evidence of a PARV4 serostatus effect on HIV RNA load or CD4+ T cells in children (p = 0.13, p = 0.68, respectively; online Technical Appendix Table 1) or adults (p = 0.15, p = 0.77, respectively; online Technical Appendix Table 2).

We found an unexpected negative correlation between PARV4 IgG and HIV status in children (p = 0.05, Fisher exact test; online Technical Appendix Table 1). One possible explanation is that a detectable PARV4 IgG response is not mounted or maintained in the context of HIV infection; however, this theory is not supported by previous studies in which PARV4 IgG seems to be more prevalent in HIV-infected populations (5,8).

Our analysis was limited by small numbers tested and the retrospective approach to sample testing. Demographic data were not recorded for this cohort, so we are unable to explore further possible social or demographic risk factors that might correlate with PARV4 infection.

This study contributes to an evolving body of data suggesting that PARV4 is highly endemic to different settings across Africa. The unknown clinical effects and transmission routes of this virus remain pressing questions for future research.

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#### References

- Matthews PC, Malik A, Simmons R, Sharp C, Simmonds P, Klenerman P. PARV4: an emerging tetraparvovirus. PLoS Pathog. 2014;10:e1004036. http://dx.doi.org/10.1371/journal.ppat.1004036
- Sharp CP, Lail A, Donfield S, Gomperts ED, Simmonds P. Virologic and clinical features of primary infection with human parvovirus 4 in subjects with hemophilia: frequent transmission by virally inactivated clotting factor concentrates. Transfusion. 2012;52:1482–9. http://dx.doi.org/10.1111/j.1537-2995.2011.03420.x

- Sharp CP, Lail A, Donfield S, Simmons R, Leen C, Klenerman P, et al. High frequencies of exposure to the novel human parvovirus PARV4 in hemophiliacs and injection drug users, as detected by a serological assay for PARV4 antibodies. J Infect Dis. 2009;200:1119–25. http://dx.doi.org/10.1086/605646
- Simmonds P, Manning A, Kenneil R, Carnie FW, Bell JE. Parenteral transmission of the novel human parvovirus PARV4. Emerg Infect Dis. 2007;13:1386–8. http://dx.doi.org/10.3201/ eid1309.070428
- Sharp CP, Vermeulen M, Nebie Y, Djoko CF, LeBreton M, Tamoufe U, et al. Epidemiology of human parvovirus 4 infection in sub-Saharan Africa. Emerg Infect Dis. 2010;16:1605–7. http://dx.doi.org/10.3201/eid1610.101001
- Lavoie M, Sharp CP, Pepin J, Pennington C, Foupouapouognigni Y, Pybus OG, et al. Human parvovirus 4 infection, Cameroon. Emerg Infect Dis. 2012;18:680–3. http://dx.doi.org/10.3201/ eid1804.110628
- Chen MY, Yang SJ, Hung CC. Placental transmission of human parvovirus 4 in newborns with hydrops, Taiwan. Emerg Infect Dis. 2011;17:1954–6. http://dx.doi.org/10.3201/eid1710.101841
- Simmons R, Sharp C, McClure CP, Rohrbach J, Kovari H, Frangou E, et al. Parvovirus 4 infection and clinical outcome in high-risk populations. J Infect Dis. 2012;205:1816–20. http://dx.doi.org/10.1093/infdis/jis291
- Sharp CP, LeBreton M, Kantola K, Nana A, Diffo Jle D, Djoko CF, et al. Widespread infection with homologues of human parvoviruses B19, PARV4, and human bocavirus of chimpanzees and gorillas in the wild. J Virol. 2010;84:10289–96. http://dx.doi.org/10.1128/ JVI.01304-10
- May J, Drexler JF, Reber U, Sarpong N, Adjei O, Panning M, et al. Human parvovirus 4 viremia in young children, Ghana. Emerg Infect Dis. 2012;18:1690–2. http://dx.doi.org/10.3201/ eid1810.111836

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# **Co-infection with Avian (H7N9) and Pandemic (H1N1) 2009 Influenza Viruses, China**

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To the Editor: Since the first case of avian-origin influenza (H7N9) virus infection was reported in March 2013 in Shanghai, China, this virus has caused ~400 confirmed cases (http://www.who.int/influenza/human animal interface/ influenza h7n9/Data Reports/en/). According to the Chinese Influenza Weekly Report (http://www.cnic.org.cn/eng/ show.php?contentid=699), during the winter of 2013-14, multiple influenza viruses that infect humans co-circulated in southern China; these viruses were influenza A(H1N1) pdm09, seasonal influenza A(H3N2), and influenza B viruses, together with avian influenza (H7N9) virus,. Coinfection of humans with avian virus subtype H7N9 and human virus subtypes were reported in Jiangsu Province in June 2013 (1) and in Zhejiang Province in January 2014 (2), respectively. We report a fatal case of co-infection with influenza (H7N9) and A(H1N1)pdm09 viruses, which was further confirmed by virus isolation and neutralization antibody detection.

In a retrospective study, we identified co-infection with A(H1N1)pdm09 and novel avian-origin H7N9 virus in a 61-year-old female patient from the urban area of Shanghai, China. She had a 3-year history of thrombocythemia. In October 2013, she received an annual vaccine that included an A/California/7/2009(H1N1)pdm09-like virus, an A/Texas/50/2012(H3N2)-like virus, and an influenza B virus, as recommended by the World Health Organization (http://www.who.int/influenza/vaccines/virus/recommendations/2013 14 north/en/). On December 26, 2013, the patient experienced influenza-like symptoms; the next day, she was hospitalized. Despite oral administration of oseltamivir, a rapidly progressive pneumonia developed, and the patient died of multiple organ failure 9 days after admission. On December 31, 2013 (day 5), 1 serum and 2 throat swab samples were collected; both throat swab samples were positive for influenza A and A(H1N1)pdm09 virus, according to the universal and subtype-specific primers provided by the Chinese Center for Disease Control and Prevention (http://www.who. int/influenza/resources/documents/diagnostic recommendations/en/). On January 3, 2014 (day 8), 1 bronchial secretion and 1 serum sample were also collected.

Recent DNA sequencing analysis of the stored bronchial secretion specimen, performed on a Roche 454 platform (*3*) (Roche, Basel, Switzerland) showed co-existence of H1, H7, N1, and N9 genomic segments, which were further confirmed by real-time reverse transcription PCR (RT-PCR). The cycle threshold values of H7 and H1 were 35.65 and 29.94, respectively.

We then determined antibody levels of the 2 serum samples collected on days 5 and 8 by using a microneutralization assay (4) with MDCK cells infected with 2 representative strains, A/Shanghai/4664T/2013(H7N9) and A/Shanghai/37T/2009(H1N1), respectively. The samples were serially diluted 2-fold (1:10 to 1:1,280) at a starting

dilution of 1:10; titers were expressed as the reciprocal of the highest dilution of 50% neutralization. The microneutralization titers against novel subtype H7N9 virus were 160 and 320 for the samples collected on days 5 and 8, respectively. This finding indicated that the patient could have been infected by novel subtype H7N9 viruses (5); microneutralization titers against A/Shanghai/37T/2009(H1N1) were 320 for both samples.

To determine whether the reassortment had occurred between the 2 subtypes of influenza A viruses during the co-infection, we isolated the virus strains from the bronchial secretion on either MDCK cells (A[H1N1] (http://www.who.int/influenza/gisrs laboratory/ pdm09) manual diagnosis surveillance influenza/en/) or embryonated eggs (H7N9) through several passages. The hemagglutination titers of the isolated H7N9 (A/Shanghai/Mix1/2014[H7N9]) and A(H1N1)pdm09 viruses (A/ Shanghai/Mix1/2014[H1N1]) in allantoic fluid were 32 and 8, respectively. Cultures of the 2 isolates were subjected to RT-PCR for detection of 8 genomic segments. The RT-PCR products were sequenced on an ABI 3730XL Automatic DNA Analyzer by using an ABI Prism BigDye Terminator v3.1 Cycle Sequencing Kit (both from Applied Biosystems, Foster City, CA, USA). The full-genome sequences were submitted to the National Center for Biotechnology Information Influenza Virus Resource (GenBank accession nos. KJ946415, KJ946416 and KP058484-KP058489 for A/ Shanghai/Mix1/201[H7N9] and KM607860, KM607861 and KP058490–KP058495 for A/Shanghai/Mix1/2014[H1N1]).

Phylogenetic trees were constructed by using the neighbor-joining method in MEGA 5.1 (http://www.mega software.net) to estimate relationships with selected influenza A virus reference sequences obtained from GenBank and the Global Initiative on Sharing Avian Influenza Data database. DNA sequence analysis showed that no genetic reassortment had occurred between the 2 subtypes because only H7N9 or A(H1N1)pdm09 genomic fragments were found in the culture of the respective isolate (Figure; online Technical Appendix, http://wwwnc.cdc.gov/EID/ article/21/4/14-1560-Techapp1.pdf). Phylogenetic analyses of the hemagglutinin and neuraminidase genes revealed that the A/Shanghai/Mix1/2014(H7N9) and A/Shanghai/ Mix1/2014(H1N1) viruses were clustered into the clade of A/Shanghai/01/2014(H7N9)-like viruses (6) (Figure, panels A and B) and A/Shanghai/6109/2014(H1N1)-like viruses (Figure, panels C and D), respectively. In addition, the phylogenetic trees of the 6 internal genes were close to those of H7N9 viruses or A(H1N1)pdm09-lineage viruses that had recently circulated in China (online Technical Appendix).

Co-infections with H7N9 and other influenza subtypes have been reported from Jiangsu (1) and Zhejiang (2) Provinces as well as in our study, indicating the potential risk for co-infection during the influenza season

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**Figure.** Phylogenetic analyses of A/Shanghai/Mix1/2014(H7N9) and A/Shanghai/Mix1/2014(H1N1) viruses from Shanghai, China, January 2014. A) Hemagglutinin and B) neuraminidase of A/Shanghai/Mix1/2014(H7N9); C) hemagglutinin and D) neuraminidase of A/Shanghai/Mix1/2014(H1N1). Multiple alignments were constructed by using the ClustalW (http://www.clustal.org/) algorithm based on the sequences of the hemagglutinin and neuraminidase genes. Genetic distances were calculated by using the Kimura 2-parameter method, and phylogenetic trees were constructed by using the neighbor-joining method with bootstrap analysis of 1,000 replicates in MEGA 5.1 (http://www.megasoftware.net). Horizontal distances are proportional to genetic distances. Numbers next to nodes indicate bootstrap value percentages (>70%). Circles indicate the A/Shanghai/Mix1/2014(H7N9) and A/Shanghai/Mix1/2014(H1N1) virus strains isolated from the co-infection patient from Shanghai, China. Triangles indicate the representative strains of the Shanghai area during the same period as the influenza (H7N9) outbreak in China. Squares indicate the representative strains of the Shanghai area during the same wave of the H7N9 outbreak in China. Scale bars indicate nucleotide substitutions per site. The Global Initiative on Sharing Avian Influenza Data database or GenBank accession numbers of the influenza viruses used in the construction of the phylogenetic analyses are displayed in the phylogenetic trees, which follow the taxon names.

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in China. Although reassortment was not detected in this co-infection, a potential risk for emergence of a new pandemic strain by reassortment between these 2 viruses (with humans as mixing vessels) should not be ignored. To reduce the risk for emergence of new viral subtypes, the public health and scientific communities should enhance surveillance for co-infection with influenza (H7N9) virus and other influenza virus subtypes.

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#### References

- Zhu Y, Qi X, Cui L, Zhou M, Wang H. Human co-infection with novel avian influenza A H7N9 and influenza A H3N2 viruses in Jiangsu Province, China. Lancet. 2013;381:2134. http://dx.doi. org/10.1016/S0140-6736(13)61135-6
- Li J, Kou Y, Yu X, Sun Y, Zhou Y, Pu X, et al. Human co-infection with avian influenza and seasonal influenza viruses, China. Emerg Infect Dis. 2014;20:1953–5. http://dx.doi.org/10.3201/ eid2011.140897
- Ramakrishnan MA, Tu Z, Singh S, Chockalingam A, Gramer M, Wang P, et al. The feasibility of using high resolution genome sequencing of influenza A viruses to detect mixed infections and quasispecies. PLoS ONE. 2009;4:e7105. http://dx.doi.org/10.1371/ journal.pone.0007105
- Chan KH, To K, Hung I, Zhang A, Chan J, Cheng V, et al. Differences in antibody responses of individuals with natural infection and those vaccinated against pandemic H1N1 2009 influenza. Clin Vaccine Immunol. 2011;18:867–73. http://dx.doi.org/10.1128/ CVI.00555-10
- Dong L, Bo H, Bai T, Gao R, Dong J, Zhang Y, et al. Combination of serological assays to detect human antibodies to the avian influenza A H7N9 virus. PLoS ONE. 2014;9:e95612. http://dx.doi.org/10.1371/journal.pone.0095612
- Zhang W, He Y, Xu L, Dai F, Mei Z, Qian L, et al. Full-genome analysis of influenza A(H7N9) virus from Shanghai, China, 2014. Genome Announc. 2014;2:e00578–14. http://dx.doi.org/10.1128/ genomeA.00578-14

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# Nairobi Sheep Disease Virus RNA in Ixodid Ticks, China, 2013

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To the Editor: Nairobi sheep disease virus (NSDV; genus *Nairovirus*, family *Bunyaviridae*) causes acute hemorrhagic gastroenteritis in sheep and goats (1,2). First identified in Nairobi, Kenya, in 1910, it is considered endemic in East Africa (1,3). Ganjam virus, a variant of NSDV, is found in India and Sri Lanka (2). NSDV has a limited effect on animals bred in areas to which the virus is endemic but can cause large losses of animals during introduction of new livestock or transport of animals through these areas (4). In humans, NSDV infection can cause febrile illness, headache, nausea, and vomiting (5).

Ticks are the main transmission vectors of NSDV and many other viral pathogens and therefore pose a major threat to public health (6,7). Here, we describe a newly discovered NSDV, named NSDV (China), identified by viral metagenomic analysis of ticks collected from the northeast region of the People's Republic of China (Liaoning, Jilin, and Heilongjiang provinces) during May–July, 2013, and divided into 9 groups according to tick species and sampling sites. Four tick species were morphologically identified: *Haemaphysalis longicornis* (84.8%); *Dermacentor silvarum* (7.2%); *D. nuttalli* (5.5%); and *Ixodes persulcatus* (2.5%) (online Technical Appendix Table 1, http://wwwnc. cdc.gov/EID/article/21/4/14-1602-Techapp1.pdf).

Of the 6,427 ticks collected, 3,410 were divided into 9 groups (average 379 ticks/group, range 163–512); each group was homogenized in SM buffer (50 mmol/L Tris, 10 mmol/L MgSO<sub>4</sub>, 0.1 mol/L NaCl, pH 7.5). Viral RNA extraction, Solexa sequencing, and analysis are described in the online Technical Appendix. Among the sequences annotated to mammalian viruses, 65 contigs were found to target the small (n = 15), medium (n = 27), and large (n = 23) segments of the NSDV genome (online Technical Appendix Tables 2–4).

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# Co-infection with Avian (H7N9) and Pandemic (H1N1) 2009 Influenza Viruses, China

## **Technical Appendix**

Hul/DEWH72-03/2013\_CY181536 Hul/DEWH72-09/2013\_CY181536 JU/DEWH72-09/2013\_CY181584 JU/DEWH730/2013\_CY187625 HU/DEWH730/2013\_CY187625 HU/DEWH720/2013\_CY187625 HU/DEWH720/2013\_CY1872529 H/3/2013\_KP007065 HU/2013\_KF00500 HU/2013\_KF00500 HU/2013\_KF00500 HU/2013\_KF00500 HU/2013\_KF00500 HU/2013\_KF00500 HU/2013\_KF00500 A (F034908 2013\_KF021594 -Z3U01/2013\_KJ633805 ijlang/DTID-2JU01/04/2\_ MU/DEW/17-05/2013\_CY181552 buhu/DEW/17-05/2013\_CY181558 buhu/DEW/17-05/2013\_CY181558 buhu/DEW/17-05/2013\_CY181558 cker/5hangha/S1084/2013\_CY147121 Hargarbou/1/2013\_K7001507 Hargarbou/1/2013\_K7001507 hu/DEW/17-01/2013\_CY181520 ck/Zheijang/SC410/2013\_CY147185 Shangha/S10917/2013\_K797838 eming pigeon/Jiangbu/S1084/2013\_CY147185 Jiangwi/J2013\_J27013\_K71800524 ligeon/Shangha/J12013\_K71800524 tree sparrow/Shangha/J01/2013\_K71800524 Hawar1/2013\_K728142 Hawar1/2013\_K728142 VAnainga/1/2013\_K7280725 VAnainga/1/2013\_K71800552 VAnainga/1/2013\_K71800755 VAnainga/1/2013\_K705755 VAnainga/1/2013\_K705755 VAnainga/1/2013\_K705755 VAnainga/1/2013\_K705755 VAnainga/1/2013\_K705755 VAnainga/1/2013\_K705755 VAnainga/1/2013\_K705755 VAnainga/1/2013\_K705755 VAnainga/1/2013\_K705755 ou/3/2013, og/HZ1/2013, shal/S10 ang/1/2013\_kF277196 formmett/Shandon/S5038/2013\_CY1470 mment/Henan/S0429/2013\_CY147089 gnha/2/2013\_KF420311 onment/Henan/SC232/2013\_CY147081 gha/LY0112013\_KF609516 hal/CN02/2013\_KF609516 onment/Fujlan/SC337/2013\_CY147073 ang/0T10-22108/2013\_KF500927 /515/201 //rturbac/515/2013\_kF260953 Chejang/TDL2/U01/2013\_KF042112 //013\_wf042013\_kF042112 //013\_b015013 //011D-22N05/2013\_kF042112 //01D-22N05/2013\_kF0500924 //bangha/St1410/2013\_CY147017 hu/s2702/2013\_CY147057 //d2013\_kF0047013\_CY147017 //d2013\_kF0047113 2013\_kF034916 ment/Guandomu/35/2013\_kF042111 //d2013\_bF034916 (%2013.3\_KF007137 (%2013\_KF03916 anment)/Guangdong/22013\_KF667744 anment/Guangdong/22013\_KF667744 ment/Harg2Not/34/2013\_CY146905 sou/3/2013\_KF007105 (Zhejlang/SD07/2013\_CY147033 anment/Shandong/SD04/2013\_CY147113 anment/Shandong/SD04/2013\_CY147113 anment/Shandong/SD04/2013\_CY147113 and/2013\_KF007049 ment/Shandong/SD04/2013\_CY147113 and/2013\_KF007049 = A/environment/Shanghal/Y10012013\_KF918664 = mct/Shanghal/S136/2013\_CY147001 u/2/2013\_KF00512 Arenvironment/Shanghar/S1436/2013\_CY147129 Archicker/Shanghar/S1086/2013\_CY147001 Arkinker/V12013\_KF0034844 Arbeiging/1/2013\_K61260 Arbeiging/1/2013\_K612409 Arbeiging/1/2013\_K612404 Arbeiging/1/ DZ A

A/Shanghai/MH01/2013\_KF609501 В A/Wuxl/2/2013\_KF034917 A/environment/Suzhou/14/2013 KF034885 A/tree sparrow/Shanghai/01/2013\_KJ508888 - A/Beijing/3/2013\_KJ476647 A/Wuxi/1/2013\_KF034909 A/Suzhou/3/2013\_KF007106 A/chicken/Jiangsu/SCS37/2013\_CY146938 A/chicken/Zhejiang/C481/2013\_KF042095 A/chicken/Zhejiang/DTID-ZJU01/2013\_KC899667 A/Suzhou/S/2013\_KF007138 A/Shanghal/S190T/2013\_KF997837 — A/chicken/Shanghal/017/2013\_KF542888 A/environment/Shanghal/S1088/2013\_CY147122 - A/Taiwan/1/2013\_KF018038 A/Taiwan/1/2013\_KF018038
 A/Wuxi/4/2013\_KF007074
 A/Pipigeon/Shanghal/S1423/2013\_CY147186
 A/chicken/Shanghal/S1053/2013\_CY14794
 A/wild pigeon/Jiangsu/SD01/2013\_CY14794
 A/Manjing/4/2013\_KF007050
 A/chicken/Zhejiang/SD019/2013\_CY147042
 A/bicken/Zhejiang/SD019/2013\_CY147042 A/chicken/Shanghai/S1055/2013 CY146962 A/environment/Shanghai/TY01/2013\_KF918665 - A/Wuxi/3/2013\_KF007066 A/Xuzhou/1/2013\_KF150614 A/Zhejiang/HZ1/2013\_KF055468 A/Zhejiang/DTL-ZJU01/2013\_K633806 A/Zhejiang/DTL-ZJU01/2013\_K685961 A/Chejiang/DTL-ZJU01/2013\_K685961 - A/chicken/Jiangsu/SC035/2013\_CY145922 A/environment/Shanghal/S1438/2013\_CY147146 A/homing pigeon/Jiangsu/SD184/2013\_CY147162 — A/tree sparrow/Shanghal/01/2013\_KF609525 - A/Beijing/2/2013\_KJ476639 A/chicken/Shanghal/S1410/2013\_CY147018 A/chicken/Rizhao/871/2013\_KF260711 A/chicken/Rizhao/867/2013\_KF260710 A/chicken/Rizhao/855/2013\_KF260712 A/environment/Fujian/SC337/2013\_CY147074 Avlandjing/7/2013\_KF007146
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	4 A/New Mexico/06/2011 KC881939	
	A/Michigan/03/2011 KC882276	
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	- A/New York/3835/2010_CY065033	
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	A/Florida/02/2010_KC780535	
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	- A/Georgia/M5081/2012_CY148065	2009 pdmH1N1
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- A/California/VRDL10/2010_CY063182	
74 A/California/VRDL123/2009_CY066362	
- A/Alaska/47/2009_KC780776	
74 A/Boston/DOA08/2011_ CY134468	
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A/Beijing/4/2009_GQ232094	
A/California/07/2009_FJ969536	
A/New York/1669/2009_CY039896	
73. A/Arizona/01/2011_KC881968	
A/California/21/2011_KC882272	
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A/California/20/2011_KC882267	
A/Georgia/T51700/2012_CY148254	
A/Shanghai/3184T/2011_JN631064	2009 pdmH1N1
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	A/New York/WC-LVD-13-012/2013_CY188906
	A/New Jersey/NHRC403730/2013_KF928646
	A/Boston/YGA_01218/2013_CY170088
	45 A/IIIINOIS/NHRC415/06/2013_KJ538540
	• A/TIIII0IS/NERC415/12/2013_KJ538490
	- A/New York/WC-LVD-13-016/2013_CY188938
	A/Gainesville/08/2013 KJ645764
	A/Gainesville/05/2014_KJ645772
	A/Shanghai/Mix1/2014_KP058494
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	A/New York/WC-LVD-14-004/2014_CY189074
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	A/New York/WC-LVD-14-022/2014_CY189218
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	A/Washington/07/2014 KM409137
	- A/Illinois/NHRC414454/2013_KJ538532
	A/New York/WC-LVD-13-015/2013_CY188930
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	A/Chicago/YGA_04123/2012_CY171544
	A/Boston/YGA_00037/2013_CY168096
	81 A/Houston/JMM_93/2012_CY182930
	A/Houston/JMM_04/2012_CY182/14
	- A/Houston/JMM_148/2013_CV183330
	A/Santa Clara/YGA 03030/2013 CY170672
	A/North Carolina/02/2011_KC881769
	A/Georgia/NHRC0001/2011_CY092905
	A/California/14/2011_KC881738
	<ul> <li>A/South Carolina/NHRC0002/2011_CY092897</li> </ul>
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	A/Wisconsin/16/2011_KC881646
	A/Boston/DOA40/2011_CY111287
	A/North Carolina/06/2011_KC882238
	A/California/21/2011_KC881066
	A/District of Columbia/INS600/2011_CY129871
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	A/Colorado/11/2010_KC882367
	A/New York/6530/2010_CY065060
	A/Alabama/01/2010_KC781902
	A/Washington/01/2010_KC781291
	– A/Texas/JMS406/2010_CY061132
	A/New York/1669/2009_CY039894
	A/Alabama/02/2009_GQ45/4/4
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	A/Houston/22H/2009_CY053151
	A/California/07/2009_FJ969537
	A/Boston/594/2009_CY089204
	A/California/08/2009_FJ969532
	A/California/06/2010_KC780144
	A/Fuzhou/01/2009_GQ288375
	A/Houston/23H/2009_CY053159
	A/May York/4662/2010_CV065052
	A/Tennessee/F1063A/2010_CY167357
	A/Wyoming/01/2010 KC781182
	A/Wisconsin/02/2010_KC780524
	A/Texas/JMS402/2010_CY061108
	A/Boston/606/2009_CY075525
	- A/Colorado/02/2010_KC780223
	A/Los Angeles/INS423/2010_CY083818
	A/Techigi/2/2010_AP704481
	A/Alaska/47/2010_AD/04461
	- A/California/02/2010 KC780602
	A/Louisiana/01/2010_KC781458
	A/Virginia/01/2010_KC780582
	A/Alabama/03/2010_KC781170
	L A/Beijing/132/2010_KF918706
	L A/Boston/DOA44/2011_CY111295
	A/Georgia/F32551/2012_CY148260
	A/Bronx/INS3_6/3/2012_CY176691
	80 A/Texas/20/2012_KC891344 A/Boston/DOA90/2012_CV125776
	- A/Texas/22/2012 KC891095
	A/New York/34/2012 KC891575
	A/North Carolina/09/2012_KC891294
	A/Boston/19/2009_CY089710
	100 A/Boston/22/2009_CY089052
	84 A/Boston/2/2009_CY088578
	A/Boston/28/2009_CY080730 2009 seasonal H1N1
	A/Boston/100/2009_CY080619
	A/Boston/1/2009_CY080627
	A/Boston/3/2009_CY080505



**Technical Appendix Figure.** Phylogenetic analysis of 12 internal genes of the co-infection viruses in Shanghai, China. Phylogenetic trees were constructed by using the neighbor-joining method with bootstrap analysis of 1,000 replicates in MEGA 5.1 program. Numbers next to nodes indicate bootstrap value percentages (>70%). Panels A, B, C, D, E, F were the PB2, PB1, PA, NP, MP, NS phylogenetic trees of the A/Shanghai/Mix1/2014(H7N9) strain, respectively, and panels G, H, J, K, L, M were the PB2, PB1, PA, NP, MP, NS phylogenetic trees of the A/Shanghai/Mix1/2014(H7N9) strain, respectively. Red font indicates the A/Shanghai/Mix1/2014(H7N9) and A/Shanghai/Mix1/2014(H1N1) strains isolated from the co-infection patient from Shanghai, China. Blue font in the phylogenetic trees of the A/Shanghai/Mix1/2014(H7N9) strain indicates the representative strains of Shanghai area during the same wave of the H7N9 outbreak in China (1). Blue font in the phylogenetic trees of the A/Shanghai/Mix1/2014(H1N1) strain indicates the recommended influenza vaccine strain in the 2013–14 Northern Hemisphere influenza season

(http://www.who.int/influenza/vaccines/virus/recommendations/2013\_14\_north/en/). Scale bars indicate nucleotide substitutions per site. The GISAID or GenBank accession numbers of the influenza viruses in the construction of the phylogenetic analyses are displayed in the phylogenetic trees, which followed the taxon names.