

The role of the WHO Regional Office for Europe in response to seasonal, avian, and pandemic influenza

The World Health Organization (WHO) Regional Office for Europe (WHO/Europe) is one of the six regional offices of the WHO. It serves the WHO European Region that comprises 53 member states (MS), covering a vast and varied geographical region from the Atlantic to Pacific oceans. Approximately 900 million people live in diverse economic, political, and social and conditions, in countries that have built different health systems and approaches to health. WHO/Europe has country offices in 30 countries, in 12 countries of the European Union (EU), and in countries of the Southeastern Europe Health Network (SEEHN [1]) and the newly independent states (NIS).

The objective of the WHO as described in its constitution [2] is the attainment by all peoples of the highest possible level of health. The WHO is the directing and coordinating authority on international health work: in emergencies, including outbreaks of infectious disease, the WHO provides appropriate technical assistance if requested to do so by governments. The WHO's responsibilities in these situations are mandated primarily by the International Health Regulations (IHR, 2005) [3], and this was tested to the utmost during the 2009 pandemic. The response by the WHO to the 2009 pandemic, as well as the preceding preparedness activities, has been scrutinized extensively during the external review of the IHR [4]. The committee concluded that the IHR helped make the world better prepared to cope with public health emergencies, but that the world is ill prepared to respond to a severe influenza pandemic or to any similarly global, sustained and threatening public health

emergency. The WHO was considered to have performed well in many ways, but demonstrated shortcomings in responding to a global public health emergency of protracted duration. The committee found no evidence of malfeasance on the part of the WHO, refuting allegations that WHO recommendations regarding the use of pandemic vaccines were influenced by the pharmaceutical industry.

Although the review was comprehensive, the full extent of the activities conducted in the area of pandemic preparedness and response by the WHO regional and country offices, and how these were coordinated with other (UN) organizations, stakeholders, and WHO collaborating centers, is not captured by the report. Against this backdrop, this article reviews the activities of WHO/Europe in this area from 2005 throughout the 2009 pandemic until the present time. It concludes with a forward look based on the lessons learned.

The work of WHO/Europe in the area of influenza

Influenza is a priority disease in the WHO European region. Activities in the area of influenza are led by the Influenza & Other Respiratory Pathogens program (IRP), supported by programs dealing with vaccine-preventable diseases and immunization, alert and response operations, IHR area coordinators, country emergency preparedness, and the division of health systems and public health. The aims of the IRP are to:

- Strengthen surveillance for mild and severe disease caused by influenza across the region and share data to in-

form global influenza vaccine strain selection

- Use surveillance data to estimate the burden of influenza to prioritize national influenza vaccination and treatment programs
- Support pandemic preparedness activities at the national level and the implementation of core capacities required under the IHR
- Support the response of MS to outbreaks caused by influenza or other respiratory pathogens

Implementation through coordination and collaboration

WHO/Europe conducts its work jointly with its country offices and with WHO headquarters. Activities are conducted at the regional level involving all 53 MS, at the subregional level involving countries of the SEEHN or NIS, or with individual countries. These activities include meetings to present new WHO guidance and discuss their implementation, discuss new developments, and exchange good practice and training. MS participants are either formally nominated by the Ministries of Health (MoH) to represent their country or invited in their own right as experts, depending on the activity. In addition, WHO/Europe develops operational guidance (e.g., for the implementation of influenza surveillance and standards for laboratories), and through weekly bulletins and reports it collects, analyzes, and disseminates influenza surveillance data and data related to influenza vaccine policies and uptake that are reported by all 53 the MS. All key documents related to influenza are published in English and Rus-

Tab. 1 Key activities conducted by WHO/Europe in the area of influenza 2005–2011

Timeline	Event(s)	Activity	Countries	Objective(s)/Outcome(s)
2005–2007	Outbreaks of H5N1 in wild birds and poultry across multiple countries of the European region; human cases in two countries	Outbreak response missions	Azerbaijan, Cyprus, UNMIK ^a , Romania, Turkey	Support countries' efforts to investigate and control the outbreaks
		Risk assessment missions	Armenia, Azerbaijan, Georgia, Serbia, the Former Yugoslav Republic of Macedonia, Turkmenistan, Ukraine	Assess the risk for outbreaks of H5N1 in birds and humans
2006–2008	The continued threat of outbreaks of H5N1 in the European region	Training in rapid response	Armenia, Azerbaijan, Bulgaria, Kazakhstan, Kyrgyzstan, Russian Federation, Uzbekistan	Provide training (in theory and practice) and establish multidisciplinary rapid response teams at national and local level to manage future outbreaks
		Desk-top exercise	Country exercises: Albania, Armenia, Azerbaijan, Republic of Moldova, and Tajikistan Multi-country exercise: Albania, Serbia, Bosnia and Herzegovina, Croatia, the Former Yugoslav Republic of Macedonia and UNMIK	Identify strengths and weaknesses in avian influenza contingency plans related to coordination and communication at national and inter-country level
2005–2007	The possibility of a pandemic gained prominence on the global agenda for health security, due to outbreaks of H5N1 in wild birds and poultry across multiple countries of the European region and human cases in two countries	Three regional workshops on pandemic preparedness ^b	All 53 MS	Accelerate MS' efforts to develop national pandemic plans [reinforced by entry into force of the IHR (2005) in June 2007]
2005–2008	The possibility of a pandemic gained prominence on the global agenda for health security, due to outbreaks of H5N1 in wild birds and poultry across multiple countries of the European region and human cases in two countries	Missions to assess pandemic preparedness in countries ^b	Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Denmark, Finland, Kazakhstan, Montenegro, Republic of Moldova, Romania, Serbia, Switzerland, the Former Yugoslav Republic of Macedonia, The Netherlands, Turkey, Ukraine	Provide advice on the content of pandemic plans and determine status of preparedness in the region
2006–2008		Missions to support the development of national pandemic plans	Armenia, Azerbaijan, Bosnia and Herzegovina, Tajikistan, Turkmenistan	Provide advice on the content and implementation of pandemic plans
2008–present	Recognition of the need to increase capacity for routine influenza surveillance in the region	WHO/Europe influenza surveillance platform (EuroFlu) established and three annual meetings held ^b	50 MS	Number of MS in the region reporting influenza surveillance data to WHO/Europe nearly doubled, allowing for better monitoring of the pandemic and seasonal influenza
11 June 2009	Declaration by WHO of the first pandemic in more than 40 years, caused by a new strain of influenza H1N1	NA	NA	Accelerated finalization of preparedness plans by some countries; MS, WHO, and other international organizations mount a global response
August–December 2009	Evaluation of the early response to the pandemic	Sub-regional workshops ^b	Countries of southeast Europe (SEE) and newly independent states (NIS)	Support countries' ongoing response to the pandemic, facilitate sharing of experiences
April–June 2010	All countries of the WHO European region have experienced epidemics caused by pandemic (H1N1) 2009	Missions to seven countries	Armenia, Bosnia and Herzegovina, Denmark, Germany, Portugal, Switzerland, Uzbekistan	WHO/Europe evaluation conducted to determine the usefulness of pandemic preparedness activities in response to the pandemic and to develop recommendations for pandemic plan revisions
2011	Most countries have experienced epidemics, localized outbreaks continue (pandemic declared to be over in August 2010)	Four sub-regional workshops ^b	45 MS	Obtain an overview of major changes being made to countries' pandemic plans and agree on options for future inter-country collaboration

^aUnited Nations Interim Administration Mission in Kosovo ^bJoint activities with ECDC and/or the European Commission MS member states

sian and can be found on the WHO/Europe Influenza website [5].

WHO/Europe coordinates its activities and conducts joint work with the European Commission (EC) and the European Centre for Disease Prevention and Control (ECDC) in EU countries and countries of the European Economic Area (EEA). Regular coordination meetings ensure that best use is made of scarce resources and that duplication is avoided. In this respect, influenza surveillance data provided by EU/EEA MS to ECDC through the Tessa platform are automatically transferred to the regional platform EuroFlu [6] and subsequently to the global WHO platforms FluNet and FluID [7].

WHO/Europe works closely with the Center for Disease Control and Prevention, USA (CDC), and with two WHO collaborating centers (WHOCC) in the United Kingdom, one for reference and research on influenza (WHOCCRI) and one for pandemic influenza and research (WHOCCPIR). WHO/Europe works with MS experts and has established a regional network of national focal points for influenza surveillance, which includes the same experts as the European Influenza Surveillance Network for EU/EEA countries (EISN [8]).

Work with countries is conducted in collaboration with the MoH based on a biennial cooperative agreement (BCA) that covers policy and technical support, including knowledge transfer, assessments, and evaluations. Country offices play a crucial role in the implementation of the BCA through liaison with the MoH as well as other organizations that are supporting programs in the area of health. Depending on the country needs, country offices have national and sometimes international staff. Country work in the area of influenza focuses on countries of the NIS and SEEHN.

As part of the WHO secretariat, WHO/Europe participated in the intergovernmental meeting that led to the establishment of the *Pandemic Influenza Preparedness Framework for the sharing of influenza viruses and access to vaccines and other benefits* ("PIP Framework"), bringing together MS, industry, other key stakeholders, and WHO [9].

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Abstract

Between 2005 and 2011, the WHO Regional Office for Europe assisted the member states of the WHO European Region to prepare and respond to outbreaks of avian influenza H5N1, the 2009 pandemic, and to enhance their capacities for the prevention and control of seasonal influenza. It did this through conducting a combination of regional and subregional meetings and trainings, establishing a regional network for influenza surveillance, providing operational guidance for implementing influenza surveillance and strengthening the capacities of National Influenza Centers, and through assistance at the country-level where needed. In all, close to 60 country-missions or country-level activities were conducted. These activities were conducted in close coordination

with WHO headquarters, WHO European Region Country Offices, the European Commission, the European Centre for Disease Prevention and Control, and with other partner organizations, and were in line with the implementation of the International Health Regulations (2005). The results of activities as well as guidance documents were disseminated to a wide audience through publication on the WHO Regional Office for Europe Influenza website, on the EuroFlu website, and through peer-reviewed publications.

Keywords

WHO Regional Office for Europe · Outbreak response · Influenza · Pandemic · Capacity building

Rolle des WHO-Regionalbüros für Europa während der saisonalen, aviären und pandemischen Influenza

Zusammenfassung

Zwischen 2005 und 2011 half das WHO-Regionalbüro für Europa den Mitgliedsstaaten der WHO-Region Europa, sich auf einen Ausbruch der Vogelgrippe H5N1 und der Pandemie 2009 vorzubereiten und zu reagieren sowie ihre Kapazitäten zur Prävention und Überwachung der saisonalen Influenza zu erhöhen. Es tat dies, indem es eine Kombination regionaler und subregionaler Kongresse und Trainings durchführte, zur Influenzaüberwachung ein regionales Netz einrichtete und Handlungsempfehlungen gab und die Kapazitäten der nationalen Influenzazentren erhöhte sowie durch Hilfe auf Landesebene, wenn nötig. Insgesamt erfolgten fast 60 landesweite Einsätze oder Maßnahmen. Diese Maßnahmen wurden in enger Koordination mit dem WHO-Hauptquartier, den

Länderbüros der WHO-Region Europa, der Europäischen Kommission, dem Europäischen Zentrum für die Prävention und die Kontrolle von Krankheiten und mit anderen Partnerorganisationen durchgeführt und standen in Übereinstimmung mit der Anwendung der Internationalen Gesundheitsvorschriften (2005). Durch die Veröffentlichung auf der Influenza-Website des WHO-Regionalbüros für Europa, auf der EuroFlu-Website und durch wissenschaftliche Publikationen wurden die Ergebnisse der Maßnahmen sowie die Handlungsempfehlungen einer großen Öffentlichkeit zugänglich gemacht.

Schlüsselwörter

WHO/Europa · Reaktion auf Epidemien · Influenza · Pandemie · Kapazitätserhöhung

Acute public health events in the WHO European region and the response of WHO/Europe

A number of acute public health events occurred in the WHO European region that triggered and accelerated work in the area of influenza and pandemic preparedness. In 2003, the SARS outbreak accelerated adoption by the World Health assembly in 2005 of the new IHR, and in 2004

the re-emergence of H5N1 viruses in birds and humans in China and Southeast Asia prompted the 2005 publication of updated WHO pandemic guidelines and a checklist. Events from 2005 onward are summarized in **Tab. 1**, along with the key activities undertaken by WHO/Europe in this period aimed at building capacity in countries to respond to future outbreaks. Altogether, between 2005 and 2011, WHO/Europe conducted nearly 60 country mis-

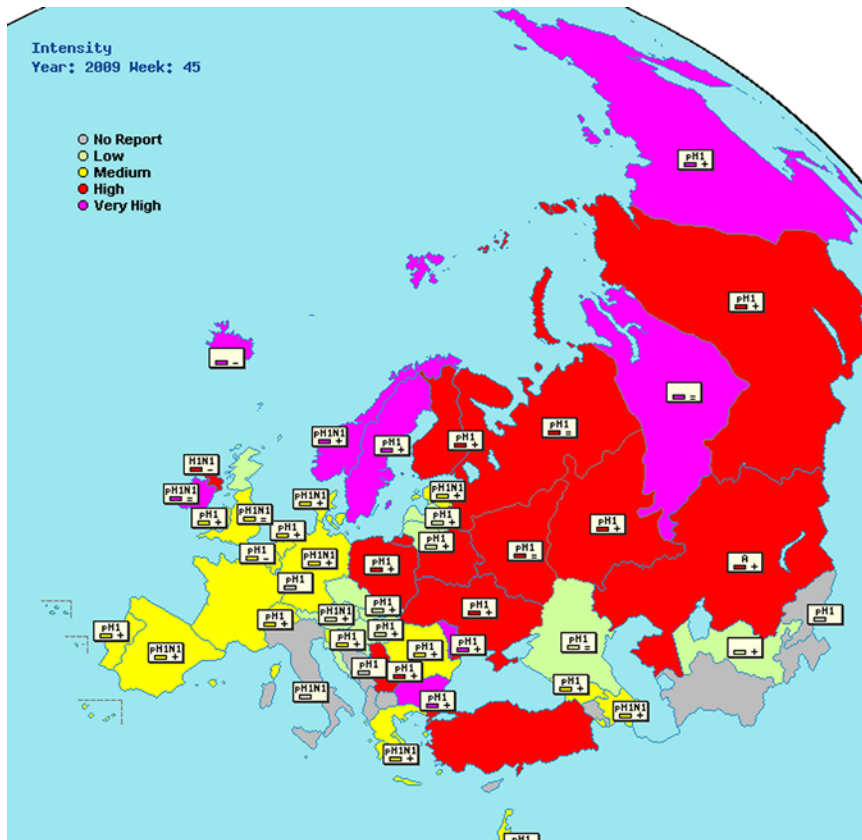


Fig. 1 ▲ Map showing the member states who reported influenza surveillance data to World Health Organization/Europe (ref http://www.euroflu.org/cgi-files/bulletin_v2.cgi?season=2011&inter=n&menu=y). EuroFlu bulletin week 45/2009 (at the peak of the pandemic in the WHO European region). The map presents the intensity of influenza activity. *Low*: no influenza activity or influenza at baseline* level. *Medium*: level of influenza activity usually seen when influenza virus is circulating in the country based on historical data. *High*: higher than usual levels of influenza activity compared to historical data. *Very high*: influenza activity is particularly severe compared to historical data. *Baseline influenza activity is the level in which clinical influenza activity remains throughout the summer and most of the winter

sions for outbreak response, training, and assessment. In the WHO/Europe evaluation of the 2009 pandemic, countries reported that these activities greatly enhanced their capacity to respond to the pandemic [10].

Response to outbreaks of avian influenza H5N1

As IHR Regional Contact Point for the European Region, WHO/Europe receives and exchanges information on outbreaks in countries with the IHR National Focal Points, who under IHR 2005 are obliged to notify public health events of potential international concern and to verify in a timely manner events detected by WHO through its surveillance programs. WHO conducts missions to countries to perform a joint risk assess-

ment and assist with the investigation and response to an outbreak if formally requested to do so by the MoH. Such requests are channeled through the country offices, who lead the mission supported by WHO/Europe staff. WHO/Europe, with the assistance of headquarters and the Global Outbreak Alert and Response Network (GOARN), mobilizes the necessary experts and other required resources, such as supplies of personal protective equipment, mobile laboratory, or antiviral drugs. Mission teams are multidisciplinary, comprising experts chosen according to the type of outbreak, in infection control and clinical management, epidemiology, laboratory, human and animal public health, communications, social mobilization, and logistics. Their mode of operation is reflected in the mis-

sions to Turkey and Azerbaijan in 2006, described below. WHO/Europe, with international partners, supported the governments of Azerbaijan and Turkey in responding to the outbreaks of avian influenza H5N1 in 2006. These followed the first outbreaks of H5N1 in the WHO European region that occurred in poultry in the summer of 2005 in the Russian Federation and Kazakhstan. They were to be followed by multiple outbreaks in poultry and wild birds in a total of 28 WHO European region MS that occurred mainly between 2005 and 2008, after which outbreaks became sporadic as countries controlled the outbreaks among the animal population. The last outbreak in poultry in a WHO/Europe MS was reported to the World Organization for Animal Health (OIE) in March 2012 [11].

Late 2005/early 2006, amidst widespread outbreaks in poultry, the only human cases to have been reported in Europe to date occurred in Turkey (12 confirmed human cases 4 of which were fatal) [12]. WHO/Europe deployed multidisciplinary teams of experts for several weeks in both countries, who worked with national and local authorities at the epicenter of the outbreaks to investigate the outbreak and detect possible new cases, to provide advice on the clinical management of patients and on infection control measures in health care facilities, surveillance, and laboratory settings, and to support the provision of regular government communications on the outbreak. The mission team leader has an important role, exercising health diplomacy when liaising with the MoH to explain the work being done and when requesting certain actions from the ministry. One potentially sensitive area is the sharing of viruses with the WHOCC: obtaining agreement for their shipment requires knowledge of national regulations and procedures. Clinical specimens and viruses from the outbreaks of avian influenza H5N1 in humans in Turkey and Azerbaijan were shared with the WHOCCRRI, facilitating in-depth analyses that informed further risk assessment of the outbreak and its implications for public health.

A description of the outbreak in Turkey as well as practical lessons that national and international public health agencies

Tab. 2 Progress made in influenza surveillance in the 53 countries^a in the WHO European region between 2008 and 2011

Activity	MS 2008 (n)	MS 2011 (n)
Has sentinel outpatient influenza surveillance	36	45
Has sentinel hospital (SARI) surveillance	0	12
Regularly report epidemiological and virological data to WHO	29	45
National Influenza Center is recognized by WHO	38	40
Shared influenza viruses with WHO ^b	19	28
Participates in WHO laboratory proficiency testing program	39	44

^aThree out of 53 MS do not have influenza surveillance systems in place

^bIncludes only countries that used the WHO shipment fund. The actual number may be higher

and policy makers can use to respond effectively to future outbreaks and an influenza pandemic have been published by the WHO [13] and in peer-reviewed journals [14].

The mission team deployed to Azerbaijan in March 2006 was assisted by two epidemiologists who had been deployed previously to assist the MoH establish surveillance for human cases of H5N1. Of note is that the H5N1 cases in Azerbaijan are the only human cases of H5N1 reported so far to have become infected after contact with sick or dead wild birds (swans). The details of this outbreak have been published in full cooperation with the MoH [15, 16]. The surveillance system that was established is still functioning today and is being modified with WHO/Europe support to detect severe cases of respiratory illness caused by influenza, whether seasonal, H5N1, or pandemic.

Influenza surveillance network

Another major focus of the work is influenza surveillance. The WHO has a long and successful history of working with networks [17, 18]. Currently, surveillance networks in the European region exist in the areas of polio, measles and rubella, HIV, TB, and influenza. In 2008, in cooperation with ECDC, WHO/Europe established the WHO European Region Influenza Surveillance Network by expanding the existing network for the 29 EU/EEA MS, the EISN [8], to include all 53 MS. The regional network now includes national focal points for epidemiological and virological influenza surveillance, nominated by the MoH, from the 50 MS that have routine seasonal influenza surveillance systems [6]. WHO-recognized National Influenza Centers (NIC) in 40

countries are also part of the Global Influenza Surveillance and Response System, GISRS (formerly known as GISN [19]). NIC in EU/EEA MS participate in the Community Network of Reference Laboratories for Human Influenza in Europe (CNRL) [20]. Through the national focal points, MS provide weekly data to the EuroFlu platform from which the bulletin is published in English and Russian. As described above, EU/EEA MS provide data through the ECDC platform, Tessa, to avoid duplication of data provision.

The first EuroFlu bulletin was published in February 2009, which was extremely timely occurring as it did only weeks before the start of the 2009 pandemic. It resulted in almost a doubling of the number of countries reporting data to the WHO throughout the pandemic and increased the geographic coverage dramatically (shown in [Fig. 1](#) and [Tab. 2](#)). The number of visits to the EuroFlu website was greater than 1 million in April 2009, and over 2 million at the peak of the winter pandemic influenza activity in Europe in November 2009. A survey performed among EuroFlu bulletin users indicated a high level of satisfaction [21]. Taken together, the above confirms the importance of the regional influenza surveillance network and positions the EuroFlu bulletin as a key WHO/Europe publication that reaches a wide audience. EuroFlu data are also used to develop season overviews and situation analyses [5].

WHO/Europe, in coordination with ECDC, supports the surveillance network through the organization of joint annual influenza surveillance meetings [22], the development of the “WHO Regional Office for Europe guidance for sentinel influenza surveillance in humans” [23], and the

provision of methodologies for calculating thresholds for influenza activity (currently implemented for 18 MS on EuroFlu [24]), for analyzing risk factors for severe disease associated with influenza, and for estimating the burden of disease. For estimates of mortality associated with influenza, WHO/Europe works with the European Mortality Monitoring Project (EuroMOMO [25]). WHO/Europe also conducts missions to assist countries with the development of national guidelines for the implementation of sentinel influenza surveillance.

The influenza laboratory network currently includes WHO-recognized NIC in 40 WHO/Europe MS and another ten countries have designated national influenza laboratories. In close collaboration with the WHOCRRRI and the CNRL, WHO/Europe supports these laboratories, especially those that seek to attain WHO recognition, through the provision of guidance and assessment tools [26], training in biosafety and influenza laboratory techniques, and the shipment of infectious substances, logistics support with the shipment of viruses, and provision of proficiency testing programs. This has resulted in improved capacities to perform virus isolation, share viruses with the WHO, and detect novel influenza viruses as part of pandemic early warning.

Taken together, these activities have resulted in tangible improvements to surveillance in the region since 2008. The number of countries with sentinel surveillance systems in the region, including sentinel hospital surveillance for severe acute respiratory infections (SARI), has increased considerably, as has reporting the data to EuroFlu ([Tab. 2](#)). This, together with the improved capacities of the laboratories, has significantly increased the region's capacity for: (a) monitoring influenza types/subtypes and antigenic/genetic characteristics of locally circulating influenza viruses, thereby increasing the representativeness of viruses provided for the annual vaccine strain selection process, (b) understanding and determining the timing and spread of influenza viruses, (c) identifying changes in circulating viruses, and (d) responding to potential pandemic viruses.

Tab. 3 Timeline of the spread of the 2009 (H1N1) pandemic, declaration of phases by the WHO, and recommendations

Date	Situation	Phase declared by WHO	Main recommendations to countries provided by WHO
25 April 2009	Relatively few cases of a new subtype of influenza A(H1N1) not previously known to infect humans reported in one WHO region	PHEIC/phase 3	Intensify surveillance for unusual outbreaks of influenza-like illness and severe pneumonia
27 April 2009	Confirmed outbreaks in Canada, Mexico, and the USA	Pandemic alert phase raised from 3 to 4	Containment not feasible; focus on mitigation measures; no border closer nor restriction to international travel
29 April 2009	Sustained human-to-human transmission in at least two countries in one region	Pandemic alert phase raised from 4 to 5	Immediately activate pandemic preparedness plans; effective and essential measures are heightened surveillance, early detection and treatment of cases, infection control in all health facilities; ramp up capacities for preparedness and response
11 June 2009	~30,000 confirmed cases reported in 74 countries and further spread considered inevitable. Pandemic expected to be of moderate severity	Pandemic alert phase raised from 5 to 6	Pandemics spread rapidly across the globe, countries not yet affected should be vigilant for the first cases. Countries with widespread transmission should focus on the clinical management of patients, with limited testing and investigation of patients to save resources. Pending the availability of vaccines, nonpharmaceutical interventions can confer some protection. WHO continues to recommend no restrictions on travel and no border closures
13 July 2010	Pandemic	Phase 6	SAGE recommendations on target groups for vaccination
10 August 2010	Most countries have experienced epidemics, localized outbreaks may continue	Pandemic declared over: post-pandemic period	Evaluation and revision of plans based on lessons learned; vigilance for return of the pandemic virus in subsequent influenza seasons

Pandemic preparedness and response

Since 2005, WHO/Europe together with the EC and ECDC has assisted MS with the development and implementation of their national pandemic plans (■ Tab. 1). As described above, activities related to avian and seasonal influenza also contributed to pandemic preparedness and the ability of countries to respond to the 2009 pandemic. Between 2005 and 2007, three regional meetings for all 53 MS were held to present the 2005 WHO global pandemic plan and checklist and to facilitate the exchange of experience and good practice among countries. A number of sub-regional workshops were also conducted, among EU/EEA MS, countries of the SEEHN, and NIS countries, the last one taking place just before the pandemic in February 2009. Missions to assess jointly with the countries the status of implementation of their pandemic plans using a standardized tool were also undertaken, in 40 out of the 53 WHO European MS by 2009 [27]. Status reports were published by ECDC for EU/EEA countries in 2007 and by WHO/Europe for SEE countries in 2008. Some countries also published their individual reports. WHO/Europe also provided input to the actual development of the pandemic plan in several countries. Lastly, European indica-

tors for pandemic preparedness were developed [28] and are currently being revised with input from MS to incorporate lessons learned.

All in all, by the time the pandemic was declared by the WHO in June 2009, all 53 MS in the WHO European region had developed a national pandemic plan and were relatively well prepared compared with other regions. However, country assessments and other activities identified a number of gaps, chiefly that national plans were not operational—they described what had to be done but few activities had been (fully) implemented, at national or local level. Examples include strategies for vaccine and antiviral delivery, surge capacity in the healthcare services, routine surveillance for severe disease associated with influenza, and business continuity in essential services.

The response to the 2009 (H1N1) pandemic

The world has recently experienced the first influenza pandemic of the twenty-first century lasting 14 months between June 2009 and August 2010. Although the 2009 pandemic was less severe than the three pandemics of the twentieth century, it caused a wide spectrum of illness [30] and in the USA caused severe disease and

death more frequently in the under-60s, compared with seasonal influenza, in persons with underlying conditions, pregnant women, but also healthy individuals [29]. Regarding the community effect of the 2009 influenza pandemic, analysis of EuroFlu data showed it arrived earlier than previous seasons and caused a significantly higher number of outpatient consultations in children [31].

On 17 April 2009, the United States government alerted the WHO about two children living in adjacent counties in southern California infected with a new influenza H1N1 virus of swine origin that had not been previously detected in pigs or humans. In Mexico, unusual levels of influenza-like illness had been detected in mid-March 2009, and by mid-April atypical cases and clusters of severe pneumonia occurring mainly among previously healthy young adults in different areas of Mexico were observed. On 23 April, samples from Mexico were found to contain genetically identical viruses to the influenza H1N1 viruses from California and this information was immediately reported by the MoH to the WHO [32]. On 25 April, nearly 2 years after the IHR came into force, the 2009 (H1N1) pandemic was the first event to be declared a *public health emergency of international concern* (PHEIC) by the Director-Gen-

eral of WHO, after consultation with an Emergency Committee and in accordance with IHR provisions. These events signaled the emergence of the 2009 pandemic. WHO continued to alert countries to the situation by the declaration of phases describing the global spread of the virus [33]. Phase 6 is the pandemic phase, declared when it is considered inevitable that the new virus has the potential to cause epidemics in every country. Summarized in **Tab. 3** is a timeline showing the declaration by the WHO of the phases and the main recommendations provided by the WHO (a full timeline of events has been published by the WHO [34]). Recommendations were based on the spread of the virus but also on severity and impact from information received from early-affected countries.

The WHO mounted a full-blown response to the pandemic, which has been described in detail in the external review of the IHR [4]. WHO/Europe, along with the other five regional offices and country offices, played a crucial role in this response. The response mounted by WHO/Europe was essentially a continuation of the activities being conducted since 2005, but with additional manpower and increased working hours. By 25 April 2009, WHO/Europe had activated its emergency steering committee and established a Pandemic Response Team (PRT). Up until July 2009, the PRT consisted of about 25 technical staff available 24/7 on a rotational basis and held daily meetings. During the remainder of the pandemic, the PRT core team consisted of about 15 technical staff, with additional staff as needed. The responsibilities of the PRT were as follows:

- Coordinate activities with WHO headquarters, country offices, and key partners such as the EC and ECDC (mainly through the early warning and response system for EU MS, EWRS)
- Collect, analyze, and present information obtained through IHR channels, EuroFlu, public national bulletins, and other sources, and assess the situation together with WHO headquarters; disseminate information on the severity and impact of the pandemic in the region through the WHO/Eu-

rope website and the influenza surveillance network

- Publish the weekly EuroFlu bulletin throughout the pandemic, also in the summer months of 2009 and 2010, in English and Russian
- Provide information and guidance to MS and to country offices
- Provide input to global efforts to mobilize resources for low-resource countries in the region

The PRT also provided operational support to MS in the following areas:

- 100 diagnostic kits (received from CDC, Atlanta, USA) to detect the new virus were shipped to 36 countries
- Facilitated the sharing of viruses through the WHO Shipment Fund Project by 30 MS with the WHOC-CRRI; this is more than in a normal season
- Facilitated in 2009 the shipment of about 550,000 courses of oseltamivir, which were donated to the WHO, to 19 countries in the region
- Conducted workshops for all 53 MS to assist with the development of pandemic vaccine deployment plans. Provided a risk communication package to support the deployment of pandemic vaccines
- Held inter-country meetings to review the response to the pandemic and provide further guidance
- Held two annual influenza surveillance meetings in the autumn of 2009 and 2010

WHO/Europe also supported countries that requested assistance to assess the situation during the pandemic. In early November 2009, WHO/Europe mobilized an outbreak response mission to support investigations of the MoH of Ukraine in to reports of increased numbers of cases of pneumonia and severe respiratory illness in the western part of the country [35]. Experts from WHO, ECDC, and GOARN partners in the areas of clinical management, epidemiology, laboratory diagnostics, logistics, and crisis communication worked with national public health and healthcare services to establish whether the outbreak was due to

the pandemic (H1N1) virus, to gain a better understanding of vulnerability to and risk factors for illness, and identify best-practice scenarios for treatment. A number of viruses from severe and fatal cases were further analyzed by the WHOC-CRRI and it was established that there had been no changes to the virus strain that would alter its pathogenicity or antigenicity, the latter indicating that the pandemic vaccine should be effective. The mission team focused on providing recommendations for clinical management, infection control, surveillance, and communication for immediate implementation. The team also conducted an assessment of healthcare settings with regard to the availability and needs related to medical devices and equipment that was used to guide donations from EU countries mobilized through the Monitoring and Information Centre for Humanitarian Aid and Civil Response of the European Commission [36].

Evaluating the response and lessons learned from the 2009 pandemic

The ability to respond to a complex health emergency such as an influenza pandemic requires a continuous process of pandemic preparedness planning, exercising plans, and incorporating lessons learned into plans. For the first time in history, countries implemented a pandemic response that drew on pandemic plans and activities undertaken in the few preceding years, and for the first time in history a pandemic vaccine was available during the first wave of the pandemic. By January 2010, most countries in the WHO European region had experienced an epidemic caused by the new virus and countries and international organizations alike started to evaluate their response to the pandemic and to take the necessary steps in the transition to seasonal influenza. In light of a main conclusion of the IHR review, that “the world is ill-prepared to respond to a severe influenza pandemic or to any similarly global, sustained and threatening public-health emergency,” these are critical steps.

In the WHO European region, from evaluations performed by individual countries at the EU and regional level, the

following key lessons learned were identified:

- The process of pandemic planning with broad stakeholder involvement and the pandemic plans themselves were useful. However, national pandemic plans had been insufficiently implemented at the subnational and local level.
- Global phases describing the spread of the pandemic virus were not useful as triggers for response measures at the national level and local level.
- A rapid assessment of severity and impact was hampered by a lack of standardized protocols and indicators, by a lack of routine surveillance for severe disease associated with influenza, and by tenuous links between public health authorities and health service providers.
- The deployment of, and risk communication activities related to, pandemic vaccine were considered extremely difficult, with generally low uptake in risk groups, some countries having a surplus of vaccine and others receiving vaccine only after the epidemic, particularly those countries that received donations through the WHO.
- Front-line responders—family physicians and hospital healthcare workers—had been insufficiently included in the pandemic planning process and were hard to reach during the pandemic.

The evaluation performed by WHO/Europe together with the WHOCCPIR in seven countries focused on the degree to which pandemic preparedness plans and associated activities proved useful during the 2009 pandemic. The goal was to provide recommendations for pandemic plan revisions and to identify areas of planning that require further strengthening. Using a systematic approach, more than 200 individuals representing national, regional, and local responders in seven MS were interviewed. In addition to the lessons learned summarized above, the evaluation revealed six major themes essential for effective pandemic preparedness: communication; coordination; capacity; adaptability/flexibility; leadership; and mutual support. With respect to the theme of sup-

port, the WHO pandemic planning guidance and the guidelines produced during the pandemic were considered extremely important. With respect to capacity, preparedness activities including training, inter-country exchange of expertise and experience, assessments and strengthening in specific fields such as surveillance and risk communication had a positive impact on the ability of MS to respond to the pandemic [10, 37].

Conclusions and next steps

Based on the experience of the past 7 years and feedback from MS, it can be concluded that the activities conducted by WHO/Europe in the area of influenza and pandemic preparedness have been useful and have filled a number of gaps. The level of pandemic preparedness and the capacity for influenza surveillance in the region, both epidemiological and virological along with early warning, has increased. These capacities will benefit public health in a broader context, as influenza surveillance can detect other respiratory infections; the capacities built as part of pandemic preparedness will support preparedness for other infectious diseases as well as the implementation of IHR core capacities. WHO/Europe was well positioned to guide and assist its country offices in the implementation of activities, and has coordinated activities with WHO headquarters as well as regional and global partners. This is commensurate with the goals of the WHO Reform [38] regarding health security, whereby the WHO will provide surveillance, alert–verification–assessment support, and event management mechanisms, along with direct operational support on the ground when needed, as well as assist countries to build their institutional capacities. However, a number of gaps were also identified, and to address these in times of shrinking resources, in 2011 the IRP program performed a situation analysis and developed a 5-year strategy. Based on this strategy, WHO/Europe will continue to assist MS efforts to strengthen surveillance for severe disease due to influenza and it will focus more on assist-

ing countries to determine the burden of disease and risk factors for severe disease so as to inform seasonal influenza vaccination programs. Therefore, in collaboration with the VENICE project and ECDC [39], in 2011 the first regional survey of seasonal influenza vaccine policies and uptake in the 53 MS was conducted. Currently, only one country in the region meets the 2005 WHO target of 75% vaccine uptake in the elderly, and few countries have programs to vaccinate other risk groups, such as persons with underlying conditions and pregnant women, or systems in place to monitor uptake (unpublished data). WHO/Europe will continue to conduct regular surveys to target assistance to countries in this area. WHO/Europe will continue to assist national influenza laboratories in the ten countries that currently are not recognized by WHO to obtain WHO recognition, to measure the impact of seasonal influenza in the region, as was done for the pandemic [31], and to respond to requests for assistance in periods of unusual influenza activity. In 2011, during the first post-pandemic season that was dominated by the pandemic (H1N1) virus and which caused strains on critical care services in a number of countries, WHO/Europe together with the EC and ECDC organized regional teleconferences for clinicians from the first affected countries to share their experience in the management of severe cases with clinicians from countries that had not yet been affected [40]. WHO/Europe will continue to support MS efforts to revise their pandemic plans, through inter-country workshops jointly with ECDC similar to those organized in 2011 [41], through sharing of good practice, and through assistance to individual countries. This work will be integrated with efforts to enhance general preparedness for public health emergencies as well as the implementation of IHR core capacities. WHO/Europe together with MS experts and ECDC is currently revising the European pandemic indicators [27] that will form a new European guidance for pandemic preparedness. WHO/Europe, as WHO secretariat, will support the implementation of the PIP Framework [9].

Influenza, whether seasonal, avian, or pandemic, will continue to feature on the public health agenda, and to take us by surprise: the 2009 pandemic was first detected not in Southeast Asia, the epicenter of the H5N1 outbreak, but in the Americas. It was milder than previous pandemics but yet was difficult to manage for many countries. WHO/Europe will therefore continue to work in this area, based on the needs of countries as well as the requirements for global surveillance and response.

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References

- Countries of the South-eastern Europe Health Network; <http://www.euro.who.int/en/what-we-do/health-topics/Health-systems/public-health-services/activities/south-eastern-europe-health-network-seehn>
- WHO Constitution <http://www.who.int/governance/eb/constitution/en/index.html>
- International Health Regulations (2005) <http://www.who.int/ihr/en/>
- Implementation of the International Health Regulations (2005): Report of the Review Committee on the Functioning of the International Health Regulations (2005) in relation to Pandemic (H1N1) 2009 http://www.who.int/ihr/review_committee/en/index.html
- WHO/Europe Influenza website <http://www.euro.who.int/en/what-we-do/health-topics/communicable-diseases/influenza>
- WHO/Europe influenza surveillance platform <http://www.euroflu.org>
- WHO global influenza surveillance platforms FluNet http://www.who.int/influenza/gisrs_laboratory/flu-net/en/and/FluID and http://www.who.int/influenza/surveillance_monitoring/fluid/en/
- European Influenza Surveillance Network of the EU/EEA (EISN) <http://ecdc.europa.eu/en/activities/surveillance/EISN/Pages/index.aspx>
- Pandemic Influenza Preparedness Framework <http://www.who.int/influenza/pip/en/>
- Recommendations for good practice in pandemic preparedness: identified through evaluation of the response to pandemic (H1N1) 2009 http://www.euro.who.int/__data/assets/pdf_file/0017/128060/e94534.pdf
- OIE <http://www.oie.int/animal-health-in-the-world/update-on-avian-influenza/2012/>
- Cumulative number of confirmed human cases of avian influenza A(H5N1) reported to WHO http://www.who.int/influenza/human_animal_interface/H5N1_cumulative_table_archives/en/index.html
- Making preparation count: lessons from the avian influenza outbreak in Turkey http://www.euro.who.int/__data/assets/pdf_file/0018/90513/E89139.pdf
- Avian Influenza A (H5N1) Infection in Eastern Turkey in 2006 <http://www.nejm.org/doi/full/10.1056/NEJMoa060601>.
- Human avian influenza in Azerbaijan, February–March 2006. World Health Organization. *Wkly Epidemiol Rec.* 2006 May 5;81(18):183–8. English, French. No abstract available
- Giltsdorf A, Boxall N, Gasimov V et al (2006) Two clusters of human infection with influenza A/H5N1 virus in the Republic of Azerbaijan, February–March 2006. *Euro Surveill* 11(5):122–126
- WHO/Europe polio laboratory network <http://www.euro.who.int/en/what-we-do/health-topics/communicable-diseases/poliomyelitis/activities/polio-laboratory-network>
- Featherstone DA, Rota PA, Icenogle J et al (2011) Expansion of the global measles and rubella laboratory network 2005–09. *J Infect Dis* 204(Suppl 1):491–498
- Global Influenza Surveillance and Response System, GISRS http://www.who.int/influenza/gisrs_laboratory/en/
- Community Network of Reference Laboratories for Human Influenza in Europe http://ecdc.europa.eu/en/activities/surveillance/EISN/laboratory_network/Pages/laboratory_network.aspx
- EuroFlu survey http://www.euro.who.int/__data/assets/pdf_file/0006/116916/EuroFlu_evaluation_June-2010.pdf
- 2011 Joint WHO Regional Office for Europe/ECDC Influenza Surveillance Meeting <http://www.euro.who.int/en/what-we-do/health-topics/communicable-diseases/influenza/surveillance/influenza-surveillance/surveillance-meetings/2011-joint-who-regional-office-for-europeecdc-influenza-surveillance-meeting>
- WHO Regional Office for Europe guidance for sentinel influenza surveillance in humans <http://www.euro.who.int/en/what-we-do/health-topics/communicable-diseases/influenza/publications/2009/who-regional-office-for-europe-guidance-for-sentinel-influenza-surveillance-in-humans>
- VegaT, Lozano JE, Meerhoff TJ et al (o J). Influenza surveillance in Europe: Establishing epidemic thresholds by the Moving Epidemic Method (accepted for publication)
- The European Mortality Monitoring Project <http://www.euromomo.eu/>
- How to become a WHO-recognized National Influenza Centre: Guidance on the process for influenza laboratories in the WHO European Region [web site]. Copenhagen, WHO Regional Office for Europe <http://www.euro.who.int/en/what-we-do/health-topics/diseases-and-conditions/influenza/publications/2010/how-to-become-a-who-recognized-national-influenza-centre-guidance-on-the-process-for-influenza-laboratories-in-the-who-european-region>
- Nicoll A, Brown C, Karcher F et al (2012) Developing pandemic preparedness in Europe in the 21st century: experience, evolution and next steps. *Bull World Health Organ* 90(4):245–320
- Joint European Pandemic Preparedness Self-Assessment Indicators <http://www.euro.who.int/en/what-we-do/health-topics/communicable-diseases/influenza/publications/2010/joint-european-pandemic-preparedness-self-assessment-indicators>
- Shrestha SS, Swerdlow DL, Borse RH et al (2011) Estimating the Burden of 2009 Pandemic Influenza A (H1N1) in the United States (April 2009–April 2010). *Clin Infect Dis* 52:75–82
- Nguyen-Van-Tam JS, Openshaw PJ, Hashim A et al (2010) Risk factors for hospitalisation and poor outcome with pandemic A/H1N1 influenza: United Kingdom first wave (May–September 2009). *Thorax* 65:645–651
- Martirosyan L, Paget WJ, Jorgensen P et al (2012) The community impact of the 2009 influenza pandemic in the WHO European Region: a comparison with historical seasonal data from 28 countries. *BMC Infect Dis* 12:36 doi:10.1186/1471-2334-12-36
- Weekly Epidemiological Record <http://www.who.int/wer/2009/wer8420/en/index.html>
- Current WHO phase of pandemic alert for Pandemic (H1N1) 2009 <http://www.who.int/csr/disease/swineflu/phase/en/index.html>
- Evolution of a pandemic http://www.who.int/influenza/resources/publications/evolution_pandemic_Ah1n1/en/index.html
- WHO/Europe response to the 2009 pandemic in Ukraine <http://www.euro.who.int/en/what-we-do/health-topics/communicable-diseases/influenza/pandemic-influenza2/pandemic-h1n1-2009/who-europe-news-and-updates/who-begins-investigating-pandemic-h1n1-2009-in-western-ukraine>.
- Monitoring and Information Centre for Humanitarian Aid and Civil Response of the European Commission http://ec.europa.eu/echo/policies/disaster_response/mic_en.htm#were
- Ahmed Hashim, Lucie Jean-Gilles, Michala Hegermann-Lindencrone, Ian Shaw, Caroline Brown and Jonathan Nguyen-Van-Tam. Did pandemic preparedness aid the response to pandemic (H1N1) 2009? A qualitative analysis in seven countries within the WHO European Region. In press for *Journal of Infection and Public Health*
- WHO reform for a healthy future <http://www.who.int/dg/reform/en/index.html>
- Vaccine European New Collaborative Integrated Effort (VENICE) <http://venice.cineca.org/news.html>
- Flu Focus, WHO/Europe e-magazine http://www.euro.who.int/__data/assets/pdf_file/0004/147181/Flu_Focus_July_2011.pdf
- Key changes to pandemic plans by Member States of the WHO European Region based on lessons learnt from the 2009 pandemic <http://www.euro.who.int/en/what-we-do/health-topics/communicable-diseases/influenza/publications/2012/key-changes-to-pandemic-plans-by-member-states-of-the-who-european-region-based-on-lessons-learned-from-the-2009-pandemic>