How prepared is Europe for Pandemic Influenza?

An Analysis of National Plans

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EXECUTIVE SUMMARY

The emergence of avian influenza H5N1 and the threat of a new influenza pandemic have prompted European governments and the European Commission (EC) to plan and prepare an appropriate response to the threat. The past year has seen a considerable amount of planning for a potential pandemic and most European countries have now published national preparedness plans.

We surveyed all countries in the European Union (EU) (25 member states), in addition to Bulgaria, Romania Norway and Switzerland. Of these, 21 countries had published preparedness plans that were included in the survey. Each plan was scrutinised according to a checklist based on the World Health Organization (WHO) checklist1 – a total of 169 criteria were identified and were either fulfilled ("yes") or not fulfilled ("no"), thus giving an indication of the plan's completeness. We also evaluated the plans against the same criteria that were weighted according to their perceived importance following discussions with two member states' experts – a measure of quality.

The average completeness score for all surveyed national preparedness plans is 54%. The average quality score is 58%, ranging from 27% to 86%. Europe is moderately-well prepared but gaps exist. Overall, plans are satisfactory in addressing areas such as surveillance and communication. However, other areas are less than satisfactory, and there are a number of gaps common to many plans.

Most plans adhere to WHO and EU recommendations in their approach and format. Moreover, most countries have set up a National Planning Committee based on multi-sectoral participation and have organized their responses according to WHO's pandemic influenza phases. Yet, whilst the goals of most plans are expressed in general terms, the target audience of the preparedness plans is often unclear. Indeed, it seems most plans are addressed to a number of different audiences including decision makers, health service providers, and the population at large. The defined purpose of many plans remains obscure. This lack of specificity in terms of audience and purpose may be a limitation when it comes to putting plans in to practice.

We have identified in our survey a number of gaps which are common to the majority of plans and for which preparedness will prove critical should a pandemic occur in the near future.

- Many plans document only weak linkages between human and animal surveillance and response systems. For example, many countries fail to mention veterinary services as part of preparedness plans or address the specific needs of those who work with animals.

- Many countries fail to identify appropriate strategies to ensure early containment of the disease in the case the pandemic originates at home.

- Whilst most plans are clear in their intention to cooperate with EU institutions, few countries are explicit in how they cooperate, and will do so in the future, with other EU countries including near neighbours. Where policy differences are substantial, this may be a cause for tension during a pandemic. This is particularly likely in regard to cross-border population movements and provision of what may be scarce public health goods, such as antivirals and vaccines.

- Roles and responsibilities of different levels of government, including regional and central government, are not always clear. This in turn raises the issue of the actual level of preparedness of individual regions, especially in the case when the planning and implementation of the response to pandemic influenza is decentralized. Monitoring and testing of regional preparedness plans are missing from most national plans.

- The planning and prioritization of laboratory testing capacities during the pandemic phase are not properly addressed by national plans.

- Plans do not consider adapting (or discontinuing) surveillance during the pandemic. The selection and prioritization of surveillance indicators are poorly addressed.

- Whilst considerable attention recently has focused on national needs and purchase of antivirals less attention has been placed on their distribution and supply to defined populations. Moreover, many plans fail to distinguish between treatment and prophylaxis, an issue that could have a profound impact on demand.

- Whilst vaccine provision is recognized as the cornerstone of all national responses to influenza pandemic, plans are not always specific on their operational strategy and on how and when to procure vaccines. There is a need to clarify issues related to advance purchase agreements, liability and immunization provisions.

- The impact of pandemic influenza on health systems is likely to be considerable. Yet few plans address how patients will be managed and where they will be treated. Health care facilities need plans that are specific regarding clinical management. But they also need guidance on human resource management, patient triage and admission policies.

- In addressing pandemic influenza, fewer than half of the plans address the maintenance of essential services despite the need for clearly defined roles and responsibilities at all levels, from ministers to local community-based implementers.

There are a number of limitations to this study. The fluidity of the environment and the changing evidence-base means that plans are being drafted, updated, and constantly modified. Moreover, clearly plans from countries not included in this analysis are likely to be launched in coming months, and these may change any assessment of overall European preparedness.

An important limitation of this study concerns the difference between evaluating country plans and determining countries' preparedness for an influenza pandemic.

Whilst the completeness and quality of national preparedness plans may be an important indicator of a country's preparedness, plans are only that, one element. Moreover, any determination of criterion inclusion is, because of the nature of plans, somewhat subjective. Ultimately, the test of a country's preparedness will rest on the effectiveness of its response. This analysis of countries' preparedness plans describes, therefore, a partial but important component of preparedness.

In summary, it is clear that there is considerable variation between the plans of different countries in Europe, and some important gaps are present in many plans. This analysis should facilitate countries in drawing lessons from other countries' plans and improve their preparedness planning. The EU has an important role to ensure that policies are consistent, planning is robust, and that resources are distributed appropriately.

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INTRODUCTION

Influenza pandemics have occurred at different times and to different degrees over the past 100 years. The most catastrophic – the 1918 Spanish influenza pandemic – resulted in an estimated 40 million deaths, with half being among 20–40 year-olds. Other more recent pandemics that occurred in 1957 and 1968 were less devastating, but each still resulted in an estimated 1 million deaths worldwide.[2] With the emergence of the H5N1 avian influenza virus in Asia and outbreaks of this strain occurring in parts of the European continent, there are concerns that the threat of a potential influenza pandemic will become a reality in the not too distant future. In a resolution issued in April 2005, the WHO expressed concern about the general lack of global preparedness for pandemic influenza[3]. WHO's global influenza preparedness plan, launched in 1999, was updated in 2005 and outlines the components that each country's preparedness plan should include to ensure an effective response.[2]

In 2005, WHO published a checklist to facilitate preparedness planning, with the aim of reducing transmission, decreasing cases, hospitalizations and deaths, maintaining essential services and reducing the socio-economic consequences of a pandemic.[1] In Europe, the EC updated their planning in line with the revised WHO definitions of pandemic phases and the opening of the European Centre for Disease Prevention and Control (ECDC). WHO issued further guidance following their checklist to assist national authorities in the preparedness planning.[2] This document urged every country 'to develop or update a national influenza preparedness plan' and suggested that 'each national authority should play its part towards achieving the international harmonization of preparedness measures'. Moreover, through 2005, WHO and EC jointly organised workshops at the European regional level to strengthen and coordinate country preparedness, conducted surveys on the state of preparedness,[4, 5] and carried out a regional simulation exercise.[6]

Urged by WHO and the European Commission, which initiated a dynamic Europe-wide coordination process in March 2005, European countries have made substantial progress in their preparations for an influenza pandemic. A questionnaire that was sent in October 2005 to all WHO European-region countries by the EU and WHO-Europe, and to which 52 countries have responded, showed significant progress had been made, with 30 countries having a national plan available and published, and 18 countries noting that they have a draft plan. The results of this questionnaire indicated that all 25 EU member states had a plan either available and published (19 countries) or in draft form (6 countries).[7]

The purpose of this survey is to describe and analyse European national pandemic influenza preparedness plans in a robust, systematic and timely manner. In describing strengths and gaps, we hope this information will be useful to member states, multilateral institutions and others as preparedness plans are further developed.

METHODS

We surveyed the 25 European Union (EU) countries, the two acceding countries (Bulgaria and Romania), and two non-EU countries, Norway and Switzerland, and evaluated each plan against criteria drawn from the WHO checklist.[1] Published plans in the public domain were identified and sourced through the WHO, through internet-based searches, and through countries' Ministry of Health representatives. Plans were eligible for inclusion if formally published between 1st January 2002 and 30th November 2005. All plans that were not available in either English or French were translated by public health specialists fluent in the original language into English. We evaluated main plans and, where clear links were documented, references or annexes that were made to other formal and accessible documents.

A data extraction tool, based on the WHO checklist for influenza epidemic preparedness,[1] was designed in consultation with pandemic influenza planning experts, and piloted. One hundred and sixty-nine criteria were identified from plans and scored as either 'present' or 'absent', thus giving an indication of each plan's completeness. We also attributed a weighted score against the same criteria according to their perceived importance in preparedness planning following discussions with two member state's experts, thus giving a measure of quality. Of these 169 criteria, 47 were designated 'essential' and it was these that were given additional weight in scoring. Subset analysis of only these 'essential' criteria was also conducted. Preparedness plans were scored independently by two researchers, and where differences arose agreement was reached through review and discussion.

Countries' preparedness plans were assessed in their entirety and by seven thematic areas drawn from WHO's guidelines:[1, 2] planning and coordination; surveillance; public health interventions; health system response; maintenance of essential services; communication; and putting plans into action.

RESULTS

Twenty-one national plans were eligible for inclusion in our analysis: Austria, the Czech Republic, Denmark, Estonia, France, Germany, Greece, Ireland, Italy, Latvia, Lithuania, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Spain, Sweden, Switzerland and the UK. Hungary's plan was available but published before 2002. Plans from other countries were not available. Twelve countries' plans required translation into English. The 21 countries' plans cover 93% of the population of the 29 countries selected for possible inclusion.

We found that the average completeness (un-weighted) score (169 criteria) of plans was 54% (range 24% to 80%). The average quality (weighted) score was 58% (range 27% to 86%). The average score for the 47 essential criteria was 66%. There is a very close correlation between completeness and quality scores (measured in terms of weighted scores and in terms of essential criteria scores): completeness of plans is associated with quality of plans.

Twelve countries had a completeness score of below 54% and 9 had a score higher than 54%. Five countries had scores of more than 70%. Some countries have incomplete plans and focus their preparedness on certain topics.

Figure 1.

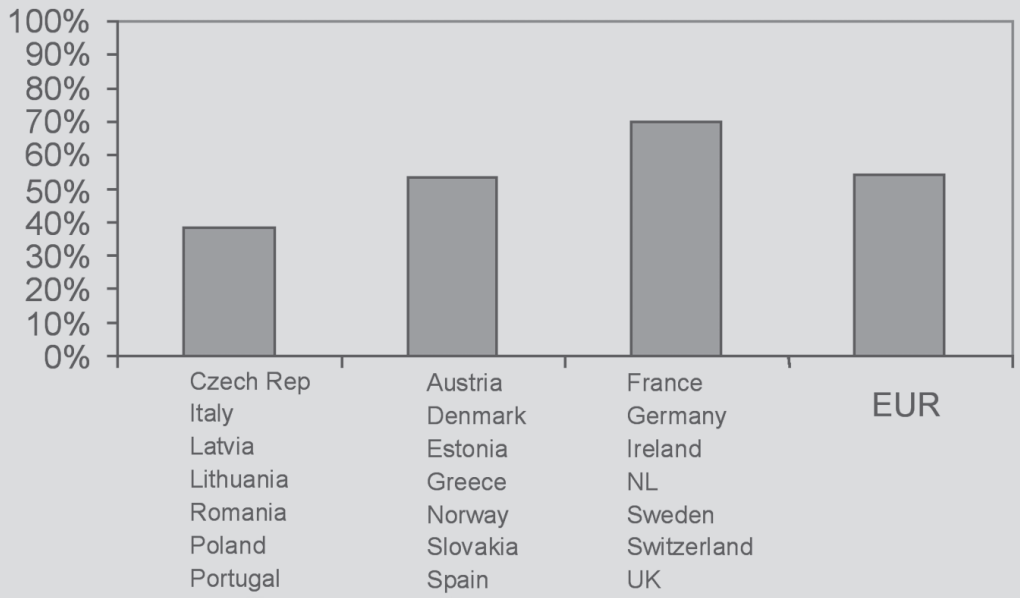

Figure 1. Completeness scores of countries' preparedness plans (un-weighted).

The average score for 'essential' criteria for the 21 plans is 66%; nine plans score over 75%, and two score over 95%. Twelve countries have scores below average and three countries have scores at or below 40%.

Figure 2.

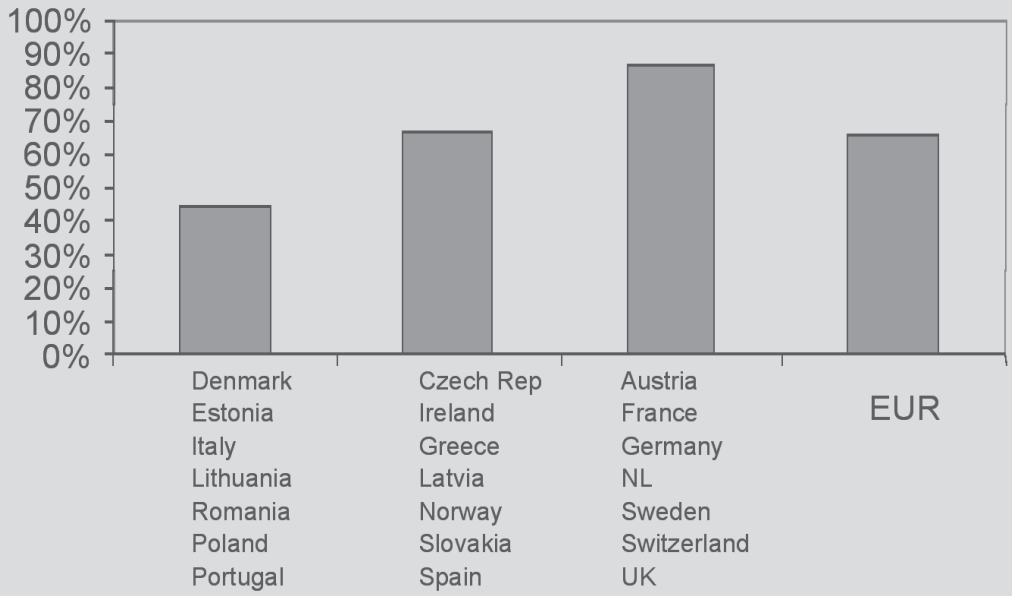

Figure 2. 47 'essential' criteria scores of countries' preparedness plans.

Scores under each of the 7 key topics suggest that some countries are better prepared in some areas than others. Whilst completeness scores for communication and surveillance (average scores 63% and 65%) suggest that these important themes are well addressed by most plans, maintenance of essential services, public health interventions and operationalization of the plan are dealt with in a less satisfactory manner, with average weighted scores of 38%, 51% and 41%, respectively.

Table 1.

	Planning and coordination	Surveillance	Public health interventions	Health system response	Maintaining essential services	Communi cation	Putting plans into action	Total unweighted
Total Europe (21 countries)	59%	65%	51%	50%	38%	63%	41%	54%

Table 1. Average completeness scores by topic.

Figure 3.

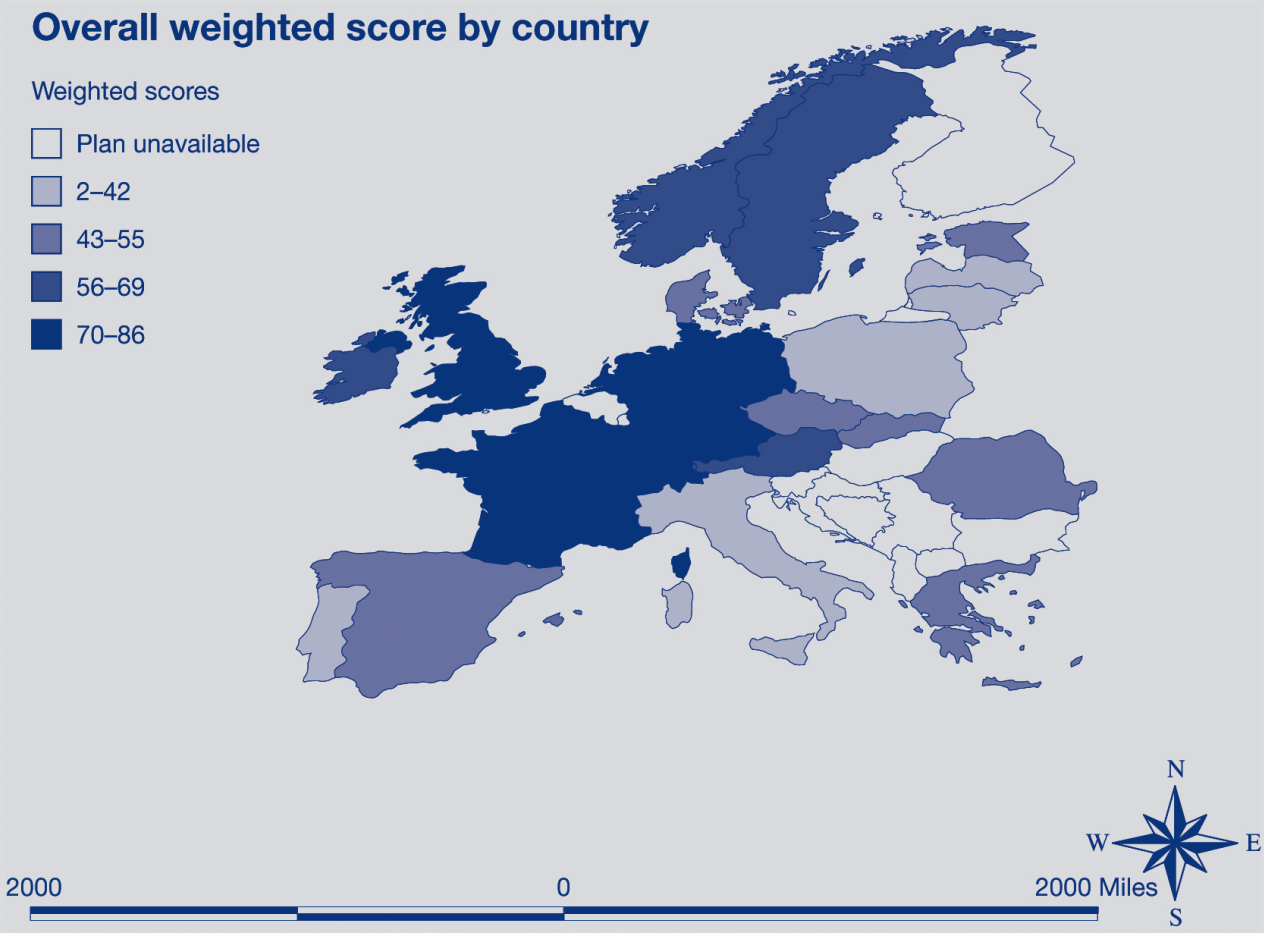

Figure 3. Quality of preparedness plans across Europe.

Correlations

We correlated national weighted scores with several factors including the geographical size of the state, the size of the population, gross domestic product (GDP$) per capita, geographic position of each state's capital city, and anticipated population coverage with antiviral drugs.[8]

We found an association between completeness scores and GDP per capita and also a strong link between overall completeness scores and planned availability of antiviral treatment for the population. However, there was minimal correlation with plans' completeness and the north-south and east-west geographic position of states' capital cities. There was no correlation between plans' completeness and population size or population density.

Figure 4.

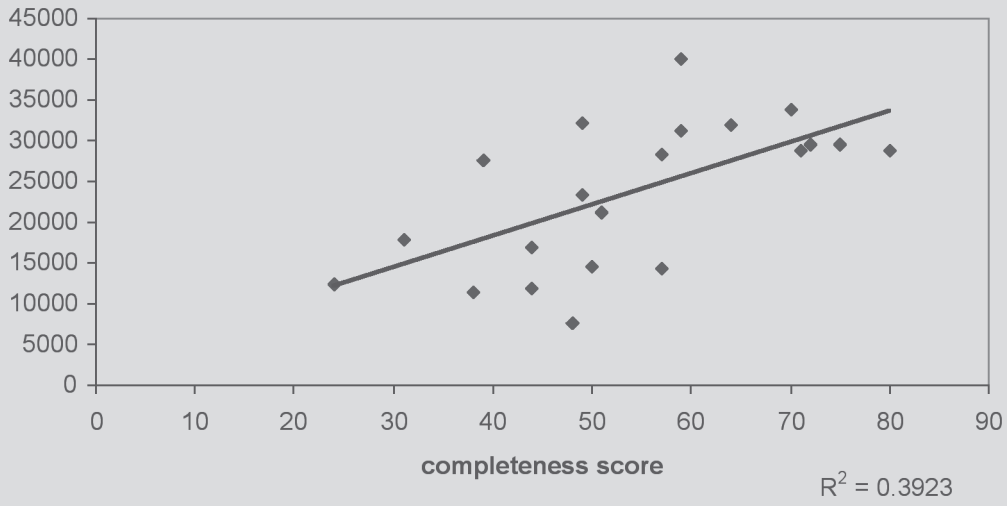

Figure 4. Correlation between completeness scores for country pandemic influenza plans and country gross domestic product (GDP) per capita.

Figure 5.

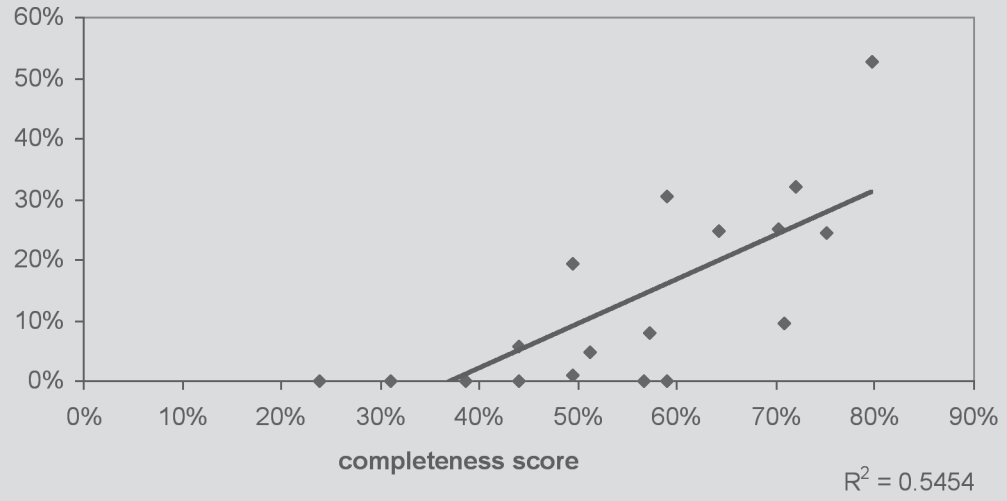

Figure 5. Correlation between completeness scores for plans and planned country antiviral population coverage.

Planning and coordination

- The intended audience of plans need to be specified and operational guidelines for interested parties should be provided
- Links between health sector and animal sector should be strengthened explicitly (for example, surveillance, policy development, joint procedures, public health interventions for animal workers)
- Veterinary authorities should be embedded in planning committees
- Ministries in charge of contingency plans should be involved in planning committees
- Preparedness plans should include provisions for an early containment strategy on their territory
- Instructions to regional authorities for planning preparedness and implementing response should be clear and specific, notably in states with devolved health care systems
- Progress of regions in their preparedness planning should be monitored
- Legislative gaps identified for implementing response need to be addressed
- Ethical issues need to be addressed and practical guidelines issued relating to ethical choices for decision makers and health staff
- Better coordination is needed between EU member states, notably with neighbours

In its Global Influenza Preparedness Plan, the WHO advocates the importance of pandemic planning and the need to ensure that plans are developed in close collaboration with all relevant stakeholders.[2]

A National Planning Committee has been established in 18 of the countries surveyed – three countries do not cite the existence of a national committee (one of these countries is planning to set up such a committee). Most plans describe the structure of a committee and these generally include public health and epidemiology related agencies. Veterinary services are clearly mentioned as part of the planning committee in 14 plans only. Public health agencies assume a lead role in all plans and in 14, government institutions beyond health, such as ministries of defence and interior, are also involved.

For 17 countries, the goals of the plans are clearly described. Ensuring that goals of national plans are explicit is important for countries to plan their response effectively and to disseminate an adequate message to the public. For most, goals include a reduction of mortality and morbidity, the need to ensure care for a large number of patients, and the minimisation of social disruption and economic loss.

The target audience for most of the plans remains unclear. We infer that for most plans, the intended audience is the general public, national decision makers and health care providers. Targeting the plans is not specified other than in a few cases, where parts of the plans are obviously aimed at pre-defined audiences. Because of this, these plans are more effective as operational tools.

Planning according to different phases of the pandemic will be essential to enable countries to provide an effective response at each stage of the pandemic and draw effectively on their capacity in different spheres. Twenty countries' plans organize their response according to the WHO's pandemic phases (see annex), although in most cases, WHO 'old phases' are used with only seven countries having updated their plan to reflect WHO's 2005 revised definition.[2] Half of countries have made note of a specific alert mechanism, by which they may declare a pandemic.

Only seven countries envisage an outbreak originating within their territory while all countries indicate that the most likely scenario for an influenza outbreak will be caused by human cases imported from abroad. Planning according to different phases of the pandemic will be essential to enable countries to provide an effective response at each stage of the pandemic and draw effectively on their capacity in different spheres. Twenty countries' plans organize their response according to pandemic phases although only seven countries have updated their plan to reflect WHO's 2005 revised definition.[2]

Sixteen countries have included in their plans some assessment of the impact of the pandemic, although apparently few have drawn upon sophisticated simulation tools. Most plans estimate attack rates ranging from 15% and 50% of the population being affected; the wide variation reflecting the uncertainty surrounding the transmission of any future pandemic. Estimated death rates vary from 14 to 1,685 per 100,000 (0.014 to 1.69%) people. For example, Slovakia has included in its plan, potential for a worst case scenario with 45% of the population being affected and with high numbers of fatalities. Most countries' plans make note of estimates of death rates of between 230 and 465 per 100,000 (0.23 to 0.47%) population. Anticipated hospitalization rates vary between 40 and 2,707 per 100,000 (0.04 to 2.71%) population with most drawing upon ranges between 376 and 1,060 per 100,000 (0.38 to 1.06%) population. Few plans model the impact of public health interventions in simulations. To our knowledge, only three countries draw upon assessments of the impact of antivirals and vaccines through simulation exercises in their plans (the Netherlands, France, UK). Switzerland is the only country to include an evaluation of the possible economic impact of the pandemic.

In all but 4 countries, roles and responsibilities of the main national stakeholders are well described, most notably those in the health sector. Command and control structures are well-defined in 17 countries. For a majority, the Ministry of Health is the coordinating body responsible for the domestic response and in a minority, a crisis coordination body is set to lead the process. Often, this body is led by the Ministry of the Interior or is directly the responsibility of the head of government. Overall, at national level, 15 plans describe clearly which institutional body is responsible for which designated response.

Governance issues, such as roles and responsibilities of regional and central governments are described in 17 plans, although with few details.

Few plans make it clear when or on how many occasions the plan has been updated. Fewer than half of plans state a clear commitment to formally review the plan and offer a timeframe.

Fifteen plans make note of the need to consider the existing legislative framework and of these, 12 document that specific legislative changes may be needed in order to implement the pandemic response plan. The most frequently mentioned legal issues are enforcement of quarantine (12 plans), compulsory immunisation (11 plans), and responses to side effects from a vaccine (7 plans). Four plans address liability issues and temporary health care workers, and 5 plans consider the legal implications of using privately-owned facilities for health care measures.

Ethical concerns are mentioned in all plans, principally when considering prioritising and allocating specific medical interventions, such as vaccines and antivirals. Few plans refer to or draw upon a specific or defined ethical guide to help when designing their plan and putting it into action.

However, institutions that are charged with decision-making on issues where ethical considerations are thought to be important are identified. A few plans specifically recognize the need to ensure that the population is given equal or universal access to health care independent of citizenship. Ethical issues relating to rights and duties of health care staff are not addressed by plans.

Cooperation with the EU institutions is noted in all plans. Collaboration with EU institutions is planned notably through the European Influenza Surveillance System, the Early Warning and Response System (EWRS), and the licensing of vaccines through the European Agency for Evaluation of Medicinal Products (EMEA).

Plans rarely state the need for collaboration with neighbouring states or other member states, including direct neighbours, despite a European Commission (EC) communication stating that "it will be important to coordinate clinical care and health service plans with bordering jurisdictions to avoid patients migrating across borders in expectation of better health care".[9, 10] Only 7 countries make note of the need to coordinate responses coherently with other member states during a pandemic, the majority being countries from Eastern Europe. Stakeholders from EU countries have argued that that there is a lack of awareness by member states about strategies being adopted by their neighbours. This may be important in matters such as travel restrictions or when providing public health interventions such as the supply of antiviral medicines and vaccines.

Concerns are expressed in some plans that countries manufacturing vaccines may demand that they are produced for their own needs at the expense of their non manufacturing neighbours – these plans stress that cooperation at European level is necessary.

Figure 6.

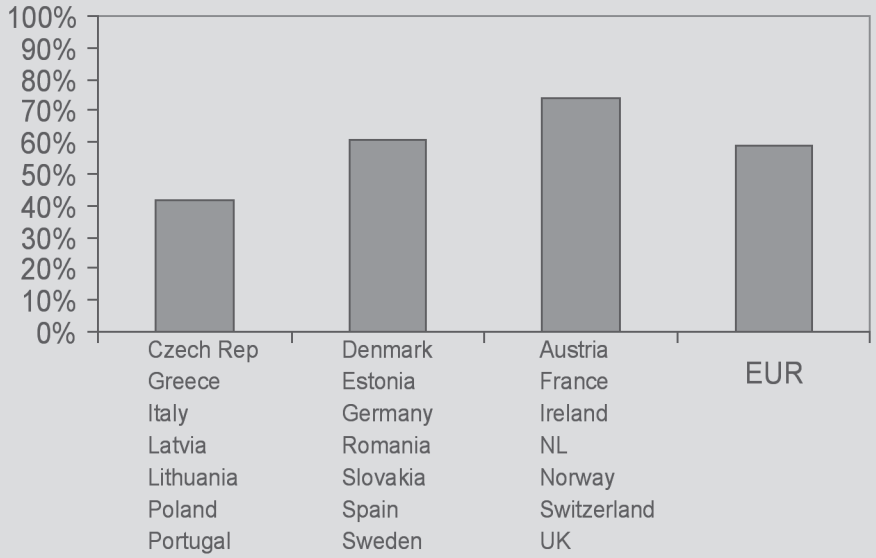

Figure 6. Completeness of planning and coordination in country preparedness plans.

Surveillance

- Policies and guidelines for surveillance and public health control measures relating to animal workers need to be developed
- Plans need to clarify how surveillance will be adapted during epidemic phases
- Rapid diagnostic testing needs to be improved and clarity provided on how to manage and prioritize
- Whether a country has the capacity to test antiviral resistance should be clearly stated

All surveyed countries have a national system for influenza surveillance. All assess the burden of seasonal influenza with the support of sentinel surveillance networks that report data to the EISS. Of the EU 25 member states, 21 have a reference laboratory approved by the WHO as a National Influenza Centre. All but two countries in our survey have a national reference laboratory recognized by WHO. Only 7 countries indicate in their plans that they have the capacity to test for antiviral drug resistance and 9 address the issue of specimen transport.

Seventeen plans describe links with animal surveillance networks, although these are rarely detailed. Eleven plans mention the need to take specific public health measures in relation to the handling of infected animals. Ten countries make note in their plans of public health measures targeted specifically at animal workers including an option for preventive treatment (prophylaxis) (7 countries), seasonal influenza immunisation to reduce the risk of virus re-assortment of genes (4 countries), and the use of protective equipment by animal workers (3 countries). Two countries' plans state that they will draft guidelines to reduce human contact with infected animals, and two countries' plans indicate that workers should receive information to minimize the transmission risk. A possible reason for the lack of inclusion of this potentially important issue in plans could be that the specific handling of avian influenza is addressed by veterinarian or other guidelines. However, only one country includes a reference to another formal plan issued by a veterinary agency. As noted, most countries assume that a pandemic strain of influenza will not originate as a result of animal transmission within the country, but more likely through human cases imported from abroad.

During the initial stages of a pandemic, most countries indicate that they would reinforce or enhance surveillance by increasing the number of samples processed and increasing the frequency of reporting. Seventeen plans state that they will look specifically to detect unusual events such as clusters of acute respiratory illnesses (ARI) or unexplained deaths, while 10 countries specifically state in their plans that they have outbreak investigation capacity to address suspected cases.

Major indicators of pandemic surveillance are included in most plans; these include deaths, hospital admissions and complications. The surveillance of side effects from vaccines and antiviral medicines are noted by 16 and 18 plans, respectively. Surveillance of secondary infections caused by bacteria is mentioned by 16 countries, and many link this to antibiotic policy. Few (7) countries plan to conduct surveys on immunity against the virus or monitor persons who are immune.

Only 7 countries address the issue of their capacity to prioritize sample testing in the later phases of the epidemic, some with the possible use of rapid diagnostic kits.

Ten countries envisage the use of rapid diagnostic tests, although most note that the sensitivity and specificity of available tests remain inadequate at the present time. One country plan notes the intention to use a simulation model to inform management and prioritise sampling and testing.

Seven countries address the issue of modifying approaches to surveillance as the pandemic evolves and consider either adapting surveillance or discontinuing it; other countries either envisage increasing surveillance in later pandemic phases or offer no specific advice. Among the countries that intend to discontinue some elements of surveillance, some are considering shifting surveillance to monitor how the health care system is coping with a surge in demand so that planning could be adapted. Some acknowledge that the amount of reporting will have to be reduced, while others accept that specific ad hoc telephone surveys could be conducted to assess the effect of the response on health care systems.

Figure 7.

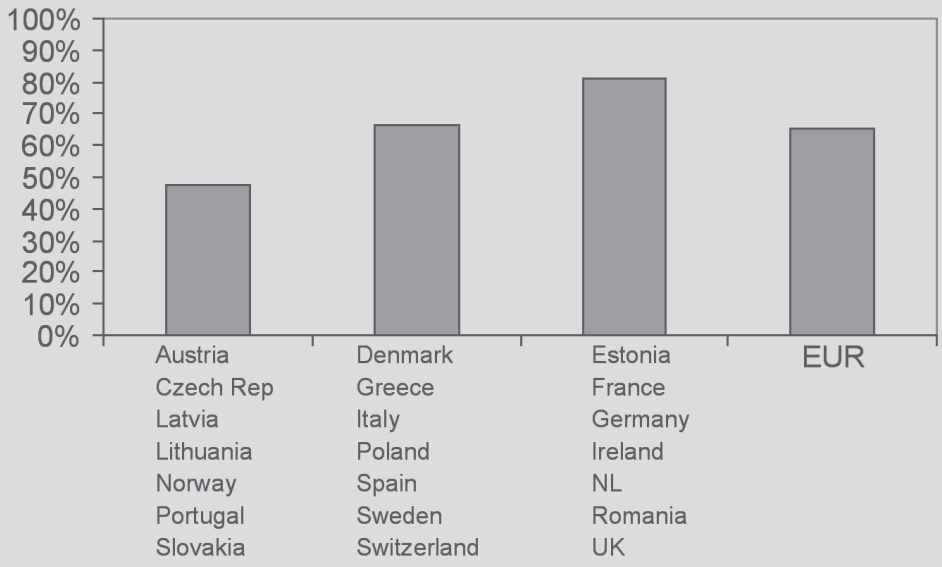

Figure 7. Completeness of surveillance in country preparedness plans.

Public health interventions

1. Public health control measures

- There is a lack of coherence between European countries regarding travel restrictions and border interventions
- Most countries intend to close schools and restrict public gatherings
- A divergence of approaches is seen in plans regarding use of masks

The implementation of public health interventions by pandemic phase is unclear in many plans. WHO recommends specific public health interventions to limit the spread of the disease. These interventions include those targeted at limiting the spread of disease (screening, travel restrictions), reducing its spread nationally (isolation, quarantine, closure of schools), and reducing an individual's risk for infection (hygiene, masks).[11, 12]

Countries consider using a selected range of public health control measures in their plans:

- All but 2 countries advise at least one measure of non-medical public health control.
- School closures are recommended by 19 countries, although some countries indicate that this measure would have to be carried out with care as it may result in considerable disruption to both health care systems and essential services, with parents staying at home to care for their children.
- Restricting public gatherings is mentioned by 18 plans.
- Fourteen countries include in their plans public health control measures to reduce transmission of infection such as measures to trace all persons who have been in physical contact with the infected and for individuals to monitor their own health.
- Nine plans encourage voluntary quarantine.
- Fourteen plans note the possible use of mandatory isolation or quarantine, with eleven plans mentioning specific sites for isolation, principally hospitals.
- Of the 8 countries that make provision for the supply of food and care to confined patients (mainly at home), 5 mention that non-governmental organizations (NGOs) will assist with this task, while most suggest that local authorities would be coordinating the logistical support to patients.

Hygiene measures are proposed by 12 plans, with several of them including comprehensive ready-to-use guidelines for the public. The use of masks for the public is recommended by 11 countries, with 7 countries noting that there is – as yet – insufficient evidence on the effectiveness of masks. The type of mask recommended is often not clear, and instructions for their use by the public are generally not included in plans.

A total of 15 plans recommend at least one measure to potentially restrict international travel. Many cite measures including travel restrictions (9 countries), measures at borders to restrict persons entering or exiting the country (13 countries), measures at borders to restrict international travellers coming from or going to affected areas (12), and entry screening (8).

Few countries (4) indicate that they will use specific measures targeted at travellers onboard international conveyances, such as isolation and supply of protective equipment for airline passengers.

Possible screening procedures for persons entering a state are rarely defined, with only 2 countries advocating thermal screening or clinical examinations.

One country notes that it is considering drafting a law by which it could stop all international or national travel within its borders. Some plans note, however, that measures to restrict travel would probably be of limited effect, in particular during phase 6 of the pandemic; such measures might only be of benefit in the early phases (stated by 4 countries). One country acknowledges that the benefit of such measures would mainly be political, whilst one country states that they would only be used in extreme circumstances.

Figure 8.

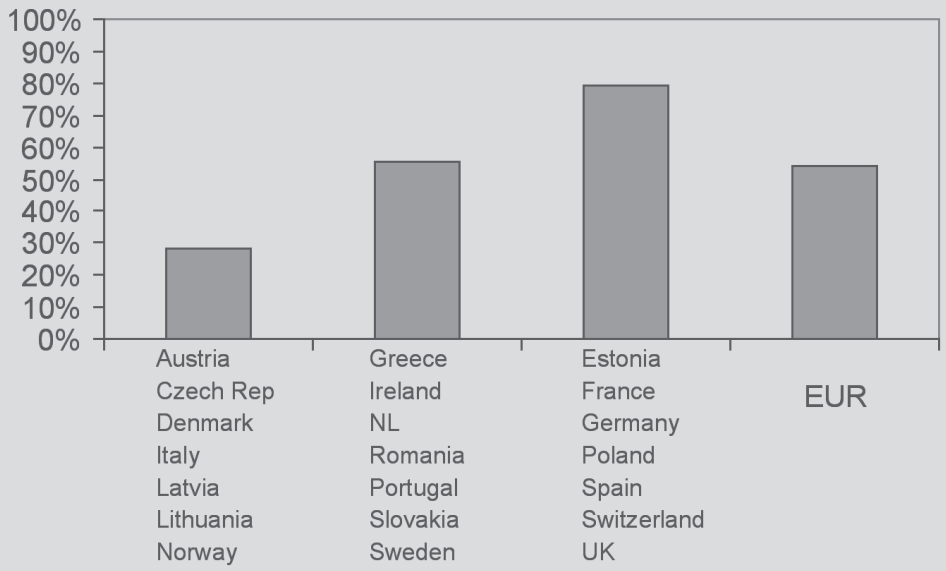

Figure 8. Completeness of planning for non-medical interventions in country preparedness plans.

2. Antiviral drugs

- While all plans advise the use of antivirals, the practical issues of diagnosis, treatment and distribution need to be addressed in pandemic plans
- Guidelines for defining priority between treatment and prophylaxis should be written according to the phase of the pandemic
- Priority groups for treatment and prophylaxis need to be defined and clear

Twenty countries have developed an antiviral drug strategy, although the level of detail varies substantially between countries. Only 1 country has left the development of a strategy to a later stage. Thirteen countries have issued guidelines for the use of antiviral drugs, with again wide variation in the level of details provided.

All countries advise treatment using antiviral medicines. Eighteen plans recommend that individuals are given prophylactic antiviral drugs after exposure to the virus. Thirteen plans advise giving antiviral drugs before potential exposure to the virus or as a precaution on a seasonal basis. The distinction within the plans between giving prophylactic antiviral drugs after exposure to the virus and giving precautionary antivirals on a seasonal basis is not always clear. Some countries note that during a pandemic outbreak this distinction will prove difficult especially if the number of people affected is high. Only 5 countries (the Netherlands, UK, France, Latvia, Romania) are clear in determining the priority of treatment over prophylaxis – the remainder do not distinguish. One country (Sweden) notes that antiviral drugs could be used for long term prophylaxis prior to exposure to the virus.

Sixteen countries have established which groups of people should be given priority for the prophylactic use of antiviral drugs. Health care workers are a clear priority, with 11 plans making them top priority. Four countries identify high-risk groups as their first priority group and 1 reserves prophylactic treatment for poultry workers and close contacts. Other key workers are generally mentioned in second priority. Several countries advise that people who are unable to be immunised should also be prime candidates for prophylaxis.

Thirteen countries have established priority groups for treatment with antiviral drugs. Only 11 countries give some indication of the size of these priority groups in each country. Patients suffering from severe disease and complications are most frequently mentioned as the first priority group. Patients at high risk of serious complications and patients who cannot be immunised are a second priority group, while key workers are mentioned third.

Many plans note that, ideally, a short (48-hour) time frame should be allowed from the moment patients seek medical examination to the point when they receive treatment, but little attention is given to the practical solutions or suggestions provided on how this can be achieved. One country (Ireland) indicates that laboratory confirmation will be required before antiviral drugs are offered. Other countries stress that clinical signs of infection will be used to start treatment. One country (France) has made provisions for ensuring that antiviral medicines will be available for its citizens abroad.

Several countries have decided on different priority groups according to the phase of the pandemic. For example, they indicate that in the early stages, animal breeders or close contacts of infected patients would receive prophylaxis, while in the (late) phase 6 of the pandemic, treatment would be given as a priority over prophylaxis, regardless of type of group involved.

Seven countries provide some details regarding their policies on storage and distribution of antiviral drugs, although in most cases, these remains very brief and limited to storage (for example, hospital pharmacies). The mechanisms of delivery to patients are not made clear, and nor is how and by whom the writing and filling of prescriptions will be organized (if needed). Distribution channels cited include routine pharmacies, public health agencies, occupational health bodies, and hospitals. General practitioners are made mention of in this regard by two plans as prescribers for antiviral drugs.

Nine countries state specifically that antiviral drugs and vaccination will be provided free of charge – others do not address the issue.

Figure 9.

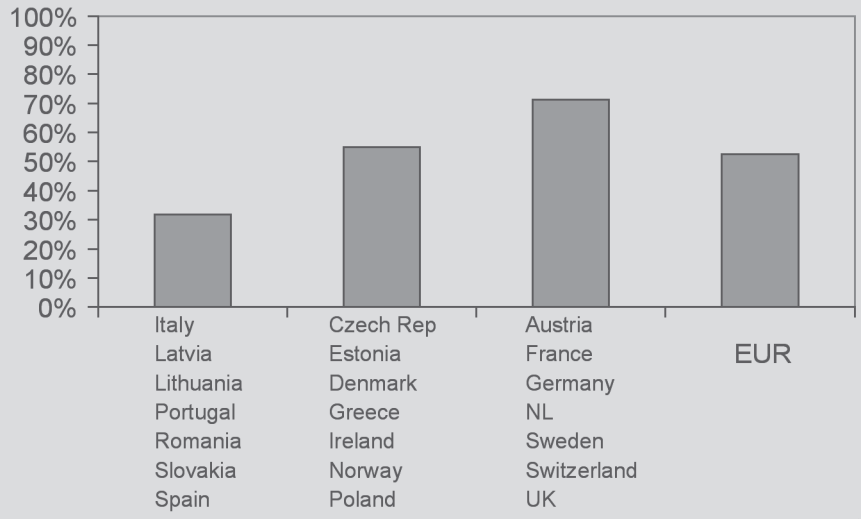

Figure 9. Completeness of strategic planning for use of antivirals in country preparedness plans.*

3. Vaccines

► Action plans on provision, storage, distribution and administration of vaccines need to be clearer.

Twenty countries have an immunisation strategy for a pandemic vaccine. This includes elements on obtaining vaccines, who should be immunised first, and provision of immunisation. One plan states that their immunisation strategy will be developed at a later stage. Four plans (Norway, Sweden, Denmark, Switzerland) state that their government is currently considering producing their own national vaccine supply. Fourteen countries plan to immunise their entire population provided the quantity of vaccine is sufficient.

Additionally 14 countries indicate they have a policy recommending pneumococcal vaccination for risk groups, although half of these have not yet been put into practice. Several countries are planning such vaccination in later phases of the pandemic.

In 19 plans priority groups for receiving the pandemic strain vaccine are defined. However, few countries give reasons for their prioritisation. Nine plans only describe the size and type of population included in their immunisation priority groups.

Most (15) plans rank health care workers as their first priority; essential services workers are ranked second (13 plans) and the third priority group (noted in 11 plans) are persons at risk of serious medical complications likely to be associated with influenza. In 2 national plans, populations at risk of medical complications have a higher priority than essential workers or health care workers. Other plans specifically include children, employees and persons thought likely to pose a risk to vulnerable groups.

**The actual stockpiling of antivirals is accounted for in the putting plans into action section.*

Detailed immunisation strategies are not provided in plans. Immunisation plans stipulate the purchasing agency in 17 cases, principally the national Ministry of Health. Seven countries state that they possess a generic plan for mass immunisation, which they could deploy for pandemic influenza immunisation. Only nine of the plans give details on vaccine distribution mechanisms, six plans outline storage mechanisms and three give any details of transportation procedures.

Six countries (France, Germany, the Netherlands, UK, Italy, Romania) indicate they possess manufacturing capacity for vaccine production.

Figure 10.

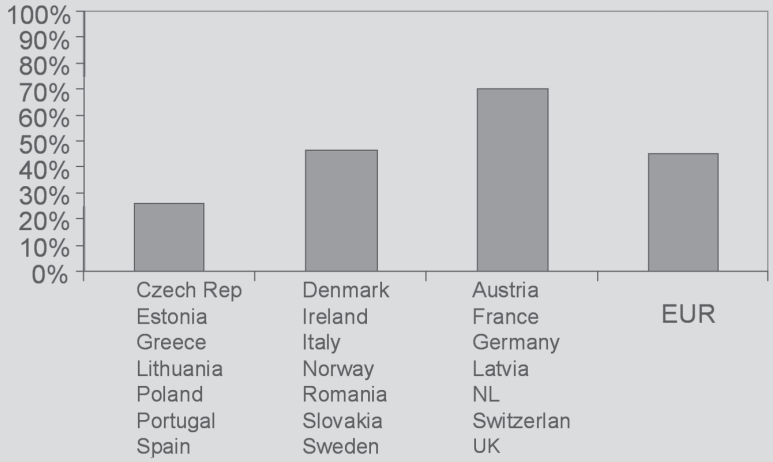

Figure 10. Completeness of vaccine strategic planning in country preparedness plans.

The response of national health care systems

- Triage procedures – classifying patients into priority groups based on their needs and best place of treatment – need to be developed and tested
- Mechanisms for calling on additional health care staff should be specified
- Management of deaths as a result of the pandemic needs to be better planned

Twelve countries mention specific clinical guidelines for influenza in their plans. Some include these guidelines in their national plans while others make reference to them. Guidelines inserted in the plan include treatment instructions for antiviral drugs and antibiotics.

Twelve plans include a reference to existing guidelines for infection control in health care settings, while 16 plans outline essential requirements for isolating infected patients in health care settings. Thirteen plans indicate that protective equipment will be provided to health care workers, with protective masks most frequently mentioned. Mask specifications are given only by some plans. Only 5 countries specifically refer to laboratory bio-safety guidelines.

In terms of the overall response of health care facilities, 18 plans detail a specific model for delivery of care. For 12 plans, home care is preferred and health care facilities would be reserved only for those with severe complications. In other plans, a combination of hospitals and, sometimes, dedicated health care centres is proposed to cater for patients' needs. Ten plans indicate that countries will resort to creating new medical care sites if numbers overwhelm existing care facilities. These include military hospitals, hotels, community centres and spas.

Private health sector involvement is mentioned by only 10 plans, including input by private primary care providers into the care of patients or request for use of private health facilities. Few concrete details are provided on the roles and responsibilities expected of private health care institutions.

Triage policy – classifying patients into priority groups based on their needs and best place of treatment – is an essential part of the pandemic response strategy and is poorly addressed by most plans. Only 6 countries outline a specific triage policy. A small minority of countries specify clearly which institutions will operate the triage system (15 centres in France, care centres in the Netherlands, influenza hospitals in Austria, dedicated teams in Sweden, a specially designated centre in Spain, and specific guidelines in Ireland). In other cases, triage policy is proposed as the responsibility of local health care bodies, but details of organisational responsibility and duties are not given. In most plans, criteria for accessing secondary care are not clear and guidelines are incomplete.

The majority (16) of the plans identify additional sources of health care workers, notably retired doctors, medical students, or volunteers. The roles that these individuals will play include complementing the current workforce (which may be depleted during the pandemic), logistical support, mass vaccination, nursing in the home, patient management and monitoring.

Health care supplies, such as protective equipment, antibiotics, materials for carrying out laboratory tests and medical equipment are mentioned in a large majority of plans (19). However, estimates of the magnitude of need are missing. In many cases, decisions on what to stockpile and purchase are left to local authorities although some national governments are also considering stockpiling supplies.

Management of excess mortality is covered only by 8 plans, which address the issue of storage places for corpses, with only 7 countries referring to procedures for the safe handling of corpses.

Figure 11.

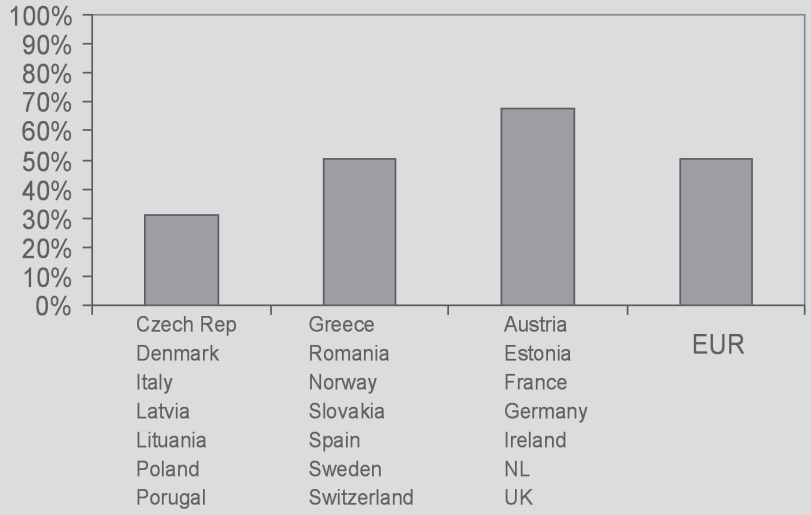

Figure 11. Completeness of health system responses in country preparedness plans.

Operational provisions for implementing the health system response need to be detailed, in particular, the split between home and hospital care.

Essential services

- National contingency plans should be developed and clearly incorporated into plans
- The roles and responsibilities of different government departments should be made obvious

A substantial number of plans (7) do not address the need to prepare for the maintenance of essential services during a pandemic. Only 8 plans note that a contingency plan has been developed for the maintenance of essential services. This lack of clarity may reflect the leading role that the Ministry of Health takes in the process of planning for a pandemic in many countries. In countries that mention the existence of a contingency plan, the Ministry of Interior or local authorities are generally documented partners in the planning process. In 2 cases, the pandemic response is actually led by the Ministry of Interior or the Emergency Services (France, the Netherlands). A basic (though often incomplete) list of essential personnel is described in 11 of the plans and in 7, replacement personnel are identified to supplement essential workers. These include military and NGO personnel who will support or replace regular personnel in providing essential services or support for confined persons.

Figure 12.

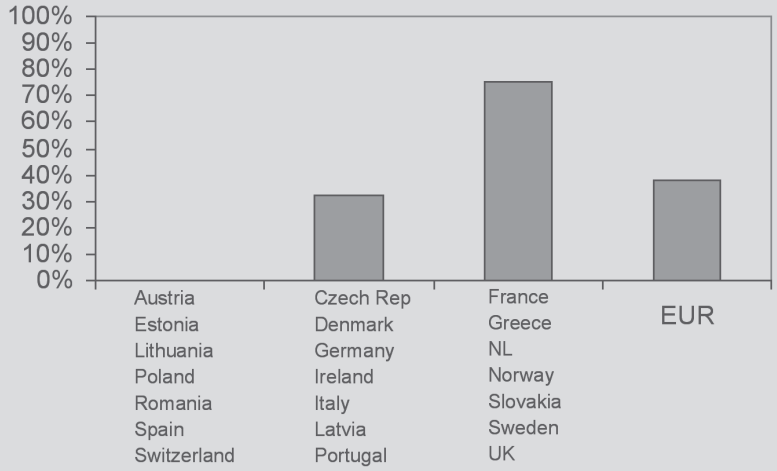

Figure 12. Completeness of essential services planning in country preparedness plans.

Communication

- Specific means of communication directed at particular target audiences will need to be developed
- Strategic communication capacity will need to be strengthened

Strategic communication capacity, that is the set of mechanisms that enable those involved in the response to communicate, is mentioned by 15 plans, although it will be an essential component of an effective and rapid response strategy.

Both the WHO and the EU recognise that communication to the public during a pandemic will be critical to effectively carry out all strategies, such as public, medical or non-medical health interventions.

A comprehensive communication strategy is developed in 14 plans, although all note the need to communicate specifically with the general public and with health professionals. In most plans, the communication strategy is developed on a phase-by-phase basis and includes some materials designed especially for the general public and for health professionals. Some countries indicate in their plans that they will develop a targeted communication strategy at later stages of the pandemic. One country (the Netherlands) has a dedicated public announcement channel that can be used to relay information to the public. Only Latvia states an intention to specifically target communication to high-risk groups. In 15 plans, the agency responsible for communication is stated and is, generally, the Ministry of Health spokesman.

Figure 13.

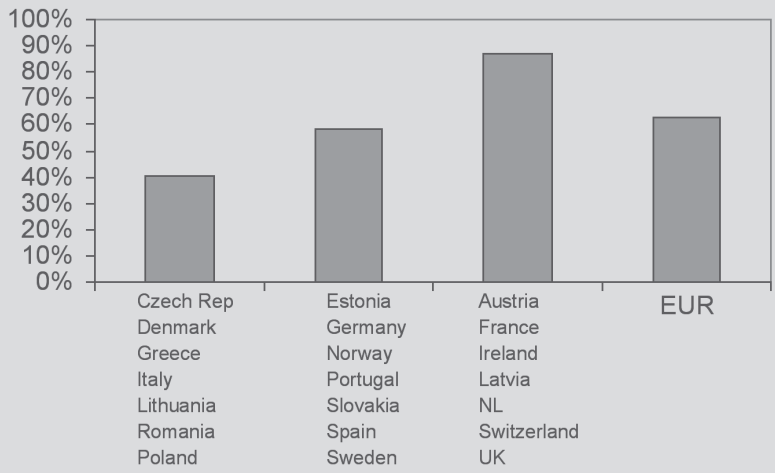

Figure 13. Completeness of communication planning in country preparedness plans.

Putting plans into action

- Target audiences, institutions, and those responsible for putting plans into action, need specific information and guidance from relevant and appropriate sources
- Regional preparations need to be in place where appropriate and relevant
- Regional preparations need to be monitored
- AV and vaccine strategies present – but operational issues (stockpiling, advance purchase arrangements, distribution) often weak

Most countries describe the implementation of their action plans (often set out phase by phase), detailing roles and responsibilities of the different governmental agencies involved in the pandemic response. For 17 countries, the procedure is clear for confirming both an alert and a pandemic outbreak. However, the process of disseminating information could be made more specific: only 7 plans include a clear flow of information in their plans.

The capacity of regions within a country to put plans into action is likely to be critically important. Overall instructions to regions/regional plans are available for 11 plans only, and these are, in general, not detailed. There was no discernable association between the type of health system (federal or unitary) and the presence of instructions to districts. Many 'federal' systems offer only general guidance, with the implication that districts need to produce their own plans. Others have instructions but these are not detailed or lack clarity.

Moreover, mechanisms for monitoring the development and completion of regional plans within national plans are not defined. Eleven of the plans mention the need for building capacity, primarily of health care staff, and a more limited number plan to implement an awareness campaign targeted at health care workers. Apart from the general exercise ("Common Ground") led by the EU commission in November 2005,10 to our knowledge, only three countries (UK, the Netherlands, France) have plans that have been tested nationally in simulation exercises (although the lessons learnt from these exercises have generally not been communicated to the public).

In terms of specific operational measures, most plans state a policy for acquiring antivirals but do not indicate quantities that have been ordered. We infer from information found in the public domain that stockpiling of antiviral drugs has started in 13 countries (stock ordered).[8]

Sixteen plans consider expanding the use of vaccines during the inter-pandemic phase when no new influenza virus strains have been detected as a way to improve the protection of risk group populations and to enhance vaccine production capacity. Most countries generally specify in their plans how they will obtain vaccines (local manufacturing or procurement), but do not necessarily give indications of the actual contractual arrangements that they have negotiated.

Figure 14.

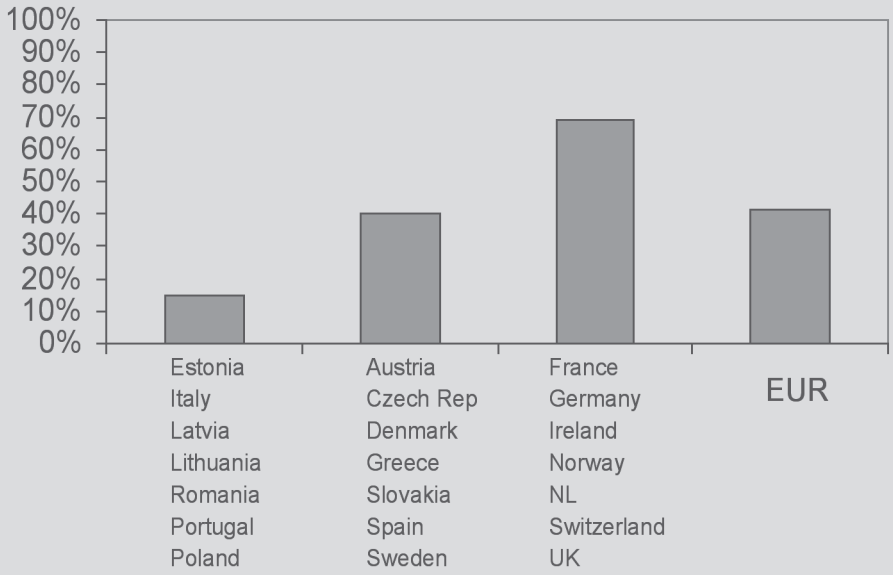

Figure 14. Completeness of operational planning in country preparedness plans.

IMPORTANT FURTHER ISSUES FOR CONSIDERATION

Links between animal and human surveillance

Veterinary services are specifically mentioned as members of pandemic planning committees in only 14 countries – this is despite cooperation with veterinary services being noted at a later stage in many plans. The links between health and animal surveillance sectors are not always optimal.[13] Of 17 countries that make note of the link with animal surveillance networks, only a minority detail specific containment measures that they plan to take to protect animal workers confronted with an outbreak of avian influenza.

Only 7 countries highlight the use of preventative antiviral medication (prophylaxis) after exposure in animal workers, and only 3 dictate the use of specific protective equipment. Four countries formally recommend seasonal vaccination for animal breeders, with a view to preventing dual infection.

While the handling of avian influenza remains the responsibility of veterinary services, it seems sensible to us that measures that may have an impact on human public health should be incorporated into pandemic preparedness plans. As the ECDC notes in its risk assessment for the influenza pandemic conducted in October 2005,[14] risk is "close to zero" for European citizens but "low" in professions involved with animal work, including the poultry industry and culling teams. Plans for the early containment of the influenza pandemic may also need to consider the possibility that the pandemic could originate in Europe, for example in a farming environment. The WHO recommends that potential high-risk breeding areas in Europe be identified and that animal and human surveillance be increased in those areas.[14]

Ten countries integrate a basic early containment strategy into their plans – 50% of these countries being from Eastern Europe. Most countries assume that the influenza pandemic is likely to be imported through human-to-human transmission. It is thought that early containment of the H5N1 strain in South East Asia, through the mass use of prophylactic antiviral medications to specific members of the population and cutting back on human contact, may be possible, assuming cases are rapidly diagnosed and antiviral drugs are distributed effectively.[15] It remains uncertain whether a pandemic emerging in a major city is containable.

Surveillance of animals and animal workers should be closely associated with effective cooperation and coordination between both systems. The WHO recommends the need to combine detection of new outbreaks in animals with active searches for human cases.[16] But, as was noted by commentators at the WHO workshop of 24–26 October 2005, there are currently no functioning joint standard procedures on the outbreak of influenza for health and veterinary authorities. A call was made for clear case management policies for animal workers, including the provision of guidelines on isolation facilities, training of personnel in infection control, and access to antiviral drugs. National plans must be consistent with veterinary contingency plans.

Cooperation within the EU and between neighbouring countries

Close communication and collaboration between country agencies, the WHO and EU institutions is a feature of most plans. Few countries, however, address the need for collaboration with direct neighbouring countries. Only 7 countries mention the need to coordinate with other member states during a pandemic (France, Greece, Spain, Lithuania, Poland, Romania, Czech Republic), despite this being an acknowledged necessity.[17] Indeed, even in matters such as travel restrictions, where cooperation is likely to be critically important, no mention is made by most countries of other countries' plans or cooperative arrangements. This omission needs to be addressed. With some countries stockpiling antiviral medications whilst their neighbours have only limited stocks, cross-border demand may be particularly challenging to manage.

There is clearly a need for countries within a European region to be informed and to inform others of their respective strategies in order to ensure that policies are consistent where necessary, or pose as few challenges as possible to public health protection where differences or inconsistencies exist. There may also be a need to ensure that European response mechanisms work together in harmony if public health interventions are to be similar in different countries. The EU's proposed Solidarity Fund is important in this respect as it aims to reimburse, post-pandemic, the cost of antivirals and/or vaccines to some countries.

Central and regional roles and responsibilities

Planning for an influenza pandemic is the responsibility of central government in all national plans. However in some cases, the 'federal' plan is only a guide for regions and offers little in the way of direction for putting plans into action. It appears that regions are often expected to undertake non-specified responsibilities and to define at a local level the requirements for these responsibilities. To be effective, preparedness planning must be in line with specific political decision-making processes and health care systems in each country. Some countries have developed individual regional plans – the Netherlands, for example, has a plan for all 24 so-called "security regions". Clearly, states must be able to balance central government-driven policies and those of the regions whilst acknowledging the agenda of current health systems and how these may need to be changed in a time of emergency.

The testing of local plans has, to our knowledge, been a rare occurrence, with only the UK and the Netherlands having publicised several regional simulation exercises. Regional planning is essential to ensure the availability of care and the coordination of responses to demand in health care and other support services. Regional planning is also crucial for coordinating sampling and testing priorities, and for organising public health interventions needed locally.

Only 11 plans include instructions to regions, though as noted, instructions are often non-specific. When operational planning and response are largely the responsibility of local regions, putting plans into action and coordinating responses may be challenging.

A report from the University of Toronto on the SARS epidemic showed how, in countries where powers are shared between regions and central government, organisational problems may occur when responding to a health threat and countries struggle to rapidly inform international bodies such as the WHO.[18]

It seems to us that it may be critical that clear lines of responsibility exist between local and central agencies; that in an emergency, some responsibilities need to be assumed at a central level; and that systems are developed to monitor progress of, and ensure consistency in, the planning process across regions. Of note, in the Netherlands, certain decentralised responsibilities have been recentralised in response to the pandemic threat (Malta Second European Influenza Conference, 11-14 Sep 2005).

Regional differences within a country may be important. In Germany a wide variation is reported in the provision of antivirals according to regions, with coverage ranging from 4.5% (in Hamburg) to 12.3% (in Rheinland-Pfalz).[19] This raises concerns regarding national constitutional and ethical issues.

Prioritising laboratory testing capacities

Most countries plan to enhance surveillance once a pandemic emerges, while a substantial number also plan on increasing surveillance even during later phases. While most countries acknowledge that there will be increased demand for diagnostic tests and test materials, few make practical recommendations on how this demand will be met.

Only 7 countries prioritise testing, principally through decreasing the number of diagnostic tests carried out and acknowledging the growing dependence on clinical diagnosis. Some countries indicate the need to rely on, as yet undeveloped rapid tests during later pandemic phases.[20] While a surge in capacity is expected by the WHO to be addressed within the plans,[13] we suggest that countries quantify their anticipated requirements in terms of laboratory supplies and staffing in order to provide a better definition of priorities for testing during the different pandemic phases.

Surveillance indicators

The WHO stresses that in later pandemic phases, laboratory resources are likely to be overwhelmed and that laboratory surveillance should be reduced accordingly. Surveillance should focus in particular on the testing of antiviral susceptibility and the effectiveness of vaccines.[13]

In plans, clarity on surveillance and monitoring as the pandemic progresses remain sketchy. During the pandemic, there will be greater expectations and requirements for improved surveillance. Alongside on-going indicators to map the evolving pandemic and the unique characteristics of the virus (transmission

patterns, risk groups, case fatality) there will also be a need to monitor the health care system response (hospital admissions, primary care consultations, etc), which might weaken the capacity of the surveillance system to cope.

Storage and distribution of antiviral drugs

Antiviral medications can play a valuable role in the initial response to the pandemic, especially given the likelihood that an effective vaccine remains unavailable in the short term.[21] Used for both the prevention and treatment of influenza, antivirals may be an important resource to reduce illness, mortality, and decrease the spread of the virus.

Both classes of existing antivirals (adamantane and neuraminidase inhibitors) are effective for the prophylaxis of influenza type A. For treatment, adamantanes and neuraminidases differ in their effectiveness, with resistance to adamantanes being more common. High level of resistance has been shown to adamantanes amongst most H5N1 isolates examined to date. The benefits of neuraminidase inhibitors include a reduction by 1.5 days in the length of time that patients suffer from influenza symptoms, and a reduction in the number of complications by 34% if medication is given within 24–48 hours of the first symptoms appearing (EMEA).

Stockpiling of antiviral drugs is recommended by the WHO and the EU because a sudden surge in production will not be sufficient to satisfy the immediate surge in demand should a pandemic occur. In the European region studied, for 21 countries (representing 93% of the total European population), the overall anticipated proportion of the population having sufficient antiviral drugs is 14%, with notable differences between countries.

WHO advises the development of means by which mass quantities of antiviral drugs can be delivered.[16] The effective use of antivirals is enhanced when the drugs are administered within 48 hours of the first symptoms appearing; for the medication to be taken over several days; and for different dosing schedules to be used according to whether the drug is given as treatment for infection or as a preventative measure. The stock of antivirals in bulk storage form (API) may also make distribution processes awkward, as doses have to be prepared in liquid form before use. Distribution of antivirals will prove particularly challenging. The effectiveness of logistics and plans for the distribution of antivirals in a pandemic setting may significantly impact on the expected benefits to public health. Countries will need to monitor both the use and stocks of antiviral drugs in order to prepare for subsequent pandemic waves.

For antivirals, prioritisation is an essential exercise that needs to be communicated clearly to the public. No plans describe the processes by which individuals belonging to priority groups will be identified nor the timeline for doing so, and none describe mechanisms to ensure that those identified as a priority actually receive the drug and take the dose as planned. In particular, it is crucial to define so-called 'high-risk groups' and this will need to be seriously refined as the pandemic progresses. The uncertain nature of the prioritisation process could lead to individual claims of unfairness and potential concerns over the equitable distribution of scarce resources.

The issue of prioritisation between treatment and prophylaxis is not addressed by most plans. Only a handful of countries clearly focus provision of drugs to those who are sick, as recommended by the European Commission Communication.[10] There are 4 possible strategies for the use of antiviral medications: (a) treatment only, (b) prophylaxis to all, (c) treatment plus limited prophylaxis (eg household contacts), (d) treatment plus limited prophylaxis combined with implementing social distancing measures, such as closure of schools. Concerns regarding clarity over this issue have been raised at the national level. For example, a report from a UK House of Lords Committee expressed particular concern at the lack of clarity in the UK Government's policy on prophylactic use of antiviral drugs, considering the limited quantity of drugs that have been stockpiled.[20]

For storage and distribution policies, 7 countries provide some detail of processes, although in most cases, they are described with little tangible practical information. Most plans make note of delivery to central storage facilities, such as hospital pharmacies. The mechanism for delivery of antivirals to patients is not clear, however, and nor is how and by whom the prescriptions will be organised. Distribution channels mentioned include normal pharmacies, public health agencies, occupational health bodies and hospitals. Primary care doctors asprescribers for antiviral drugs are mentioned by only 2 plans (Czech Republic, Switzerland). Only one country (the Netherlands) mentions a specific mechanism and states that antivirals will be deployed according to a formula based upon hospital bed numbers.

There is a need for countries to be more specific about their antiviral distribution strategies. Distribution and prescription processes should be realistic and consider how best to use or differ from existing systems for delivering medicines to health care providers. They should favour speed of distribution and delivery. Countries will need to monitor uptake of antivirals and stocks in order to prepare for subsequent pandemic waves. The issue of stock control will also be critical because the quantity of drugs available to most countries may be insufficient to cover all needs. The challenge of reconciling control, flexibility and speed of supply will need to be addressed by each country in relation to the specifics of its national health care system.

Stockpiling of antiviral drugs has attracted considerable attention. By November 2005, for example, 13 countries had publicly acknowledged stockpiling.[8] Estimates at that time, derived from publicly available stockpiling figures, suggest that in the order of 18% of the population of these 13 countries would be covered. However, country provision varied considerably, ranging from 2% to 53% population coverage. Furthermore, new purchase agreements occur frequently and many agreements are not made public until months have passed. The true position for Europe regarding antiviral coverage remains opaque and is constantly changing. In addition, calculations regarding percentage coverage achieved through antiviral stockpiles may be somewhat misleading as most such calculations are based upon treatment of infected individuals whilst many plans include, in addition, prophylaxis for essential services workers and specified high risk groups.

At the time of writing this report, most countries have obtained supplies of oseltamivir, although a number have also started to purchase zanamivir.

Vaccine strategies

Vaccine development is a critical part of preparedness. The total annual worldwide production of influenza vaccine amounts to 300 million doses, while potentially 6.2 billion people worldwide need protection. Currently, 65% of global production capacity lies within Europe (190 million doses), which gives the region a leading role both in the development and supply of vaccines.22 With 50% of European production being currently distributed outside Europe, the EU can access 90 million trivalent vaccine doses for a population of 477 million inhabitants. A trivalent vaccine combines 3 strains of the influenza virus into a single dose.

The most likely scenario put forward by experts is that the vaccine response to pandemic influenza will be monovalent (i.e. vaccines containing a single strain of influenza virus). As the entire population will not have had previous exposure to the pandemic virus, most experts think that 2 doses (injections) will probably be necessary to reach a satisfactory immunity level.[22] As a result, the manufacture of a vaccine to protect against a single pandemic strain rather than the current 'trivalent' seasonal vaccine, administered in 2 successive doses, would provide coverage for a maximum of 450 million people globally and 135 million people in Europe.

Experts broadly agree that to produce 300 million vaccine doses (based on production in eggs) will take a minimum of 6 months from detection of an emergent pandemic strain. This length of time may be reduced in light of advances in methods to produce the vaccine or because of a greater understanding of the virus genetics, in addition to the early preparation of materials required for vaccine production. Some issues remain to be addressed, for example, the liability of vaccine manufacturers, conflict with ongoing production of other vaccines (e.g. the seasonal influenza vaccine) and technological challenges.[20, 23]

Although the constraints on securing and manufacturing pandemic vaccine are well defined, many preparedness plans do not offer a solution. Countries indicate that they will purchase vaccine either from national producers or from abroad. Four plans (Norway, Denmark, Sweden and Switzerland) remark that local governments are currently examining the potential to establish domestic vaccine production. Though 14 plans recommend that the whole population should be vaccinated, they usually do not specify population targets or the amount of vaccine required. Priority groups are indicated in most plans, although the numbers of people involved are not always given. Overall, the immunisation strategy is poorly described, although 7 countries make reference to a generic (broad) immunisation plan.

In their preparedness plans, countries have responded in 3 different ways to issues regarding possible production shortages.

First, 16 countries recommend the expansion of inter-pandemic vaccine use (see Annex) although new targets are rarely mentioned. (The WHO recommends 75% coverage for high risk groups by 2010.)

This is an essential element for both lowering the probability of a new influenza virus appearing as a result of a mixing of genes from circulating avian influenza and human seasonal influenza, and most importantly, for increasing the routine production of vaccine and preparing manufacturing industry for a potential surge in demand when the pandemic occurs.

Second, a limited number of countries (France [40 million] UK [120 million], Germany [160 million], Norway [4 million], and the Netherlands (20 millions)[24] have already anticipated the likely shortage of supply by negotiating advance purchase agreements for pandemic vaccine. This, however, raises challenging issues around equitable distribution of vaccine within Europe and access to vaccine by under-resourced, developing countries. A handful of countries are also financing the development of a specific H5N1 vaccine in order to reduce the time taken for vaccine production, and to protect priority groups in the early phase of a pandemic. Four European countries have now entered into tenders for a limited quantity of H5N1 vaccines. These are the UK (3.5 million), France (2 million), Italy (estimated 0.5 million), and Switzerland (100,000).[24] Additionally, one country (Spain) notes an intention to stockpile pandemic vaccine in phase three of the pandemic.

Third, a few countries are formally addressing liability issues on potential side effects linked to the pandemic vaccine, which – some warn – may prove a deterrent for the development of vaccine by the manufacturing industry.

Triage policy

During the pandemic phase, procedures for triage – classifying patients into priority groups based on their needs and best place of treatment – may be critical to patient management and to limiting illness and mortality. The prescription of antiviral drugs for treatment will require efficient dispatch of patients to medical diagnostic settings and the rapid provision of medication. There is a risk that triage systems will be overwhelmed by people seeking advice who are not actually sick. In the plans, only 6 countries describe in general terms the mechanism they will employ to classify patients. They include telephone hotlines, special care centres, and special influenza hospitals. Most plans, however, do not give any specific details, leaving the planning of triage for later phases of the pandemic. If triage priorities are not clearly organised, it will be up to individual practitioners to classify patients, which will create ethical dilemmas as well as possible inefficiencies in the response.

Impact on the health care system

Confronted with a pandemic, the ability of the health care system to cope will be tested severely. Traditional plans for health care facilities, such as emergency or sector-wide contingency plans are unlikely to be sufficient, relying as they do on often informal cooperation and support between hospitals.[13] In a pandemic, all secondary care facilities will face similar challenges and there will be a need to rethink the division of resources in order to respond to the surge in demand. Health care facilities need plans that specify clinical management, infection control, human resources management, admission criteria and provision of neces-

sary medical supplies. Strategic choices made by the different countries on the organisational response to the pandemic raise diverse issues and challenges. In countries where home care is the preferred model of care (France, the Netherlands, Czech Republic), the services of community-based health care practitioners will be stretched. Yet, as the Dutch preparedness plan stresses, when care is primarily delivered in health care facilities, this potentially increases social contact and raises the question of how best to organise the movement of patients so as to minimise transmission.

The health care sector will be put under pressure for a significant period. In the UK, for instance, at the peak of the epidemic, there could be over one million new cases of influenza each day and pandemic influenza-related occupancy of intensive care beds could be over 200% of current capacity.[20] The strain on the system will be made worse if, as has been suggested, 25% of health care personnel are sick and, as a consequence, would be unable to work.[25] Fear and anxiety will also result in well individuals seeking reassurance and advice in medical facilities.[26]

In the UK, it has been calculated that the peak of the epidemic will occur between 50 and 70 days after the initial introduction of the virus into the country[13]; a Dutch simulation forecasts a first wave during 6 to 8 weeks.[27]

Involvement of primary care in the preparedness effort needs to be secured through relevant and timely awareness campaigns. A study by EUROPREV suggests that only 43% of countries' General Practitioners felt they were trained to handle the situation, while 86% were willing to undergo training in handling emergency situations.[13]

Countries with national insurance systems may need to formalise arrangements with health insurance providers in order to address issues of financial coverage for vaccination and antiviral medications. Currently, according to the EUROPREV survey, in most countries, seasonal influenza vaccination is not free of charge for non high risk populations,[28] which may be a barrier to giving the vaccine to the whole population. The issue of finance for public health interventions, such as vaccination and medication, is particularly highlighted in several plans from countries in Eastern Europe. In these countries, none or only limited population groups are covered by state financing – some of these countries stress that health care interventions would be free of charge during a pandemic (Estonia, Latvia, Poland, Romania).

Non medical public health interventions

Countries' national plans recommend a wide range of non medical interventions. However, evidence of the effectiveness of these measures remains limited for obvious reasons. This perhaps explains the diversity of recommended interventions and the lack of overall consistency. The effectiveness of interventions may be dependent upon the phase of the pandemic during which they are implemented. For instance, WHO points to the fact that robust measures might be used in the early phases of the pandemic when few cases are observed, while during later stages, such measures are much less likely to be effective.[2] Early containment of the epidemic through non-medical interventions is addressed by only 10 plans.

Isolation and quarantine may have a positive effect in the early containment phase of the epidemic. However, very rapidly, these measures are likely to prove ineffective as the 'serial interval' is only 2 to 4 days, which allows little time for isolation and quarantine. The serial interval is the interval between 2 cases in a chain of transmission. Voluntary confinement – recommended by WHO[2] – is advised by 9 countries in our survey and is seen as a beneficial way to increase social distance. However, how patients confined at home would actually receive the necessary care and medication is not always addressed in plans.

Closure of schools – which is one of the most frequent measures cited by plans – showed some benefits in a 2004 study in Israel when the number of medical visits for influenza significantly diminished following a teachers strike and closure of schools.[29]

Restriction of mass gatherings is an intervention supported by 18 plans, some indicating that they will update their existing legislative framework in order to do so.

In terms of international travel restrictions, although a significant number of plans recommend such measures, the WHO argues that they are unlikely to have much of an impact on the spread of the epidemic and considers enforcement of travel restrictions impractical in most countries.[2] Modelling of the pandemic in the UK shows that a reduction of 90% in international travel would only result in a small delay in the spread of the disease.[13] Restricting travel by closing roads would appear even more inefficient.[30] Screening of travellers coming from infected areas is not recommended by the WHO, except for geographically isolated, infection-free areas.[2] Any benefits that arise are likely to be primarily political. Some travel-related measures are, however, recommended by the WHO and have been adopted by a number of plans, such as health advice for travellers and screening of travellers leaving infected countries by health declaration and temperature measurements.[2]

Several plans note the demands of the new International Health Regulations, and the need to ensure coordination with international institutions such as the EU.

The protective effect of masks is widely discussed in plans. Some countries recommend their use and have started to build stockpiles. Other plans dismiss their use, citing a lack of evidence. The WHO also recognises that there is no clear support for the protective effect of masks on transmission patterns, and advises that their use be permitted but not encouraged.[2] For non health care professionals, the WHO recommends that masks are used when attending to patients with symptoms of infection and when dealing with persons seeking care in risk area, including where there is likely to be frequent exposure or close contact. For individuals already exposed to the virus, the WHO suggests recommending masks based on risk assessment, while leaving flexibility in their use by countries.[2] The WHO recently issued a clarification note on the recommended use by health care workers of masks in pandemic settings, advising the use of medical masks for health care workers who work within a distance of 1 metre of infected patients.[31]

As with masks, the evidence for hand and hygiene measures is weak, although a study on the SARS outbreak showed some protective effect for washing hands more than 10 times a day and disinfecting a person's living quarters.[32] The WHO, along with approximately half of the countries surveyed, recommends disinfection measures such as hand washing or household disinfection of potentially contaminated surfaces.[2]

Maintenance of essential services

The maintenance of essential services is addressed in fewer than 60% of the plans. Preliminary findings of joint assessment visits conducted by the WHO and the ECDC showed that the state of preparedness is generally limited to the health sector.[13] This includes ensuring that contingency plans are available, that priority groups of essential personnel are identified, and that a clear command structure is in place. It is striking to observe that very few plans provide a definition of what is meant by essential or key personnel. This needs to be addressed.

We suggest that there also needs to be a clear division of roles and responsibilities between the agency (most often the Ministry of Health) leading the response in many plans and the interested parties who are traditionally responsible for civil contingencies, such as the Ministry of Interior. The ease by which the health services and the emergency services work together needs to be addressed, including the implementation of possible plans for protecting health care sites. Undoubtedly, coordination between civil and health responses must be effective, with clear chains of command – clarity of which is largely missing from surveyed plans.

CRITICALLY IMPORTANT GAPS

During the course of our analysis, several issues appeared to be missing from many of the preparedness plans. These gaps will be critical to the effectiveness of the response to pandemic influenza. They are summarised in the table below and described in more detail in the following text.

Topic	Gaps/solution
Links between animal and human surveillance	• Many countries do not mention veterinary services as part of a preparedness plan – there should be coordination between plans that relate to humans and those for animals and birds • Those who work with animals are often not mentioned as separate groups that require special consideration with regard to protective measures, vaccination and preventative treatment • Animals and humans in regions considered high risk for a pandemic (e.g. animal and poultry breeding areas) should have more surveillance than lower risk regions • Attempts should be made to restrict the virus at an early stage, e.g. reduce movement of people from an affected area to an area that is free of the virus • Joint operational outbreak procedures should be developed for animal and health authorities
Cooperation within the EU and between neighbouring countries	• There should be awareness of the plans of neighbouring countries • The plans of neighbouring countries should, where possible, complement each other so that a similar course of action takes place (including the similar approaches to medical intervention)
Central and regional roles and responsibilities	• Sometimes, preparedness plans have been drawn up by the central government of a country and delivered as a 'guide' only to regions within that country. In these cases, there must be a balance between the policies of the central government and those of the region, whilst taking into account any changes that may need to occur within the current health systems in a time of emergency • Testing of local (regional) preparedness plans needs to take place in order to ensure the smooth running of such plans • There should be clear lines of responsibility between local and central agencies involved in the preparedness plan
Prioritising laboratory testing capacities	• Many countries should measure their anticipated needs in terms of laboratory supplies and staffing so that they have a better idea of priorities for testing during the different phases of the pandemic

Topic	Gaps/solution
Surveillance indicators	• Plans need to include clear guidance on surveillance and monitoring as the pandemic progresses, including potentially discontinuing part of the surveillance system and concentrating on key indicators such as antiviral testing or health care response system response
Storage and distribution of antiviral drugs	• Distribution of antivirals will prove particularly challenging during a pandemic, but made easier by including detailed distribution procedures into the preparedness plans • Countries will need to monitor both the use and stocks of antiviral drugs in order to prepare for subsequent pandemic waves • No plans describe the processes by which individuals belonging to priority groups will be identified, and none describe ways of ensuring that these patients actually receive medication and take the dose as planned. There is a need to clearly define the process by which persons are assigned to different priority groups and to refine these as the pandemic progresses • It needs to be clear which priority groups should receive preventative (prophylaxis) medicine and which should only be given treatment once they have potentially been exposed to the virus
Vaccine strategies	• Many countries acknowledge the difficulty in obtaining sufficient quantities of a pandemic vaccine and ensuring that the vaccine is effective, but many preparedness plans do not offer a solution • Plans recommend that the whole population or priority groups only should be vaccinated; however, they fail to specify the amount of vaccine required and the numbers of people involved
Triage policy (classifying patients into priority groups based on their needs and best place of treatment)	• A few plans describe in general terms the method they will use to classify patients, while many leave the planning of triage for later phases of the pandemic. Triage priorities need to be clearly organised to avoid ethical issues as well as possible inefficiencies in the response to the pandemic
Impact on the health care system	• Health care facilities need plans that specify clinical management, infection control, human resources management, admission criteria and provision of necessary medical supplies. • Involvement of primary care in the preparedness effort needs to be secured through relevant and timely awareness campaigns • Countries with national insurance systems may need to formalise arrangements with health insurance providers in order to address issues of financial coverage for vaccination and antiviral medications

Topic	Gaps/solution
Non medical public health interventions	• Few plans address the issue of early containment of the epidemic through non-medical interventions and may not be beneficial in the later phases of the pandemic • Although voluntary confinement was mentioned by a few countries, how patients confined at home would actually receive the necessary care and medication is not explained in all plans • Many countries recommend travel restrictions although these ones are not thought to have a big impact on reducing transmission of the pandemic virus • Many countries advise the use of masks while the WHO recommend it only for health care workers who are a distance of 1 metre from infected patients
Maintenance of essential services	• A significant number of plans do not mention the need to maintain essential services during a pandemic. Preparedness plans need to include contingency plans, a list of priority groups of essential staff, and a clear order of responsibilities and priorities (including chains of command) • There should be a clear division of roles and responsibilities between the agency (most often the Ministry of Health) leading the response and the interested parties who are traditionally responsible for civil contingencies, such as the Ministry of Interior

STUDY LIMITATIONS

There are a number of limitations to our study. The fluidity of the environment means that plans are being drafted and constantly modified. Whilst our survey offers only a snapshot in time, the timeframe we chose means that older plans – which may not have been subjected to the same urgency and pre-dated the WHO and EU initiatives (such as the Hungarian plan) – have been excluded. To subject such plans to the same rigorous scrutiny as those produced more recently, where guidance from international public health agencies could be drawn upon readily, would not – we believe – have been reasonable. Several high-profile initiatives urging the development and publication of preparedness plans have taken place during 2005. For this reason, all data collection ceased at 30 November 2005, allowing a reasonable period for plans to enter the public domain. Clearly, plans from further countries will be published over the coming months and this analysis will facilitate a comparison with those already published.A second limitation of our study concerns the difference between evaluating country plans and determining countries' preparedness for an influenza pandemic. Obviously, the completeness and quality of national preparedness plans may be an important indicator to a country's preparedness, but plans are only one element. Ultimately, the test of a country's preparedness will rest on the effectiveness of their response, and, while a robust plan may support that, many other known and unknown factors will also be critically important. Moreover, the completeness of plans may simply reflect the attention paid to drafting the plan rather than preparedness planning. Some countries may, for instance, have excellent emergency planning procedures that are not adequately reflected in their plans. Robust generic emergency preparedness plans, i.e. those that are not specific for an influenza pandemic, may not have been mentioned in the plans (therefore have not been identified in our study) but would still facilitate an effective response to such an event.

A further limitation is the subjective nature of determinations of completeness and quality. Given the nature of plans, the variations in language and format, any determination of criterion inclusion is, by necessity, somewhat subjective.

In publishing a checklist in 2005, WHO assisted the development of preparedness planning. The development of criteria, drawing on this WHO checklist, may have introduced bias: countries' preparedness plans that also draw from the WHO checklist may have 'scored' more highly because of inclusion of elements not previously considered or made explicit in plans drafted prior to publication of the checklist.

Our analysis of countries' preparedness plans describes, therefore, a partial but important assessment of preparedness. Plans reflect not only strategic and tactical policy choices that are made by governments, but also their ability to involve and coordinate a large range of relevant parties, which may be an important element in the success of the operational response.

We suggest that our analysis be supported by simulation exercises (mathematical and tabletop, perhaps drawing from earlier exercises that used HACCP methods),[33] complemented by interviews with major participating key relevant parties (stakeholders), such that a more profound understanding will emerge to further inform planning.

A further limitation of our study involves the wide variation in social and political conditions within which the different preparedness plans exist. The ability of different health systems to respond to emergencies is likely to vary considerably. An analysis of preparedness plans cannot hope to take into account the diverse situations in which the plans were prepared.

CONCLUSION

Europe has the resources to prepare for pandemic influenza. Governmental commitment in most European countries is high, surveillance and monitoring capacities allied to laboratory capacity are well developed, and public health infrastructure is robust in comparison with other regions in the world.

However, gaps in preparedness planning remain. Considerable variations exist between countries, with important implications for the entire European region and individual nation states. Different national and regional responses, and the failure to reconcile them, could create considerable ethical and political tensions as well as very varied effectiveness in reducing the impact of a pandemic.

Gaps that need to be addressed include planning for the maintenance of essential services, the organisation of the health care system response, the need to ensure that plans are practical, with clear roles and responsibilities for all relevant parties, the need to ensure robust communication systems, and the provision of containment measures such as stockpiling of the necessary medical goods including vaccines and antivirals. We also found a lack of clarity in arrangements for cooperation between sectors such as health and other civil functions, and with veterinary health systems.

Greater cooperation between countries may be needed in order to both share experiences and ensure coherent approaches. European institutions and the WHO have a role to play in supporting cooperative arrangements. The EU has a critical function in protecting its citizens from public health threats. The role of the EU will be essential to ensure improved sharing of knowledge on pandemic response among EU members, to support the effective provision of services, and to coordinate the response at a community level.

ANNEX

WHO phases

Phases	Overarching public health
INTERPANDEMIC PERIOD	
Phase 1 No new influenza virus subtypes have been detected in humans. An influenza virus subtype that has caused human infection may be present in animals. If present in animals, the risk of human infection or disease is considered to be low.	• Strengthen influenza pandemic preparedness at the global, regional, national, and subnational levels.
Phase 2 No new influenza virus subtypes have been detected in humans. However, a circulating animal influenza virus subtype poses a substantial risk of human disease.	• Minimise the risk of transmission to humans; detect and report such transmission rapidly if it occurs.
PANDEMIC ALERT PERIOD	
Phase 3 Human infection(s) with a new subtype, but no human-to-human spread, or at most, rare instances of spread to a close contact.	• Ensure rapid characterisation of the new virus subtype and early detection, notification and response to additional cases.
Phase 4 Small cluster(s) with limited human-to-human transmission but spread is highly localised, suggesting that the virus is not well adapted to humans.	• Contain the new virus within limited locations or delay spread to gain time to implement preparedness measures, including vaccine development.
Phase 5 Larger cluster(s) but human-to-human spread still localised, suggesting that the virus is becoming increasingly better-adapted to humans, but may not yet be fully transmissible (substantial pandemic risk).	• Maximise efforts to contain or delay spread, to possibly avert a pandemic, and to gain time to implement pandemic response measures.
PANDEMIC PERIOD	
Phase 6 Pandemic: increased and sustained transmission in general population. *Past experience suggests that the second wave of illness (and/or subsequent waves) will most probably occur within 3–9 months after the first wave has subsided. The second wave may be of equal intensity or it may be more intense than the first one.*	• Minimise the impact of the pandemic.

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