Evaluation of how pandemic preparedness activities aided the response to influenza A (H1N1) pandemic in 2009. A qualitative analysis in seven countries within the WHO European Region

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Dedication

This thesis is dedicated to

My gorgeous wife Noora,

My beloved son Abdullah,

And my respected parents

Abstract

Background: The 2009 influenza A (H1N1) pandemic was the first pandemic in the era of modern pandemic planning and preparedness. Although the mortality and morbidity caused by the pandemic was low compared with the previous pandemics, it gave the first opportunity for member states to implement an actual pandemic response reflecting on years of pandemic preparedness and planning. The objective of this study was to evaluate the usefulness of pandemic preparedness activities as well as to identify challenges and activities that require further improvement.

Methods: The study was conducted in seven countries within the WHO regional office for Europe; six of them were identified through a stratified random sampling in order to get a representative sample across different levels of preparedness within the WHO European Region. These were Armenia, Bosnia and Herzegovina, Denmark (pilot country for the study), Germany, Portugal, Switzerland and Uzbekistan. Research teams visited each country and interviewed six key stakeholder groups at different administrative levels. These were Ministry of Health (MOH), National Public Health Authority (NPHA), Civil Emergency Response (CER) representatives, Sub-National Government Authority, and primary and secondary healthcare workers (HCWs). Focus group interviews were conducted using open-ended questions in semi-structured interview guides.

Results: Six recurring themes were identified as essential aspects of pandemic planning activities. These were communication, coordination,

capacity building, mutual support, leadership, and flexibility. The following aspects of pandemic planning activities were found to be inadequate and should be improved in the future: risk communication with the public and healthcare workers, coordination of vaccine logistics, flexibility and adaptability of pandemic plans, and surveillance in the secondary healthcare setting.

Conclusions: Stakeholders interviewed reported that the pandemic preparedness activities were worthwhile and appropriate for the response measures carried out during the pandemic influenza (H1N1) in 2009. However, the findings identified areas of under planning that were common to most of the participating countries.

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List of publications

The following articles and presentations arose from this study:

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3. Oral presentation at the fourth European Scientific Working Group on Influenza (ESWI) conference in Malta, September 2011. "Evaluation of how pandemic preparedness helped to deal with H1N1 in the WHO European Region".

4. Moderated poster presentation at the fourth European Public Health conference in Copenhagen, November 2011. Did pandemic preparedness activities aid the response to influenza (H1N1) pandemic in 2009? A qualitative analysis.

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Chapter 1: Introduction

This introductory chapter starts by describing the project rational and objectives. The chapter introduces how influenza A (H1N1) pandemic unfolded in 2009 and highlights the significance of pandemic preparedness and planning. It demonstrates how the researcher became interested in studying pandemic planning and preparedness. As a final point, it presents a brief overview of the eight chapters of this thesis.

1.1 Project rationale and objectives

WHO Regional Office for Europe decided to conduct a service evaluation of how pandemic preparedness activities aided the response to influenza A (H1N1) pandemic in 2009 in countries within the WHO European Region. Understanding how member states' preparedness supported the pandemic response is critical to help identify useful lessons and guide future pandemic preparedness and planning activities. As many challenges and gaps in pandemic preparedness remain, this evaluation will address these issues and further inform WHO Regional Office for Europe activities and WHO guidance on how to best support countries in future pandemic preparedness planning. However, there is a current lack of certainty about which of these activities are relatively the most important; and which ones are less useful to member states for pandemic response, especially in the light of the 2009-2010 pandemic which can act as a 'yardstick' against which earlier pandemic planning activities can be judged.

The aim of this project is to evaluate how pandemic preparedness activities aided the response to the pandemic influenza A/H1N1 in 2009, and identify good practices for future pandemic planning and areas where continued improvement is required. The following specific objectives were targeted:

a) To describe the process of countries' pandemic preparedness at different administrative levels and how it aided the response during the pandemic in 2009.

b) To identify the extent to which the pandemic planning activities proved useful and to highlight areas of under planning where further improvement is needed.

c) To determine how planning activities could have been performed differently in the pre-pandemic period.

1.2 How did influenza A (H1N1) pandemic unfold in 2009?

Mexican public health authorities began to observe a high number of influenza-like illness cases as well as the Mexican medical laboratories started reporting a high number of un-typeable influenza isolates. Around the same time, specialized centres in different cities in Mexico started to report cases of severe acute respiratory infection in healthy young adults. In line with international health regulations, Mexican health officials notified the Pan American Health Organization (PAHO) about the increase in the number of cases of respiratory illness (Centres for Disease Control and Prevention, 2009a).

On April 12, Mexican public health authorities reported an outbreak of acute respiratory illness in the state of Veracruz to the Pan American Health Organization (PAHO). Two days later, the Ministry of Health in Mexico issued a notification to all healthcare workers in the community and hospital for enhanced surveillance in order to notify all cases with severe acute respiratory illness to the public health authorities. Moreover, healthcare professional were asked to collect upper and lower respiratory tract samples from those patients. Subsequently, respiratory samples with un-typeable influenza were sent to laboratories in the USA and Canada for further testing. A novel influenza strain of swine-origin was determined to be the causative agent of the increase number of cases. Based on the clinical features, epidemiology, and laboratory results, a case definition was developed (Centres for Disease Control and Prevention, 2009a).

A suspect case was defined based on the basis of clinical severity to have fever, cough, and shortness of breath. While a probable case has the same case definition as a suspect case but with a laboratory confirmation of influenza A and if it is confirmed by real-time reverse–transcription polymerase chain reaction (rt-PCR) to be of swine-origin influenza A(H1N1) then this is a confirmed case (Córdova-Villalobos, et al., 2009). In March and April, there were 97 cases of laboratory confirmed influenza A/H1N1 cases in Mexico and most of the cases were hospitalized reflecting the importance of the hospital surveillance system (Centres for Disease Control and Prevention, 2009a).

The national public health officials met with the Mexican President and decided to close schools in different parts of the country. International travellers were asked to report their illness in case they develop influenza like illness symptoms. As part of the national response to the pandemic, the Mexican health authorities started a public health campaign to increase public awareness regarding the importance of hand washing, self isolation when sick, respiratory hygiene. In addition, personal protective measures such as facemasks and alcohol sanitizers were made available. Health authorities recommended against mass gatherings in order to reduce the risk of transmission (Córdova-Villalobos, et al., 2009).

In April 2009, the Centres for Disease Control and Prevention confirmed the first two cases of influenza H1N1 in human. The emerging strain was isolated and virologists stated that it is the result of re-assortment between swine flu and human strains. The two cases were found not to be epidemiologically linked and reported no contact with pigs. According to WHO nomenclature system to include the time and place of isolation, the virus was named A/California/7/2009. More cases were reported in the following few days in different states. Public health professionals at the Centres for Disease Control and Prevention in Atlanta worked in collaboration with local stakeholders and conducted an intensive contact tracing process to try to identify the source and the index case as well as to detect secondary transmission in the community. The confirmed cases did not report contact with pigs and the assumption at that time was that an ongoing human-to human transmission

was occurring in the community (Centres for Disease Control and Prevention 2009b).

At the same time, Centres for Disease Control and Prevention tried to develop a candidate vaccine to protect the population against the novel virus. The first step in this process was to identify a virus that can be grown in eggs to produce mass amounts and then to be sent to manufacturers to start making the vaccine (Centres for Disease Control and Prevention 2009b).

Pandemic response measures were triggered by the emergence of this novel influenza virus, and many response activities started in late April 2009. These included enhanced influenza surveillance, vaccine production efforts, strengthening communication and coordination across different stakeholders. More cases were identified in different states in the following days that made the response to be on a national scale. Moreover, cases were identified in different countries and this gave the impression that a human-to-human transmission was ongoing all over the world (McMenamin and Nguyen-Van-Tam, 2013).

It is important to commend the role of Centres for Disease Control and Prevention in communicating with the public and healthcare professional during the pandemic in 2009. The Centres for Disease Control and Prevention organized a number of press conferences to inform and educate the public about the progress of the situation and provided important educational messages. Moreover, the Centres for Disease Control and Prevention published the virus genetic sequence to an online database that can be

accessed by virologist and scientists (Centres for Disease Control and Prevention, 2009b).

Dr. Margaret Chan (The WHO Director General) upon the recommendations from the emergency committee of the IHR declared a Public Health Emergency of International Concern (PHEIC). According to the WHO phases, containment was not practical and WHO phase 4 was announced on April 27, 2009 (WHO, 2009a). Again, the alert was raised to phase 5 two days later when sustained human-to-human transmission was identified in two countries of the same WHO region (WHO, 2009b). As of May 2009, new cases of the novel influenza virus have been identified in Mexico, Canada, and other countries (WHO, 2009c).

After thousands of cases were confirmed in more than 70 countries internationally, the WHO announced Phase 6 and urged international and national communities to finalize their preparedness activities (WHO, 2009d). Afterwards, the number of countries notifying the WHO with new cases continued to increase worldwide and by July 2009 all jurisdictions had experienced at least one infection (WHO, 2009e). By February of 2010, more than 200 counties documented confirmed cases of the novel virus with approximately 18,000 deaths worldwide (WHO, 2010a). WHO director general based on the recommendations by the IHR emergency committee declared the 2009 pandemic over on August 10, 2010. This meant that the world has entered the post-pandemic phase, and during this phase the countries are required to reflect on and revise their influenza preparedness

activities (WHO, 2010b). Despite the fact that WHO has declared a post-pandemic phase, northern hemisphere countries reported high influenza clinical activity during winter of 2010 (WHO, 2011a),

1.3 Pandemic influenza preparedness

Over the past 10 years, the national and international communities have invested considerably in pandemic planning and preparedness and this is mainly due to increase in the awareness of the need of coordinated response to international public health threats, including pandemic influenza (Brown and Hegermann-Lindencrone, 2013). The fact that the UK government has a pandemic preparedness plan on its risk register is a good example (Cabinet Office, 2008). International and supranational organizations such as the World Health Organization (WHO), the European Commission, and the European Centre for Disease Prevention and Control (ECDC) are considering pandemic planning activities a high priority and provide ongoing advice and technical assistance to achieve the highest status of preparedness. Over the past 10 years, these organizations issued a number of publications and recommendations for good practice in pandemic preparedness as well as organized a number of country assessments and workshops (Nicoll, 2010, WHO, 2009f, EU Commission, 2005). Pandemic preparedness activities aim to reduce transmission, mortality and morbidity, maintain business continuity, and reduce the social and economic disruption of a pandemic (WHO and EU Commission, 2005). The process of developing pandemic plans at different levels, testing them in exercises, and continuous revision are also part of these

activities. In addition, translating pandemic plans into actions is one of the most essential features of successful pandemic planning and this can be achieved by implementing these plans at national and local levels at all times (WHO, 2005a). Over the past 10 years, WHO regional office for Europe had provided leadership and supported countries to plan and prepare for pandemic influenza. The office provided advice and technical assistance to member states to prepare and respond to different emerging respiratory pathogen including the SARS outbreak in 2003 and emergence of avian influenza in 1997 and 2003. This was mainly done through ongoing meetings, workshops, country assessments, and country visits.

The WHO Regional office for Europe since 2005 had worked in collaboration with WHO headquarters in Geneva, European Centre for Disease Prevention and Control and the EU commission to support countries' pandemic planning activities through more than 60 country activities (Brown, 2013). All these activities were in line with the implementation of the International Health Regulations (WHO, 2008). The outcomes of these activities were distributed to countries through publication on the WHO Regional Office for Europe Influenza website, on the EuroFlu website, and through peer-reviewed publications (WHO Europe official website, n.d, EuroFlu official website, n.d.).

1.4 How did the researcher choose pandemic influenza preparedness to be his PhD research project?

During influenza A (H1N1) pandemic in 2009, the researcher was actively involved in the emergency response to the pandemic in 2009. He was the

principle epidemiologist and data analyst for the UK influenza clinical information network project (FLU-CIN). The aim of this project was to establish a hospital surveillance network to identify risk factors for severe outcome (hospitalization and mortality) (Nguyen-Van-Tam et al., 2010a, Myles, 2012). This system was not in place before the pandemic in the UK, and the group (Health Protection and Influenza Research Group), the researcher was a member of this group, took the initiative to design and implement this project to help national authorities to make evidence-informed decisions during the response to pandemic. Despite years of pandemic preparedness and planning which made the UK as one of the best prepared countries in the world, establishing this vital system was overlooked.

This brought to the researcher attention the importance of evaluating how countries' pandemic planning before influenza A (H1N1) pandemic in 2009 assisted the response. Late in 2009, the group (Health Protection Research Group at the University of Nottingham) led by the researcher's first supervisor Professor Jonathan Van-Tam was on its way to be recognised as a WHO collaborating centre for pandemic influenza and research. The team was asked to be involved in evaluating how countries planning and preparedness aided the response to influenza A (H1N1) pandemic in 2009.

The researcher is a physician and holds a master's degree in Public Health from the University of Nottingham and worked as an Epidemiologist and Biostatistician for the same University for almost a year before commencing his PhD studies. Influenza epidemiology was his area of research interest and

he was involved in several projects related to influenza vaccine effectiveness, systematic reviews and meta-analyses and teaching outbreak investigation skills. The researcher recognised this project to be a great opportunity to learn more on pandemic preparedness, and to conduct a proper academic training to develop his methodological and analytical skills. This includes qualitative data collection, interview skills, data transcription, coding schemes, data analysis, and reporting and communicating findings.

Initially, the researcher visited the WHO Regional Office for Europe team in Copenhagen several times in the beginning of 2010 and they visited the University of Nottingham too. Both teams used to work in a collaborative way to write study protocol and interview guides.

1.5 Thesis overview

Following this introductory chapter there will be seven chapters:

Chapter two, The basics of influenza, explains the clinical symptoms and signs of influenza and highlights the epidemiological features of both inter-pandemic (seasonal) and pandemic influenza. It describes the virological aspects of influenza and how these facilitate the emergence of novel influenza viruses.

Chapter three, Historical review, reviews major and most devastating infections throughout history and how human responses have evolved over time. It highlights the major influenza pandemics throughout history with a particular emphasis on the pandemics of the twentieth century.

Chapter four, Emergency planning and response, describes the main concepts of generic emergency planning and response management with a particular focus on organizational communication.

Chapter five, Pandemic preparedness activities, describes the main elements and priorities of pandemic planning with a brief description of national and international planning activities.

Chapter six, Methods, describes in details the qualitative and inductive methodology used to conduct this study.

Chapter seven, Findings, describes the results of the study; the major themes emerged from interviews. What pandemic preparedness activities were useful and what is needed to be improved for the future.

Chapter eight: Discussion of the findings, recommendations, and conclusion.

1.6 Summary and conclusion

This introductory chapter gives an overview of the study aims and objectives and highlights the significance of pandemic preparedness activities. It describes how the pandemic influenza A unfolded in 2009 as well as it highlights how the researcher became interested in the topic. The thesis structure were summarised too.

Chapter 2: The basics of influenza

2.1 Introduction

This chapter discusses the basic knowledge regarding influenza the disease and virus. It starts with a detailed description of seasonal and pandemic influenza. It highlights the major differences between seasonal and pandemic influenza as they represent a continuum of the same. Afterwards, a clear description of the clinical features of influenza infection with all possible complications was discussed. In addition, the clinical features of the three pandemics of the twentieth century as well as the pandemic (H1N1) 2009 were explained in details. Next, it describes the basic information about influenza virology and the associated phenomenon of antigenic variation and how they can cause outbreaks and pandemics. The chapter then states the fundamental concepts of seasonal influenza epidemiology and how these features can reverse during a pandemic.

2.2 Inter-pandemic Influenza (seasonal influenza) vs. Pandemic Influenza

Pandemic influenza is a rare and historic event while seasonal influenza occurs annually and causes outbreaks and morbidity on a regular basis. Therefore, it is crucial to study the clinical, epidemiologic, and virologic features of seasonal influenza in order to have an overall understanding of pandemic influenza (Nguyen-Van-Tam, and Hampson 2003). It is not sufficient to study pandemic influenza in isolation of seasonal influenza and this is because they represent a continuum of the same disease. The process

starts by the introduction of a novel pandemic influenza virus to the human population. Subsequently, this strain circulates as a seasonal virus in the following years. This happened during the 1918 pandemic when the influenza A/H1N1 emerged as a novel pandemic strain and subsequently circulated as a seasonal strain from 1920 to 1956 (Zimmer and Burke, 2009). Seasonal influenza is recognised as a major public health concern because of the total annual mortality and morbidity surpasses those caused by pandemic influenza (Molinari et al., 2007).

In comparison to seasonal influenza, pandemic influenza is a global outbreak that has a potential to infect a vast number of people on a wider geographic scale that can cause wider social disruption. It spreads in waves and can have a bigger health impact on the healthy adult population (Morens et al., 2009). Pandemic influenza can cause high morbidity and mortality in the healthy adult population as well as the other vulnerable groups. Therefore; pandemic preparedness and planning is essential to reduce the impact of pandemic influenza on the entire population (Simonsen, et al, 1998).

Epidemiologists and scientists infer from the history of the previous pandemics that mortality and morbidity can be very severe as the first pandemic of the previous century caused around 20 million deaths in 1918 (Nguyen-Van-Tam and Hampson, 2003). Other papers estimated total deaths of the 1918 pandemic to be approximately 40 million (Johnson and Mueller 2002, Patterson and Pyle, 1991) or even as high as 100 million (Johnson and Muller, 2002). In comparison with subsequent pandemics in the twentieth

century, the death toll experienced in 1918 was overwhelming. During the Asian influenza pandemic, there were around 80,000 deaths in the USA and one million worldwide. Hong-Kong influenza pandemic in 1968–1969 pandemic was of similar severity to the Asian pandemic influenza in terms of mortality and morbidity (Potter, 1998).

2.3 Clinical features

Influenza is an acute respiratory communicable disease mostly presented with fever, cough, and sore throat. Other constitutional symptoms include headache, coryza, fatigue, muscle pain, and chills. Less commonly, patients with an influenza infection can develop sputum, hoarseness, dizziness, chest pain, vomiting, diarrhoea, and abdominal discomfort. Influenza illness may last for few days but long-term complication such as fatigue can continue for few weeks (Nicholson et al., 1998). Almost half of influenza patients as confirmed by serology are asymptomatic (Knight, 1973). In healthy adults with no underlying chronic medical illness, influenza is mostly a mild and self-limiting; but it can sometimes result in a severe illness (Nicholson et al., 1998). Secondary bacterial infection represents the most common complication after influenza infection. Bacterial pneumonia is considered the most important cause of death attributed to influenza infection. Pneumococcus is the most common pathogen to complicate influenza infection but this can change depending on the circulating bacteria in the environment in a given season (Nicholson, 1992).

Pandemic influenza virus is unpredictable in terms of virulence or clinical severity, since the three pandemics of the previous century revealed a different level of severity (Webster, 1997, Potter, 1998). However, it can be anticipated that a new virus strain might cause a more severe illness or longer duration compared with seasonal influenza and this is due to lack of immunity in the population affected (Webster, 1997).

The clinical features of pandemic 1918 were similar to seasonal influenza and most of the infected cases experienced fever, cough, and myalgia. The most common complication was bacterial pneumonia. However, a subset of patients ended up having a quite sever haemorrhagic viral pneumonia, The case fatality rate was around 2.5% in the general population but it reached the 4 % in the healthy young adult population. The high virulence of 1918 pandemic virus strain is still an area of controversy and the exact factors are still unknown. Virologists started to believe that the virus was of an avian origin that underwent a genetic mutation and adaptation in the human. This genetic adaptability made the virus transmissible from human to human Taubenberger and Morens, 2010).

The clinical feature of the Asian influenza pandemic was less severe when compared to the 1918 pandemic. Epidemiology was similar to seasonal influenza with high mortality among elderly and young children. In addition to those two groups, pregnant women experienced high mortality and morbidity. The clinical attack rate in elderly was low compared to other age groups and this relative sparing is probably due to prior infection with an

influenza strain of the similar antigenic component. A high rate secondary bacterial pneumonia due to *Staphylococcus aureus* increased the morbidity and mortality during the pandemic. A total of one million deaths was the result of the 1957 pandemic with a case fatality of 0.5%, which is far lower than the previous pandemic (Potter, 2001).

The Hong Kong pandemic that hit the world in 1968 caused one to three million deaths worldwide with a similar case fatality rate when compared to the Asian pandemic (Kilbourne, 2006). We can conclude that the pandemics of the previous century varied in terms of clinical severity on the basis of case fatality rate. This difference in clinical severity can be due the variation in the virologic origin of the novel influenza virus. Therefore, it is not feasible to anticipate the impact of the next pandemic strain (Sellwood, 2009).

Speaking of influenza A (H1N1) pandemic in 2009, most of the cases were mild and self-limiting with highest clinical attack rates documented in the younger age group with a relative sparing of the elderly population. The overall case fatality rate was between 0.0004% and 1.47% with an average rate of 0.5% (Bautista et al., 2010). For symptomatic illness, the case fatality rate varied across countries, it was 0.048% in the USA (Presanis et al, 2009) and 0.026% in the UK (Donaldson et al. 2009). Most of the severe hospitalizations and mortality due to the novel pandemic influenza virus have occurred among children and young adults (Louie et al, 2009).

Clinical features of cases ranged from being vary mild to severe and fatal infections with up to one third of infections had mild symptoms without fever

(Cao et al, 2009). Symptoms were typical including fever, cough, and sore throat. Diarrhoea, vomiting, and nausea were documented in a higher rate compared to seasonal influenza. A number of clinical features were associated with a more severe outcome such as needing intensive care or death; these were shortness of breath, haemoptysis, productive cough, and fever for a long duration, and dehydration (Jain et al., 2009).

2.4 Influenza virology

Influenza virus is a negative-stranded RNA virus that belongs to the family *Orthomyxoviridae* and they are of three different serotypes, A, B and C. Influenza A is the most important one from the public health point of view as it has the ability to infect both human and non-humans hosts. Most clinical cases are caused by influenza A and B while C causes only mild illness (Gatherer, 2009).

Influenza A subtypes can be differentiated based on the immunogenic component of the surface antigens, hemagglutinin (HA) and neuraminidase (NA) which give each type a distinct structure that can be detected by serological tests. In the past, the classification was based only on HA component but recently NA was discovered and added more practicality in the classification of the influenza virus. There are now 16 HA and 9 NA for influenza A virus (Mueller et al., 2010). The WHO to name a give strain is using surface antigens along with the geographic location, the year of isolation, and strain number (Chanock et al., 1972).

Influenza virus as an RNA virus is genetically unstable and develops genetic errors during viral replication. This phenomenon is called antigenic drift and the drifted strains are the main reason behind seasonal influenza outbreaks and epidemics every year (Monto, 2000). These new-drifted strains are seen in the northern and southern hemispheres and this is why the WHO updates the influenza vaccine components twice a year, once per each hemisphere (Carrat and Falahault, 2007).

Antigenic shift is a virologic phenomenon that occurs with influenza A viruses and can result in substantial changes to the genetic component of the virus and subsequently can produce a novel influenza virus (Cox and Subbaro, 2000). The process that can result in antigenic shift is called genetic reassortment that occurs when two subtypes of the influenza virus infect the same host and mixed genetically together to produce a new reassorted virus with mixed genetic segments from the original strains. If one of the original viruses is a strain to which human has no pre-existing immunity, this will result in a novel virus with a potential to cause pandemic (Taubenberger and Morens, 2010).

There is a possibility that the Asian influenza pandemic and the Hong Kong influenza pandemic were a result of antigenic reassortment between two influenza strains that co-infected pigs at that time. Similarly, 2009 pandemic influenza A virus was a result of genetic reassormtent between a human virus of 1918 origins and an avian-origin virus (Garten et al, 2009). On the other hand, the 1918 pandemic virus was completely novel to human and was not

originated from the assortment of pre-existing influenza strains. The origin of this virus is believed to be of an avian source that infected the human and underwent a number of genetic mutations (Taubenberger and Morens, 2010).

2.5 Influenza epidemiology and surveillance

Influenza activity in the temperate regions increases considerably during the winter season and may last for several months (Simonsen, 1999). In tropical and subtropical regions, influenza activity occurs year-around (Simonsen, 1999, Shek and Lee, 2003).

The main function of influenza surveillance networks is to detect the onset of the influenza season by monitoring influenza like illness (ILI) consultation rates, emergency visits, hospitalizations, and deaths. In addition, laboratory surveillance is set up to identify the circulating strains and their sensitivity to antivirals. This is why the WHO created a global surveillance network that consists of the five main WHO collaborating centres in addition to 118 national influenza centres around the world (Kitler et al, 2002)

Most seasonal influenza cases are mild and mostly treated by general practitioners in the community. For this reason, national health authorities all over the world created sentinel surveillance systems to monitor influenza like illness activity and detect outbreaks. In the UK, the Royal College of GPs created a surveillance system that has the capacity to correlate influenza consultation rates with the laboratory confirmed cases. GPs who participate in those sentinel networks report ILI cases weekly as well as they submit nasal and throat swabs for a proportion of cases (Fleming, 1996).

Unfortunately, the influenza surveillance infrastructure is not well developed in many countries and this can have a negative impact on early identification of outbreaks and subsequently impair international health security (Briand et al, 2011). During influenza pandemic, the seasonal influenza networks need to be sustained but there will be an urgent need for real time data to inform decision making and immunisation policies (Nicoll , 2010).

Surveillance systems monitor the increase in the clinical activity to detect any outbreaks as well as to start the annual influenza immunisation programmes. There are many assumptions to this high influenza activity during the winter season, including enhanced viral transmission, low host immunity, and people tend to be close to each other during cold weather (Lipsitch and Viboudb, 2009).

A number of factors can determine the impact of seasonal influenza in terms of mortality and morbidity. These can be divided into host factors, virulence of the circulating virus, and environmental factors. Age and pre-existing comorbidities are considered the most important host factors. The highest clinical attack rate of seasonal influenza is observed in the elderly population, very young children, and patients with co-morbidities. In terms of hospitalizations and deaths, the elderly and people with chronic illness are the most affected groups. Therefore, national influenza programmes target those groups annually to reduce the incidence of influenza infection among them (Nicoll et al., 2008).

This epidemiology can reverse during pandemic influenza as the elderly population might be spared while the younger and healthy adults can observe high mortality and morbidity. During the second wave of the 1918 pandemic, the highest mortality rate was observed among the healthy adult age group <40 while the elderly of 50 years and older experienced lower mortality and morbidity rates (Nguyen-Van-Tam and Hampson, 2003). Similar patterns were observed in 1957–1958, 1968–1969, and 2009-2010 pandemics, but to a far lesser extent. The relative rise in excess mortality was greater among healthy and young adults (Nguyen-Van-Tam and Hampson, 2003, Bautista et al., 2009).

Countries in the southern hemisphere faced a single wave of the pandemic (H1N1) 2009 that lasted for 18 weeks during the winter season from May to September 2009 (Bishop et al, 2009). Countries in the northern hemisphere experienced two distinct waves of the 2009 pandemic. The first wave in the UK, for instance, peaked in mid-July and the second wave peaked in mid-October 2009 after the summer holiday (Health Protection Agency, 2010).

Although WHO declared the post-pandemic phase in August 2010; the UK and other countries experienced an increase in clinical activity of pandemic (H1N1) cases in mid-2010 and late 2010 respectively (Mytton et al, 2012). The first winter after the 2009 pandemic provided crucial information about the new circulating strain and countries in both hemispheres kept their surveillance system vigilant. Although the world has entered the post-

pandemic phase after the WHO declared the pandemic over in August 2010, countries in the southern and northern hemispheres experienced high clinical attack rates in the winter of 2010-2011(Bandaranayake et al, 2011, Orsted et al,, 2013). Therefore, it is not possible to examine the post-pandemic seasonal outbreaks in isolation from the context of the pandemic itself.

Laboratory confirmed influenza cases demonstrated that the highest clinical attack rates were among the young and healthy adults. This was the case in the UK and the highest attack rate was among children 14 years and younger (McLean et al, 2010). However, hospital surveillance data from the UK revealed that morbidity and mortality were highest in patients with underlying illness, pregnancy, and elderly (Nguyen-Van-Tam, et al., 2010a). An estimated figure of 7500 to 44100 deaths was attributed to influenza A (H1N1) virus for the period May to December in the USA (Viboud et al., 2010).

2.6 Conclusion

Influenza is unpredictable in terms of timing, severity and geographical origin. It is of a major public health importance as outbreaks cause severe social and economic disruption together with excess mortality and morbidity. The most significant clinical features are cough, fever and the rapid onset range of other symptoms and complications. High attack rates can be recognised in elderly and too young children but the mortality rate is high among elderly and patients with chronic medical illness; therefore should be targeted by annual influenza vaccination programmes. However, this pattern

may reverse during pandemic as mortality and morbidity of the influenza virus is higher among the younger ager group and patients with comorbidities compared with the elderly population.

Chapter 3: Historical review

3.1 Introduction

Humans have tried to understand the natural course and risk factors affecting patterns of infection and death since the earliest time in the history. Theories have evolved as human knowledge started to try to understand the natural world. This understanding was not progressing in a steady pace; sometimes wrong theories or obscure knowledge has hindered it but good examples and achievements are still there.

Studying the history of pandemic influenza is not possible without referring to the broader history of emerging infectious diseases and how the response to these diseases evolved throughout history; this chapter provides background information on the early history of emerging infectious diseases and the most dramatic events that influenced humanity throughout the past. The second section discusses the factors that facilitate disease emergence and transmission; these can be further classified into demographics and behaviours, environmental, and breakdowns in public health infrastructures. Additionally, the development and the evolution of the response to emerging infections were reviewed with highlighting the most important achievements in terms of diseases prevention and control. Towards the end of the chapter, a historical review particular to pandemic influenza was performed describing the major influenza pandemics and the progress of pandemic preparedness.

3.2 Early History of Infectious diseases

Communicable diseases have been described to cause outbreaks and pandemics since early history. Historians in Egypt and Greece had documented outbreaks of Black Death, tuberculosis, smallpox, and leprosy. The devastating impact caused by those infectious agents led to dramatic threats to society and civil order at that time (Watts, 1999).

3.2.1 The plague of Athens

This epidemic hit Athens in 430-427 BC and was a direct result of the Spartan wars at that time. The war made the people of Athens move inside the city walls in order to defend their city and this resulted in an overcrowded environment, which is thought to be the reason for high mortality and morbidity (Garrett, 1994). There is still an on-going controversy about the causative agent of the plague of Athens. Langmuir and colleagues support a two-agents' theory; these are influenza and staphylococcus (Langmuir et al., 1985). Others believe that Rift Valley Fever virus caused the outbreak (Morens and Chu, 1986). Other researchers think that the agent disappeared (Holladay, 1986). Knowing the particular cause is less relevant to this research than describing how society responded to it.

In terms of the response to this epidemic, Athenian historians reported on the big impact and the social and political disruptions caused by the plague. People were panic and scared and healthy individuals stayed away from sick people and their relatives. Sick people tried to heal themselves by covering their bodies with water or even cutting part of their bodies. All attempts went

in vain and the number of sick people increased despite all the efforts (Nelson and Williams, 2007). We can infer from the history of the plague of Athens that there were no organized preparations and coordinated response and this was mainly due to the lack of understanding around the nature of outbreaks at that time.

3.2.2 The Black Death

Due to the lack of basic knowledge of communicable diseases, communities interpreted outbreaks and pandemics through religious explanations. It was thought to be sort of punishment by God to humans because of their sins and bad doings (Nelson and Williams, 2007).

The Black Death is considered the most damaging infectious disease ever. Since the start of recorded history, it has been recorded that many nations and communities were entirely destructed and disappeared because of the bubonic plague, which is the causative agent of the Black Death (Lee, 2000, Fears, 2004). It contributed to the collapse of the Roman Empire six years after the downfall of the Han Empire (Porter, 2006). In the twelfth century, the disease killed almost 90% of the European population (Lee, 2000). The disease invaded Europe again in the fourteenth century and claimed thousands of lives and then spread to other parts of the world. Commercial ships that used to carry infected mice and fleas mainly facilitated disease transmission. During the next few years, the disease caused more than 20 million deaths in Europe and 16 mission deaths in Asia (Rosen, 1993).

Though there was a lack of knowledge and understanding pertinent to communicable diseases prevention and control, authorities and individuals noticed that the best way to stay healthy was to isolate sick individuals and their families. This practice was the basis of quarantine, which is one of the most commonly, used public health counter measures nowadays. The first city to implement quarantine measures in Europe was Venice in 1374 (Simpson, 2010). This was mainly because it was considered as a central commercial city in Europe receiving ships from different countries. Ships coming from areas infected with the Black Death were isolated for almost 40 days. Authorities in Venice believed that the 40 days wait was enough to detect any infection associated with arriving ships (Tognotti, 2013).

During the following two centuries, the Black Death invaded Europe several times and caused high morbidity and mortality. In 1486, political authorities in Italy created permanent public health authorities in charge of protecting the country against future plague outbreaks. The first measure was to isolate homeless and poor people when sick as they observed the association between the disease and poverty. In addition, designated hospitals were created in 1528 to provide healthcare for sick patients and were supported by taxation (Pullan, 1971).

During the seventeenth century, more preventive measures were implemented to prevent and control the disease. These were isolation of houses with sick people for 22 days as well as quarantining individuals for 40 days. Moreover,

authorities introduced new rules to disinfect houses with perfume and burn all equipment and material used by the deceased individuals (Cipolla, 1973).

3.2.3 Smallpox epidemic

Historians date the first outbreak of smallpox to 1350 BC. Early outbreaks in Ancient Egyptian families were described in the books of history and mainly supported by the scars found on the bodies of mummies (Watts, 1999). Immigration and wars facilitated the spread of the disease across the world and the mortality rate ranged from 10-50 % (Lee, 2000). In the eighteenth century, smallpox caused high fatalities in Europe and quarantine measures were futile in controlling the disease. Two important facts were observed at that time. First, the disease transmitted by close contact to scars and wounds of sick people. Second, infected individuals with smallpox did not catch the infection again (Hopkins, 1983). These observations motivated people to start inoculating healthy individuals who had never been infected in the past with bits removed from smallpox lesion. However, inoculation similar quarantine practices did not succeed to stop the spread of smallpox in the eighteenth century (Nelson and Williams, 2007).

Doctor Edward Jenner, an English physician, observed that the milkmaids during the process of getting milk from cows developed lesions on their palms and this resulted in life-long lasting immunity. Based on his observations, he recommended the used of cowpox particles to protect against smallpox. He was opposed and criticized for his revolutionary ideas and his work was refused many times because it was not based on scientific research.

Despite that, he kept working on his observations and tried his ideas on children including his own and finally in 1798 his work was accepted for publications (Riedel, 2005).

3.2.4 Syphilis outbreak: "The French pox"

In the second half of the fifteenth century, several countries in Europe experienced syphilis outbreaks. Syphilis is a highly contagious sexually transmitted diseases and it was observed in late 1494 when prostitutes from Italy infected the military personnel of the French army. In the following year, syphilis was diagnosed in France, Switzerland and Spain. It was believed that the French soldiers facilitated the transmission of syphilis across Europe (Morens et al., 2008a).

In the sixteenth century, almost all countries in Europe had cases of syphilis. Syphilis got its name from the famous poem written by Fracastoro in 1546 that listed the causes of the disease. The poet was telling the story of a shepherd called Syphilis who was punished by God Apollo because he committed adultery. The association between syphilis and sexual activity helped people to recognise the concept of contagion at that time(Porter, 2006).

3.3 Factors in the emergence of infectious disease

The emergence of infectious diseases occurs when an entirely new microorganism is introduced to human population. Re-emerging diseases are infections known to cause cases in humans but are considerably increasing in numbers. After the new infection is introduced to a new host, it causes

sustainable transmission and outbreaks in the new host group. Many factors can facilitate the emergence and re-emergence of infections and these factors can be categorized into environmental, population movement and human behaviours, and deficiencies in public health infrastructures (Morse, 1995).

3.3.1 Environmental factors

These factors are essential in facilitating disease emergence and subsequent outbreaks. They influence the relationship between microorganisms and human population. They bring people closer to the source of infection (natural reservoir or vector) and subsequently assist the emergence or re-emergence of diseases (Morse, 1996, Morse, 1991). The vector of Lyme disease, for instance, is deer tick. Reforestation activities in North America and Europe made the population move closer to the vector areas (Barbour, 1992). Agriculture is another important environmental factor. Crop mice are the natural reservoir of Hantavirus that is known to cause haemorrhagic fever. During rice harvest seasons, farmers get closer to the mice infected with the virus (Johnson, 1993). Water is another risk factor for emerging infections. Stagnant water serves as a favourable environment for reproduction of insects. Insects act as vectors that transmit diseases to the host population. Stagnant water is mainly found around dams, stored water and after flooding (Monath and Morse, 1993).

Global warming caused by climate changes is another factor affecting disease transmission. High temperature affects vector activity, biology and reproduction cycles. For example, mosquitos tend to be more active at higher

temperature. The incidence of West Nile fever has increased over the past years in a number of countries in Europe; such as Italy and Romania. This is mainly due to climate changes and global warming in particular (Pradier et al, 2012).

3.3.2 Population movement and human behaviours

Population movement played a major role in the emergence and transmission of diseases since the dawn of time as discussed earlier (Morse, 1995). People migration causes more people to move from rural areas to cities. In the beginning of the previous century, 15% of the population around the world lived in towns compared with 50% nowadays. The statistics project that almost two third of the human population will live in cities by 2030. The population density is going to increase considerably in cities and this will make people live in overcrowded housing conditions (Social Development, Population Division, 2002). Immigration for war or trade purposes aided the introduction of new infections to new areas throughout history. A good example on that is the introduction of the Black Death through the silk route from Asia to Europe (Morse, 1995). Also, yellow fever was brought from Africa to Europe through slave trade in the 16th and 17th centuries (Hoeppli, 1963). Cholera is another example of imported cases from India and the Middle East to Europe (Morse, 1995).

We live in a globalized world today and this is mainly due to international travelling that made human movements smoother and faster (Morse, 1995). It was estimated that there were approximately 280 million passengers travelled

by air during the year of 1990. This number was almost doubled in the year of 2000. This high volume of travellers facilitates the transmission of infections across countries (Louria, 2000). In addition to human movement, international trade of vegetables and fruits contribute to disease transmission and food-borne illness (Morse, 1995). It is important to highlight that international travelling is an essential factor to the spread of influenza and other respiratory pathogens. Infected individuals can bring viruses to their home country, or their destination country in a matter of hours. Advances in technology and industry also contributed to disease transmission. Food production industry, for example, uses certain technology to increase food production, but on the expense of the increase in contamination (Morse, 1995). Sexual activity and intravenous drug use are other examples of how human behaviours can contribute to the emergence of infections such as HIV/AIDS in the1980s (Morse, 1995).

3.3.3 Deficiencies in public health infrastructures

Access to safe drinking water and sanitation is an important public health function. Proper sanitation and infection control practices reduce the spread of infections. Therefore, any failure can lead to sever public health consequences and will give the opportunity for infectious diseases to cause outbreaks (Morse, 1995). Cholera is a standing example; its incidence can increase dramatically after any collapse in the public health infrastructure measures (Glass et al., 1992). These challenges are common for low-income countries as well as high-income countries. A problem with water treatment

in Wisconsin had resulted in a water-born outbreak of cryptosporidium with more than 400,000 cases (Centres for Disease Control and Prevention, 1994).

3.4 Development in the understanding of infectious diseases

The concept of contagion may have been recognised since early history as demonstrated by the reference of Hebrew leaders to leprosy in their writings. In the sixteenth century, the idea of contamination got more acceptance as demonstrated by Dr Fracastro's work on syphilis. He reported three methods of disease transmission: direct contact, indirect contact and through air particles (Fracastorius, 1930). These observations were not widely accepted at that time, but light microscopy two centuries later proved Fracastoro's hypotheses (Dobell, 1960).

In the seventeenth century, an English physician, Thomas Sydenham supported the concept of specificity of disease. In his book "Observations of Medicine" he was able to describe and classify different febrile infections. He claimed in his book that each disease has a specific set of symptoms, risk factors and treatment. He documented and described smallpox, pneumonia and rheumatic fever in great details. Thomas Fuller, English physician, again supported the concept of specificity of infections as he argued that plague does not cause measles nor measles can cause smallpox (Spink, 1978).

In the nineteenth century, contagion theories were accepted and proved by the two main scientists of that time Louis Pasteur and Robert Koch. The advances in chemistry, biology and pathology supported their studies. Pasteur's work demonstrated that specific microorganisms cause specific fermentation and

fermentation can be stopped by heating. This is what is known as Pasteurization, which was used later to control infection (Spink, 1978). Similar to the previous scientists and pioneers, Pasteur's work was not accepted for publication because it was thought to be unreliable as no one was able to repeat the experiments.

Robert Koch, a German physician, is considered the father of modern bacteriology. He was able to isolate specific causative agents for anthrax, cholera, and tuberculosis. Moreover, he invented the sterilization technique by dry heat that is now used in infection control practices (Foster, 1970). Both contemporary scientists worked hard in their institutes in Paris and Berlin. They were able to identify specific causative agents for specific diseases.

3.5 Progress in infectious disease planning and response

At the end of the fourteenth century, political authorities in Italy recognised the importance of controlling people's anger and panic during outbreaks of plague. They implemented a number of actions to keep civil order. Their main concern was that less advantage groups in the community might revolute against them because they were unable to escape during times of plague. They attempted to tax rich people who wanted to flee during the outbreaks of the Black Death but this did not work. In the fifteenth century, the awareness of politicians increased and they realized the importance of planning and preparing for outbreaks as well as reducing social disruption. Florentine was the first city in Europe that granted its political magistracy the power to prepare for the next epidemic of plague (Porter, 1999).

Florentine set the first example of outbreak preparedness in Europe at that time. They created a national board to respond to plague epidemics in 1493. They were anticipating that the Black Death might reach their territory from Rome and for this reason they assigned a number of people to monitor and report any sick individual coming from Rome to their city. In addition, they banned public and mass gatherings during times of epidemics. These actions were the basis of public health measures implemented nowadays in the form of travel restrictions and social isolation in order to reduce or delay the transmission of outbreaks. These measures were successful in protecting Florentine and they were the basis for further work on outbreak planning and preparedness. Over the next centuries, other European cities followed the example of the Italian cities and established permanent health committees to manage emerging infections (Porter, 1999).

Political authorities dominated the health boards and physicians were not allowed to be actively involved. Health board main job was to collect information about diseases in the neighbouring countries as well as to guard against imported cases. The power of health boards across Europe grew considerably and they were able to challenge the Church regarding banning religious gatherings to reduce disease transmission (Cipolla, 1973). National authorities supported the board of health whenever they disagreed with the religious authorities. This political commitment to prevent and control infections as well as to reduce the social and economic burden of epidemics was crucial to the work of the health officials at that time. In terms of

funding, health authorities were funded by emergency taxation, which was an area of controversy at that time (Porter, 1999).

Health boards were also responsible for early detection and monitoring of outbreaks. In Florentine, health officials asked all physicians and surgeons to be careful and notify probable cases to the health board. It was believed that the information provided by physicians working in the community and the appointed guards outside cities was important for the health committee to prepare for potential outbreaks in advance (Porter, 1999).

During the eighteenth century, the science of epidemiology was introduced to inform public health practice. Scientists described risk factors, methods of transmission, outbreaks and conducted epidemiologic studies (Nelson and Williams, 2007). John Snow, for instance, conducted an epidemiological study to find out the ways of transmission of cholera in mid-1850 in London (Snow, 1936).

By the beginning of the twentieth century and before the First World War, political authorities supported national and local tiers in their efforts to prepare and mange disease outbreaks (Tomes, 2010). The pandemic influenza in 1918-1919 claimed millions of lives and in order to have a comprehensive understanding about what happened during that time, it is important to refer to the previous pandemic to examine the progress of communicable disease control. Pandemic influenza spread from Russia in 1889 and despite all the progress made in public health knowledge and practice, health authorities were confused about it as demonstrated in the media report by the New York

Times “ the disease is undoubtedly due to some microorganism which floats in the air, and which infects the human system, but is generally killed in so doing, for influenza is but slightly if at all contagious.” (Anon., 1889).

Despite the fact that national and local health officials were anticipating the pandemic to reach the states in few months, they did not do much preparedness and it was left for frontline healthcare workers to manage individual cases rather than applying prevention and control measures. Doctors educated sick people to isolate themselves and advised elderly with underlying illness not to mix with sick individuals (Tomes, 2010).

In the following years, medical microbiology evolved in a steady pace and laboratory techniques were able to isolate causative agents repressible for specific infections, including cholera, syphilis, and anthrax. On the other hand, the science of virology during 1918 pandemic was exploring particles smaller than bacteria, but it was very early to isolate them. Public health officials responded to 1918 influenza pandemic with greater knowledge and understanding when compared to the previous pandemic. Specific messages were implemented such as public education about the importance of hand washing and self-isolation when sick. In addition, infection control measures were widely implemented at that time (Tomes, 1999).

3.6 International efforts to control communicable and infectious diseases

National governments and health authorities started preparing to respond to outbreaks in the fifteenth century when quarantine and public health measures were implemented in Italy. However, international efforts and coordination to

prevent and control communicable disease outbreaks did not start until a more comprehensive understanding and knowledge were acquired regarding the causative microorganisms and modes of disease transmission (Spink, 1978).

Cholera epidemics in the nineteenth century stimulated the international and national authorities to work collectively to stop its spread. Several international meetings were organized by the French authorities to discuss measures and activities to prevent and control cholera outbreaks at that time. During the second half of the nineteenth century, there were eleven international meetings attended by representatives from US and Europe. These meetings were held in Paris, Constantinople, Vienna, Washington DC, Rome, Dresden and Venice. Cholera was on the top of the Agenda in all of the conferences but other diseases were discussed too. Countries made great progress in terms of international public health until the start of the First World War Century. Only three international conferences were held in the first half of the twentieth century and all were in Paris (Spink, 1978).

The first international regulation on public health was signed in the seventh conference in Venice 1892. One year before the eleventh international conference in 1902, American representatives met in Mexico and created the first Pan American health body and named it “International Sanitary Bureau” and later it was called “Pan American Sanitary Bureau”. There was a consensus on the importance of establishing a permanent international health body at that time and subsequently The Office International d'Hygiène Publique (OIHP) was created five years later in 1907. The last international

health meeting before the war was held in Paris in 1911.The first sanitary meeting after the war was in Paris fifteen years later. The next international conference in 1938 was important because of the achievements in the field of bacteriology and virology (Howard-Jones, 1975).

OIHP worked closely with the Health Organization of the League of Nations and provided support to countries mainly during the war. The office provided advice to countries on a variety of health topics, including notification of infectious disease outbreaks sanitary concerns mainly related to air travel, and other public health issues (Spink, 1978).

Towards the end of the Second World War, several countries signed an agreement in Washington DC to create the United Nation Relief and Rehabilitation Administration (UN-RRA). The mandate of this new body was "*to provide for the liberated population aid and relief from their suffering, food, clothing, and shelter, aid in the prevention of pestilence and in the recovery in the health of people, and for preparations and arrangements for the return of prisoners and exiles to their homes, and for assistance in the resumption of the urgently needed agricultural and industrial production and the restoration of essential services"* (Goodman, 1971). In 1940s, there was a consensus in the international community on the need of an international health organization to extend the work of the League of Nations. The United Nations treaty was signed and the UN was established in 1945 but health issues were overlooked at that time. The delegates from China and Brazil spotted this gap and recommended a health department within the UN. Three

years later the World Health Organization was established on September 1, 1948 (Goodman, 1971).

WHO provides advice and technical assistance to both member and non-member countries. This means that countries should put effort and expertise to fix problems before seeking WHO input. WHO provided countries with training opportunities, workshops, and country assessments. WHO supports member states during planning and response to pandemics and outbreaks via collecting data from the affected countries, analyse and communicate back to member states through technical guidelines and recommendations for good practice.

Communicable disease prevention and control was one of the biggest areas for WHO since its establishment. WHO worked on a number of communicable disease including cholera, yellow fever, bubonic plague, and typhus but smallpox remained the most difficult disease to prevent and control at that time. Smallpox eradication was one of the most successful achievements by the WHO. In 1968, the disease was endemic in three regions including African countries to the south of the Sahara, Latin America, and a number of Asian countries. Immunisation and education campaigns continued until 1980 when the world was announced to be free of smallpox (Spink, 1978).

The European Centre for Disease Control and Prevention was created in 2005 to enhance Europe's capacity to plan and respond to outbreaks of infectious diseases. It works in collaboration with WHO Europe in areas of surveillance,

capacity building, communication and research. Moreover, it provides data and information to the EU commission, member states, and other agencies to help them make informed decisions in relation to communicable disease control and prevention.

3.7 Pandemic influenza preparedness: Historical review

Pandemic influenza is a historic event and analysing the history will help us understand the nature of this phenomenon as well as to take lessons for future pandemics. The recurrent pattern of influenza and our inability to predict its severity and epidemiology make reviewing influenza history a useful exercise. Most of the facts that we know about pandemics influenza are derived from history. We now know that pandemics can vary in severity, geographic origin, virologic strains, epidemiologic features, and finally pandemics tend to occur in waves.

Laboratory confirmed influenza was diagnosed for the first time in 1932. The history of influenza before that time was mainly based on clinical features, disease distribution, and the high case fatality rate. Historians interested in pandemic influenza reviewed literature, recordings, and writings that are pertinent to this disease in order to get a better understanding (Potter, 1998).

3.7.1 Pandemics before the eighteenth century

Influenza was recognised in the history of infectious diseases as a different infection based on its distinct features of acute onset of fever, cough, headache and generalised fatigue as well on its epidemiologic feature as it caused a high number of cases within unexpected periods of times and wider

geographic areas (Morens et al, 2010). All authors agree that the first pandemic in history was that of 1580. It was originated in Asia and spread to the rest of the world. The whole of Europe got infected in few months and spread then to North America. Morbidity and mortality rates were high and 8000 deaths were reported in Rome (Pyle, 1986).

3.7.2 Pandemics of the eighteenth and nineteenth centuries

The first pandemic of the eighteenth century started in 1729 in Russia. It spread to Europe in few months and reached the whole world in three years period. It spread in waves and caused a high number of deaths (Pyle, 1986). The subsequent pandemic started in China 40 years later. It spread to Russia and Europe in 8 months. It caused high attack rate among young healthy adults and it was documented that two-thirds of Rome was infected and thousands of people got sick daily in Russia. The first pandemic of the nineteenth century had an attack rate identical to that of the pandemic of 1918. Patterson reported that 20-25% of the global population got infected (Patterson, 1986). The advances in the field of epidemiology and public health in the nineteenth century enhanced the understanding of pandemic influenza. Epidemiologists were able to calculate clinical attack rates, case fatality rates age-specific incidence rates (Morens et al, 2010).

3.7.3 History of pandemics of the twentieth century

In the twentieth century population movement and international travel contributed to the global spread of communicable diseases, including pandemic influenza (Potter, 2001).

3.7.3.1 1918–1919 Spanish influenza A/H1N1

The pandemic of the 1918 is considered the most devastating event in the previous century. There is no consensus among historians or scientists about its geographic origin. It began at the end of the First World War during the spring of 1918 and killed far more people than the war itself. The pandemic has been named the Spanish flu because influenza news and updates came mainly from Spain since it was neutral during the war compared to the other countries (Trilla et al, 2008). Influenza A (H1N1) pandemic produced more severe clinical symptoms and signs than the later pandemics of the same century for reasons that are not yet understood. The pandemic caused high morbidity and mortality in the healthy and young age group with a relative sparing of the elderly population (Sellwood, 2009). It is described in the books of history that pandemic spread from the US to Europe and Asia carried by the military crops after the First World War. It is believed that the virus originated in military camps in the USA (Morens and Fauci, 2007, Crosby, 2003). Oxford argued that the pandemic of 1918 circulated few years before 1918. He stated that the pandemic had caused several outbreaks in Europe in 1916 and 1917 (Oxford, 2000). The second wave of the pandemic happened in the fall of the same year and caused several outbreaks of severe influenza all over the world. This was followed by another wave in the northern hemisphere in 1919 (Potter, 2001).

The response of the international community and national authorities was mainly based on measures that were used in the past to control other

communicable diseases. There was no coordinated or organized advance planning. Organizational communication and coordination between different stakeholders involved in response were not addressed before the pandemic. Public health countermeasures were used to control the spread of virus, including school closure, banning public and mass gatherings, and public education on hand washing (Tomes, 2010).

Influenza vaccination is considered the most effective intervention to prevent and control influenza; especially when the influenza vaccine strain matches the circulating virus strain. It is worth mentioning that influenza immunisation became available in 1945 after the successful isolation of the virus in 1930s. Therefore, it was not possible to implement mass immunisation at that time. The Americans during the Second World War used inactivated influenza vaccine, but it did not succeed to reduce influenza outbreaks (Hollenbeck, 2009).

The responsibility was given to physicians to deal with individual cases and treat them symptomatically using traditional preparations such as aspirin, camphor, or wet packs. Although these measures helped patients but it did harm sometimes. In the USA and UK, health authorities dealt with the high number of patients by social distancing, school closures, or banning mass gatherings It can be concluded that there was no coordinated and organized response at the national and local levels. The public did not receive evident information and was given some basic instructions such as rest, hand hygiene and self-isolation when sick (Hollenbeck, 2009).

3.7.3.2 1957–1958 Asian Influenza A/H2N2

This pandemic started in southern China in 1957 and then spread to other Asian countries and to the whole world. A new virus strain H2N2 shifted the previous one that circulated since the previous pandemic. The first wave of the pandemic peaked in the UK and USA during the fall of 1957 and then was followed by a second wave of high clinical attack rate in the following year (Pyle, 1986).

This pandemic was unique in that it was the first pandemic with available vaccine and diagnostic laboratory techniques. After virologists were able to isolate the virus, attempts to manufacture the first pandemic influenza vaccine started. Few years later, it was reported in an international conference that more vaccine was needed to elicit the immune response against the novel virus. It was concluded that two doses of the vaccine separated by one month produced higher immunity than a single dose (Henderson et al., 2009).

3.7.3.3 1968 Hong Kong Influenza A/H3N2

This pandemic emerged in Hong Kong in July 1968 and subsequently spread to Europe and the USA. In the USA, the virus caused high impact on healthcare facilities with excess death and hospitalization during the winter season. American soldiers returning home from Vietnam contributed to the importation of the disease to the USA. The estimated number of death ranged between one to three million deaths globally with an average case fatality rate of approximately 0.5% (Viboud et al., 2005). Hong Kong was the hub for international travel to Asia and this played a role in the global spread of the

disease in less than two years. Vaccination programmes during the pandemic of 1968 in the USA faced logistics and practical challenges in relation to procurement, production, distribution and delivery. In the USA, only 15 million doses were available to distribution at the peak of the pandemic compared to 50 million doses during the previous pandemic in 1957 (Flahault and Zylberman, 2010).

3.7.3.4 1976-1977 Influenza H1N1 Swine Flu pandemic

A localized outbreak of Influenza A happened in a military base in New Jersey in 1976. It caused 230 infections and one death among the armed forces personnel. The causative virus was isolated and identified to be influenza (A/H1N1/NewJersey/76). This strain shifted the previous strain H3N2 that circulated since the previous pandemic. Therefore, the US health authorities expected this to cause the fourth pandemic in the twentieth century. A mass vaccination campaigns were implemented to contain the outbreak and more than 40 million people were vaccinated. The campaign was discontinued because of the concerns regarding vaccine safety with several reports of Guillain Barre Syndrome reported among vaccinees (Dowdle, 1997). The virus could not spread outside the military base and this was unprecedented behaviour of influenza outbreaks. It is either the US health authorities were successful in containing the outbreak at its source or the virus transmission could not be sustained outside the military camp. Surprisingly, influenza A/H1N1 strain did not replace the A/H3N2 and they co-circulated in the following seasons. This is why the trivalent influenza

vaccine nowadays contains both strains as well as influenza B strain (Sencer, 2011).

This brings to the attention to "what is the real definition of a pandemic"; would it be considered pandemic if it caused a great panic and was too severe? Or we can call it pandemic when it spreads across wide geographic area. This controversy around the definition of a pandemic caused some confusion among stakeholders. WHO defined pandemic according to its global spread (phases) and ignored the issue of severity. This definition can have a profound impact on pandemic planning activities and how to use different set of scenarios to plan for future pandemic.

3.8 Conclusion

Emerging and re-emerging of infectious diseases are the greatest threat facing mankind. They have shaped the course of human history and have caused considerable misery and death throughout history. The Black Death and the 1918-1920 pandemic influenza were the most devastating events in the medical history; each of which killed 50 million people. Specific factors facilitating their emergence and spread can be demonstrated in almost all cases. In addition to these factors, the evolution of viral and microbial and selection for drug resistance suggests that infections will continue to emerge and highlight the importance for effective disease control and prevention strategies. Disease prevention and control strategies have evolved from very basic measures such as quarantine and inoculation to include more advance techniques such as surveillance and vaccination. Pandemic influenza remains

one of the most challenging emerging infectious diseases. The main problem with pandemic influenza is its unpredictability in terms of timing, severity and origin. Therefore, enormous efforts are required in regards to pandemic preparedness and planning.

Chapter 4: Emergency planning and response management

4.1 Introduction

The aim of this chapter is to review the literature pertinent to emergency planning and response management. It starts by describing the differences between emergency plans and emergency planning. Then it moves to highlight the two main objectives of emergency planning; risk assessment and risk reduction. Moreover, this chapter defines four guidelines relevant to emergency planning: flexibility, coordination, training, and dynamicity. Subsequently, the concepts of collaboration, cognition, coordination, and communications were explored in the context of emergency response management.

In the second part of this chapter, a comprehensive review relevant to organizational communication was undertaken since communication was an essential pandemic planning action to our evaluation of how internal communication within the healthcare system helped the response to the influenza A (H1N1) pandemic in 2009. It describes the basics of organizational communication and their role in attaining a well-organized communication process. Finally, the directionality of communication and communication networks were described in details.

4.2 Emergency planning

Emergency planning is defined as the readiness of a governmental authority to respond effectively to natural and technical disasters in a way that mitigates their consequences. This state of readiness can be achieved through

a dynamic planning process supported by the essential financial and human resources (Gillespie and Colignon, 1993). Written documents provide a comprehensive strategy on the different planning activities including plans development, revision, exercising and translating those activities into action. It is a common mistake among emergency planning officials to make emergency planning equivalent to written documents and consider having a written document is the final outcome of the emergency preparedness process. Written plans and guidelines are required to avoid chaos during response; planning is a dynamic process. A written plan does not mean a jurisdiction is well prepared because preparedness is dynamic and reliant upon on-going processes (Perry and Lindell, 2003).

4.3 Emergency planning objectives

No emergency planning effort can predict everything that will happen when emergency strikes, but good plans can at least assess major problems expected and attempt to devise solutions to reduce their impact. Future threats cannot be completely anticipated in terms of their timing, severity, and geographical spread. Thus, it is impossible to plan for every aspect of the response, and flexibility is an absolute necessity (Perry and Lindell, 2003).

Preparedness starts from a process when an authority assesses its vulnerability to all possible technical and environmental threats, ascertains personnel together with financial resources available to respond and manage these emergencies, and plans the coordinated response by identifying the command and control structures. Since capacity, scientific information, and

organizational structures are not constant, emergency planning and preparedness activities should be an active process (Buckle et al., 2000). Emergency planning is driven by two main concepts; these are risk assessment and risk reduction. Risk assessment entails the likelihood and impact of a potential emergency. Emergency planners revise hazards and threats that previously affected the population as well as identifying and detecting new potential threats. Collaboration among government departments at local and higher administrative levels can aid in identifying and monitoring these threats. Risk reduction involves activities essential to reduce the perceived degree of threat and to implement measures necessary for this particular purpose (Perry and Lindell, 2003).

Expertise and financial resources are important to shape the level of emergency preparedness. These resources may differ significantly across countries. It is mainly the responsibility of the national authorities to distribute guidelines and recommendations to sub-national authorities to attain an equal degree of preparedness. It is worth mentioning that emergency planning can be an organised process with roles and responsibilities specified for all stakeholders involved in the planning stage, or it can be quite informal with poor organizational functions (Dynes, 2005). Similarly, the product of planning is either signed off documents or mostly unwritten procedures and tasks. Size, economy and development of a given country can affect the organization and complexity of the emergency preparedness process. Countries with more advanced planning activities tend to have inter-

departmental organizational structure that is supported by financial and human resources. They often produce written and published guidelines and protocols. On the other hand, countries with less advanced emergency planning structure tend to produce less written official documents and depend mainly on informal communication among their stakeholders (Perry and Lindell, 2003).

4.4 Guidelines for emergency planning

4.4.1 Flexibility

It is not possible to plan for every single aspect in relation to future emergency response since emergency can result in a rapidly changing environment (Frosdick, 1997). Response flexibility should be incorporated into the planning process and this will make the response more adaptable to the severity of the emergency. The planning process must come up with different scenarios to account for the dynamic and changing environment of the disaster. Each scenario may have the basic principles and activities without stressing on the small issues and operational details that can render the plan inflexible. These operational details can be attached as appendices in the actual plan or in the standard operating procedures of the organization (Perry and Lindell, 2003).

4.4.2 Coordination

Managing emergency response activities has become intra-organizational within the same department as well as inter-organizational with the other stakeholders involved in the planning process and has long been known as an

important factor for the success of emergency response operations (Perry, 1991). To accomplish coordinated emergency response organisations need to be familiar with one another's responsibilities and structures, communication system, and the ways of allocation funds for the emergency planning and response (Shelton and Sifers, 1994).

The most effective way to create a well-coordinated organization structure is the planning process itself. This can be achieved through two approaches to achieve this during the planning phase. These are careful review and critique of emergency plans and throughout exercises and tests at the different administrative levels (Shapiro, 1995). It is beneficial to get the written documents reviewed and assessed even before the actual exercises. Operational challenges and communication problems can be then identified during exercises. Repeated exercises will certainly help agencies and governments to plan effective coordination strategies. Exercises should be viewed as an opportunity to assess the operational parts of the plan, and stakeholder should be open to change the plan accordingly. Moreover, exercises can also create opportunities for responding organisations to meet and discuss with each other as well as to allow individual stakeholders to communicate with one another (Ford and Schmidt, 2000).

4.4.3 Training and education

Emergency planning process has various participants and different groups are engaged in implementing emergency plans. Therefore, the requirements of the plan need to be illustrated and clarified for administrators and personnel

of those departments. In addition, organizations responsible for emergency planning need to educate and update the public in regards to emergency preparedness in order to engage the public (Perry and Lindell, 2003). Thus, training and education aspects of emergency plans have at two target groups. First group is the stakeholders and officials with no prior role or experience in emergency preparedness and the process of sharing the plan and information with this group is called risk communication. The second group is already involved with emergency planning and such training is provided by specialists in this field and can be labelled as formal training and its main focus is on technical guidelines. In summary, training is a fundamental part of emergency planning that can aid to achieve a more comprehensive and successful response measures. Moreover, training can provide a feedback channel to ask questions and raise concerns in regards to the planning process itself (Perry and Lindell, 2003).

4.4.4 Dynamicity

Emergency planning is an on going activity that requires a steady effort to assess risk and enhance response measures. Dynamicity is an essential element in the emergency preparedness process. Planning is a dynamic cycle of developing, exercising, and revising emergency plans. It is essential to accommodate any changes in the organizational structure, scientific evidence, new technologies and communication systems. Previous emergency responses as well as training and exercising plans are believed to be the major derives for plan revision and improvement (Tierney et al., 2001).

Inappropriately, this point is often not recognised by emergency planners. There is a misconception regarding emergency planning to be seen as written documents rather than a process (Wenger et al., 1985). Written guidelines are essential to document technical definitions, command structures, and risk assessment tools but emergency planning include features that are not possible to be written on papers. These consist of enhancing stakeholders' understanding and knowledge on emergencies, improving their familiarity with government organizations and resources, and creating contacts across different agencies (Quarantelli, 1976). Moreover, changes in the characteristics of the threat and population at risk make updating the plan regularly an important requirement during the planning process.

Emergency plan should clearly distinguish the difference between the function of the planning and preparedness on one hand and the response requirements on the other hand (Stallings and Quarantelli, 1985).

4.5 Emergency response management

4.5.1 Collaboration

In the last decades, the concept of emergency management had changed from the authoritarian and rigid framework to adopt a leadership model focusing on open communication and broad collaboration. It has been acknowledged in the literature that emergency response and management is unique in the sense of being dynamic and multifaceted activity in comparison to the traditional approach when dealing with stable conditions (Axelrod and Cohen 1999). Emergency manager should be capable of communicating and coordinating

successfully with other stakeholders involved in the response process (Drabek, 1987). Organizations have different roles in dealing with emergency threats. It is an essential task to develop and keep the necessary partnerships when responding to disasters. Frequent meetings and information exchange during planning and training exercises can help to build that capacity.

4.5.2 Cognition

Creating a common knowledge among stakeholders involved in the response activities is fundamental for clear, accurate, and timely communication and coordination among stakeholders. This can be accomplished by improving stakeholders' knowledge across different departments at different administrative levels through sharing experience and information throughout meetings and interactions (Comfort, 2007). Communication and coordination process can be seamless and effortless when this cognition develops across different stakeholders (Simon, 1996).

4.5.3 Coordination

Articles on emergency response coordination are scarce and it is not studied thoroughly in the emergency management literature (Chen et al., 2008). Coordinating emergency activities is an essential element to achieve an effective response. The coordination of emergency response is a challenging duty as it involves situations with high degree of uncertainty, necessity for rapid decision-making, sudden and unexpected events with high mortality, and time and resource constraints. This is even complicated by factors such as organizational interdependencies, multi-level authorities, and the high

demand for timely information (Comfort, 2007). All these factors can make coordination of response management quite a challenging task.

4.5.4 Communication

Internal communication within organizations is one of the essential features during emergency planning and response. It includes constant exchange of information. During the planning phase, the communication system is prepared to exchange information and messages at a certain limit. However, during emergency response, an information overload can result from the surge in the number of staff using the communication system, which can result in communication delays or even system breakdowns (Quarantelli, 1986, Quarantelli, 1992).

Not only internal communication can face difficulties during emergency response management. Inter-organizational communication system can also be challenged during emergency response. This is mainly because of its informal nature since officials often communicate with persons with whom they are familiar in normal situation. New list of contacts must be established and kept with new persons who occupy positions of authority within organizations where there had previously been no contact. Given the pressures of the disaster situation, this is often difficult to accomplish. Therefore, a more formal inter-organizational communication is required to be established and maintained during the planning process and not invented during the response (Granot, 1997).

It is obvious that organizations might have some issues in regards to communication that can affect the degree of collaboration and coordination between stakeholders. Therefore, the researcher is going to examine the available literature pertinent to organizational communication to explore the role of communication in creating shared vision and coordinated actions in organizations.

4.6 Organizational communication

Communication within organizations has grown considerably over the past decades as organizations have become more complex and hierarchal. The study of organizational communication became a priority area in several academic disciplines in order to respond to different needs around this area. Communication is a diverse topic since it can occur at different administrative levels, different formats, and different directions (Baker, 2002).

Originations nowadays have increased in size and responsibilities in comparison to the previous century and this has resulted in a more formal top-down communication (Conrad and Poole, 2011).

Some researchers see organizational communication as one element of an organization while others see it as the foundation of modern organizations (Drenth, 2001). Other researchers define it as “the central binding force that permits coordination among people and thus allows for organized behaviour” (Myers and Myers, 1982). Richmond and colleagues define organizational communication as “the process by which individuals stimulate meaning in the minds of other individuals, by means of verbal and nonverbal messages in the

context of a formal organisation". This means that it is an active and dynamic process. The word stimulate refers to the idea that by interaction with people we develop new information and experiences (Richmond et al., 2005).

4.7 Basics of organizational communication

4.7.1 Organizational communication as a process

The process of organizational communications is the set of interactions that happen within a given organization internally as well externally with the other organizations. These interactions can help to develop organizational strategies, organizational culture, and decision-making process. The process includes internal interaction between individuals on day-to-day basis as well as a wider communication with external clients or the public (Shockley-Zalabak, 2011).

4.7.2 Organizational communication as people

Organizational communication occurs between people who share work responsibilities in groups or teams as well as inter-personal relationships. Individuals are the basic unit of organizations and therefore personal attributes and characteristics can shape the style of organizational communication (Miller, 2011).

4.7.3 Organizational communication as messages

Messages are set of information created and exchanged between individuals in an organization. These messages can be verbal or non-verbal interactions that aid the distribution of information throughout organizations through

different communication channels. Communication as a result of technology is reaching wider geographic area connecting people in remote areas. Internet and advanced technologies now link people via audio and videoconference and shaped how organizations communicate (Shockley-Zalabak, 2011).

4.8 Organizational structure

Organizations are designed in hierarchical layers with each level has higher power and authority than the level immediately below. Information and commands flow across different hierarchical levels is called chain of commands. Organizational structure together with the chains of command ensure that staff stay on track, abide by protocols and regulations, and flow instructions from higher levels (Eunson, 2012).

4.9 Communication flows

There are various directions for communication flow within organizations. This can include vertical communication both upward and downward communication between administrative tiers with different degrees of authority and power. It can take the horizontal direction between stakeholders at the same or equal authority.

4.9.1 Vertical communication

This type of communication flow takes place between employees at different administrative levels (i.e. hierarchically positioned) and can involve both upward and downward communication exchange. This type of communication is more common and studied more often in the literature than

upward communication. It is useful disseminate information from the tier with higher authority and power down to people who are considered subordinates. These messages include instructions, reminders, notifications, updates, policy statements, recommendations, or technical reports (Eunson, 2012).

Upward communication carries information, suggestions, feedback from the bottom of the organization up to the managers and leaders. Feedback can include new ideas, solution to problems, or suggestions since people in the frontline level are closer to particular issues than people higher in hierarchy. They can come up with practical solutions that can benefit the entire organization when managers listen effectively to them (Eunson, 2012).

4.9.2 Lateral Communication

Literature on lateral communication is still evolving compared to vertical communication. It refers to communication between persons in the same hierarchical level.

There are new organizations trying to flatten their structure and hence the importance of this kind of communication. Lateral communication between individuals in different organizations is a challenging function since the communication is going to be operating at the same time rather then following the organization order (Baker, 2002).

4.10 Communication network

Two styles of communication can be present within an organization; these are formal and informal networks (Baker, 2002). Formal communication is the style that follows the organization hierarchical structure and the normal communication channels. On the other hand, informal communication does not follow the chain of command but instead it follows rumours and gossip. The latter is widely spread across organizations and sometime is more effective and faster than the formal networks.

Managers have more control over the formal communication style while staff has more control on the informal channels. It is essential for managers and their staff to acknowledge the existence and highlight the importance of informal networks within their organizations. Informal style of communication can convey sometimes more effective and timely messages compared to formal networks (Richmond et al., 2005).

4.11 Conclusion

This chapter highlighted the basic concepts of emergency planning and response. It started with describing guidelines for emergency planning including flexibility, coordination, training and dynamicity. Subsequently, it moved to explain the main objectives of emergency planning: risk assessment and risk reduction. Afterwards, emergency response management was explored in terms of collaboration, cognition, coordination and communication. A particular review of organizational communication was performed since the researcher felt the importance of this concept in

pandemic preparedness and response. A number of different aspects of organizational communication were studied including basic concepts, structure, flow, and networks.

Chapter 5: Pandemic preparedness activities

5.1 Introduction

This chapter starts by providing an overview on the issue of emerging infectious disease planning with a particular focus on pandemic planning and preparedness. The second section provides a summary of the six key elements of pandemic influenza preparedness: coordination, surveillance, pharmaceutical measures and non-pharmaceutical public health measures, health and non-health continuity and communication. The chapter ends by pointing out the main features of international and national pandemic planning. The role of the World Health Organization and national governments are defined clearly in the context of pandemic preparedness in the last section.

5.2 Background on emerging infectious disease planning

The first death from a laboratory confirmed avian influenza was in 1997. Health authorities in Hong Kong were able to contain and control the virus after it had caused 18 cases and a number of deaths. The virus re-emerged in 2003 and had caused since then many outbreaks in poultry and human in a number of countries (Ligon, 2005). Avian influenza had resulted in millions of death in poultry and caused high morbidity and mortality in human population. By August 2011, avian influenza had caused 565 cases and 331 deaths with a quite high case fatality rate of 59% (WHO, 2011b).

In addition, the first case of Severe Acute Respiratory Syndrome (SARS) was reported in China in November 2002. The causative agent was identified to be

corona virus, which is an animal virus that caused cases of acute respiratory illness in human population. It resulted in 8098 cases with 774 deaths in 26 countries. SARS outbreak caused severe social and economic disruption as well as its impact on healthcare facilities was substantial (WHO, 2003a).

Avian influenza re-emergence in 2003 caused concerns among the international community and national governments about a potential pandemic threat. This motivated many European countries and supranational organizations to start preparing and planning for potential pandemic influenza caused by H5N1. Most countries in Europe published national pandemic strategies, technical and operational guideline for this reason (Mounier-Jack and Coker, 2006).

WHO published a checklist for influenza pandemic planning and preparedness in 2005 to support and guide member states' planning activities (WHO, 2005a). Similarly, the European Commission reviewed and updated its pandemic influenza guidelines and subsequently established the European Centre for Disease Prevention and Control (ECDC) to support the WHO work to prepare Europe for the next pandemic. In 2005, WHO produced a new guidance document to support and encourage countries to start developing their national pandemic strategies. In that document WHO tried to increase the awareness and understanding among its member states to the importance of achieving coordinated actions to respond to international public health threats (WHO, 2005b).

In recent years, there have been developments in several elements of pandemic preparedness. Countries around the world have started stockpiling antivirals, antibiotics, and personal protective equipment. Moreover, countries attempted to build capacities around immunisation and surveillance system. Understanding the differences between seasonal, avian and pandemic influenza has improved in the past few years (WHO, 2009g). Public health authorities gained extensive experience from dealing with avian influenza outbreaks in poultry and human as well as responding to seasonal influenza activity and outbreaks annually. In addition, testing and exercising national preparedness plans and strategies have made stakeholders more confident and comfortable dealing with such public health emergencies. Awareness has increased to the fact that pandemic is a whole society responsibility, and it goes beyond the health sector to include non-health departments (WHO, 2009g).

In 2007, the internal health regulation came into action to provide a legal and professional framework to coordinate the response to international public health emergencies (WHO, 2008). WHO revised and published a new guidance document in 2009 to reflect on years of progress and development in this field to make the world better prepared to influenza pandemic (WHO, 2009f).

5.3 Elements of pandemic influenza preparedness

National pandemic plans serve as an overarching strategy to prepare and respond to influenza pandemic. National governments based their planning

activities on six main areas as recommended by the WHO and the outer international organization:

5.3.1 Pandemic planning and exercising

Participatory planning is an important concept that necessitates representatives from all sectors at different administrative levels to contribute to the planning process. There is a minimum set of stakeholders that is required to conduct pandemic planning and preparedness in a given country. These consist of national and subnational government officials, national and local public health stakeholders, and representatives from primary and secondary healthcare workers, and non-health emergency management sector personnel. In addition, virologists, epidemiologists, veterinary health authorities, modellers, and national drug regulatory authorities can be involved too. Public involvement in the planning phase is considered an area of good practice as this will enhance the public acceptance to the proposed plans as well as improve their engagement during response (WHO, 2005a).

In order to sustain and organize these planning activities and response measures, financial and human resources are needed. As pandemic could be seen as a non-urgent issue, political commitment is essential to allocate the required funds (WHO, 2009f).

The planning process starts by creating a national pandemic planning committee that includes representative from different health and non-health sectors from different administrative levels. This committee is required to meet at regular time intervals in order to follow up on the implementation of

different activities during the inter-pandemic phase. (WHO, 2005a, Academy of Educational Development, 2009). One of the most important functions of this committee is to determine the command structure for the stakeholders involved in the response phase. This can be achieved by defining roles and responsibilities of different stakeholders and their organizations during the response and how that might change during different scenarios. This will ensure smooth and effortless communication and coordination across different organizations (Krumkamp et al, 2009).

WHO recommends for testing and exercising pandemic plans to assess the readiness of health officials to respond to pandemic influenza. Exercises are important to translate ideas and concepts into action in an artificial way close to reality and they serve as a tool to validate different elements of the national pandemic plans. These are communication systems, knowledge and understanding regarding pandemic influenza, and incorporating lessons learned in the revision process (WHO, 2009h).

There are three important types of exercise design that can be used in respect to pandemic influenza; these are tabletop (desktop), command post, and field exercise. Tabletop exercise is a very reasonable and inexpensive approach to testing pandemic plans. These are conducted with stakeholders sitting around the table and try to test communication and coordination under different scenarios. Desktop exercise will provide a face-to- face meeting opportunity and participants will get acquaintance with each other in a realistic environment (WHO, 2009h).

The second most common design is command post exercise, in which participating stakeholders are positioned at real control locations similar to the real response. Communication systems and IT networks are heavily tested in this kind of exercise. The third type is field exercise; it is the most complicated and more expensive exercise to conduct (WHO, 2009h). Field exercise can test many elements of pandemic preparedness such as hospital infection control procedures, port health system operational aspects, and logistics of vaccine and medication distribution. Some jurisdictions had used a combination of all three designs to test pandemic plans at national and local levels (WHO, 2009h). There are many aspects of pandemic-specific issues that can be examined using exercises include command and control structure, the decision making process by stakeholders across different administrative levels, organizational communication within the health system, use of public health and pharmaceutical countermeasures, vaccination programmes and antiviral medication, and logistics (WHO, 2009h).

5.3.2 Surveillance

Influenza surveillance is an essential element of pandemic planning and preparedness. Its main role is to measure the clinical activity and impact of emerging novel influenza strains. It is a requirement now for every country to have an early warning and detection system to collect epidemiologic and virologic information to conduct a proper risk assessment (Leese and Tamblyn, 1998). As discussed in a previous chapter, pandemic influenza and seasonal influenza are not distinct features and they can represent a

continuum of the same disease. Therefore, the same infrastructures required detecting, identifying, and monitoring the activity of seasonal influenza would be necessary during pandemic influenza.

Surveillance assists national and local authorities to detect novel strains of influenza A virus which in turn can help to trigger early and timely response actions. Virologic surveillance has developed over the past few years and WHO has extended the number of influenza collaborating centres participating in its Global Influenza Surveillance System (GISN) (WHO, 2005b).

WHO has supported the international and national communities to establish and develop influenza surveillance networks. As part of this, WHO hosted a big scientific conference in 2007 on pandemic influenza surveillance. Experts and representatives from 25 countries attended the meeting to share knowledge and experience pertinent to pandemic influenza surveillance. (Briand et al, 2011). The meeting concluded that there is so much work to do to improve data quality, timeliness, completeness, and accessibility. In addition, stakeholders in this meeting stated that there is a huge diversity in countries' surveillance networks and systems and this need to be addressed by individual countries. This could be achieved by agreeing on a minimum list of core variables that is feasible for all countries to collect (Briand et al, 2011).

Two years later, WHO published guidance on global influenza surveillance and recommended that countries should plan for enhanced surveillance. This comprises timely detection, the early assessment of the first 100 cases, and

pandemic monitoring (WHO, 2009i). According to IHR, timely detection aids authorities to identify the evidence of sustained human-to-human transmission and the potential risk of pandemic. The second part, early assessment, aims at collection of clinical, epidemiologic and virologic information for the first hundred cases. This helps WHO and countries to assess the severity and respond accordingly. This does not mean that surveillance is confined to the first cases but it should be an on-going activity throughout the response phase to improve knowledge about the characteristics of the novel virus. Monitoring influenza pandemic consists of activities to observe the geographic spread of the virus nationally and locally, determine age-specific incidence, transmission rate, mortality and morbidity, and sensitivity to antiviral medications (Briand et al., 2011).

5.3.3 Pharmaceutical measures

Reducing the spread of disease will depend significantly upon applying pharmaceutical measures such as vaccines and antiviral drugs.

5.3.3.1 Pandemic influenza vaccines

Influenza vaccines have been used to prevent influenza infection and outbreaks for decades and their safety and effectiveness have been demonstrated in observational and clinical trial studies in that long period. Influenza immunisation reduces morbidity and mortality in high-risk groups. Influenza viruses drift and change their genetic component annually; therefore, vaccine strains have to be updated accordingly. During a pandemic it can take few months before influenza immunisations become available to

the human population; therefore, supply is going to be limited during the first part of the pandemic (Watson and Pebody, 2011).

The trivalent influenza vaccine is considered the most effective countermeasure to prevent and control influenza virus, but during influenza pandemic a monovalent vaccine has to be developed to reduce the spread and healthcare burden of pandemic influenza virus. Health authorities are required to ensure that plans and mechanisms are in place to produce influenza vaccines to cover the high demand. This was highlighted in the 2003 World Health Assembly when governments were asked to prioritise pandemic planning and preparedness activities including vaccine procurement and distribution strategies (WHO, 2003b).

International collaboration between health authorities and pharmaceutical drug companies during the planning phase is fundamental to avoid challenges and difficulties during the response. It is common sense that the seasonal influenza vaccine will not be effective against a novel influenza virus. However, the on-going production and distribution of seasonal influenza vaccines annually are considered an effective capacity building practice for a future pandemic. In addition, the implementation of seasonal influenza vaccination campaigns will increase vaccine acceptability and distribution among the public as well as healthcare workers (Kieny et al, 2006). Immunisation strategies within national pandemic plans are required to define high-risk categories for immunisation, as the supply will reach countries from the manufacturer gradually. National authorities are required to conduct mass

immunisation campaign to cover the entire population but sometimes this will be challenging in the emergency setting. In addition, governments have to prepare a list of key workers in the community to be immunised first during a pandemic. These include healthcare workers, police, fire, power and water stations workers and others. Immunisation of children has great effect in reducing the transmission of the virus early in pandemic (Emanuel, 2006).

Health authorities on national and international levels are required to plan operationally for vaccine logistics in terms of procurements, deployment, and distribution. This structure has to be in place before the pandemic to meet the need for the vaccine during pandemic (Fedson, 2005). Transporting vaccine supplies from pharmaceutical companies to warehouses and subsequently to providers needs careful consideration and planning. Next, stakeholders need to be familiar with the roles and responsibilities as well as the process of collecting vaccines from those centres and their further distribution to the public Planning for storing syringes and needles are part of this planning process. Security protection for vaccine storage centres is essential during the emergency environment of a pandemic (Fedson, 2005).

The production process of seasonal and pandemic influenza vaccines is similar. The candidate strain is isolated first and then made available to pharmaceutical companies to start mass production of the pandemic vaccine. Both seasonal and influenza vaccine production processes use the same facilities and require the same highly trained personnel with skills and experience in producing vaccines. However, the production during pandemic

is more rapid to accommodate the high and urgent demand. Therefore, supporting seasonal influenza manufacturing process is seen as a proxy to pandemic preparedness (Carrasco and Leroux-Roels, 2013).

5.3.3.2 Antiviral drugs stockpiling

Antiviral medications can be used both prophylactically and therapeutically against a novel influenza virus during pandemic. In the first few months of a pandemic with no immunisation available yet, antiviral supplies are most likely to be exhausted and overwhelmed. Stockpiling antivirals in advance is recommended. The two main influenza antiviral medications are Oseltamivir (Tamiflu®) and Zanamivir (Relenza®) (Longini et al., 2004).

Antiviral medications are efficacious against all known influenza virus strains as supported by in vitro data and this implies that they are going to be effective against potential novel influenza viruses. However, antiviral resistance patterns should be monitored during influenza pandemic. These drugs as demonstrated by clinical trails and systematic reviews reduce influenza symptoms, secondary complications, and time required to return to normal activity when prescribed early after symptoms onset (Hsu et al, 2012, Hayden et al, 1999, Treanor et al, 2000).

Moreover, data from hospitalized cases demonstrate that death rate can be reduced by Oseltamivir therapy (McGeer et al., 2007). Paediatric data show that Oseltamivir treatment decreases duration of symptoms, complications, requirements of antibiotics, pneumonia, and hospitalization admissions (Whitley et al, 2001). A systematic review and meta-analysis from the 2009

pandemic shows that treatment with neuraminidase inhibitors was associated with reduced mortality, especially if they were administrated within two days of symptoms onset. Moreover, early treatment reduced severe outcomes and critical care utilization when compared to late treatment (Muthuri et al, 2013). Antivirals deployment strategies require careful planning before the pandemic. There is a wide range of scenarios on how to implement these strategies but every county has to make its own calculations and strategies and there is no one size fits all countries. The general rule is the larger the stockpile the more options that can be implemented. However, the cost might be an issue to low-income countries. Based on the historic data from previous pandemics regarding clinical and case fatality rates, 40% of population size stockpile is required in order to treat all population during pandemic. However, the size would increase to 70% if countries wanted to implement treatment and prophylaxis strategies (Longini et al., 2004).

5.3.3.3 Antibiotics

The temporal association between influenza virus and secondary bacterial infection and pneumonia is well understood and documented for seasonal influenza (Murata et al., 2007). This relationship has been documented for influenza pandemics for the past century (Louria et al, 1959, Morens et al., 2008b). Bacterial complication following the influenza infection can cause morbidity and mortality unless early treatment with antibiotics can be started. Hospital surveillance data from 2009 pandemic revealed that about 30% of

the hospitalized and 12% of deceased developed bacterial pneumonia (Nguyen-Van-Tam et al., 2010a).

Although antiviral medications are expected to be effective against a potential novel influenza virus during pandemic influenza, it is unsafe assumption not to plan for secondary bacterial pneumonia, as antiviral effectiveness during pandemic is still inconclusive. In addition, pandemic vaccine would not be available during the first few months and therefore it is reasonable to prepare a stockpile of antibiotics to reduce the rate of secondary bacterial pneumonia. Antibiotics stockpiling is considered an essential element of countries' pandemic preaddress process (Nguyen-Van-Tam and Gupta, 2009).

5.3.4 Non-pharmaceutical public health measures

Public health measures are aimed at reducing mortality and morbidity as well as social and economic disruption. They can reduce and slow the peak of pandemic to allow more time until pandemic vaccine become available. Evaluating the impact of those measures is challenging and sometimes the choice to implement them is not based on concrete evidence. The secondary consequences to their implementation should be considered and addressed (European Centre for Disease Prevention and Control, 2009).

The decision to apply quarantine measures or banning mass gathering can have considerable social and economic costs that might be even higher than those of the pandemic itself. Therefore, strong legal and ethical frameworks are required to address this. Public awareness should be increased about the nature of these measures and their impact on their lives. These can include

school closure, travel and border restrictions, banning mass gatherings, and quarantine (Gostin, 2006).

5.3.5 Business continuity planning

5.4.5.1 Health sector

Preparing hospitals to cope with the surge in the number of cases admitted as a result of influenza pandemic is another pillar in pandemic preparedness and planning. Surge capacity is the extent to which hospital capacity can expand to manage the increase in number of cases and continue working as long as possible (Toner et al, 2006).

Therefore, hospital planners and managers need to start a comprehensive assessment and planning processes during inter-pandemic seasons to prepare hospitals to respond to outbreaks and pandemics. Hospital facilities could be put under immense pressure and could cause disruption of other health services provided and high rate of staff absenteeism could complicate things further. Proactive and active hospital planning activities are required to respond effectively to pandemic at a secondary healthcare facility. These activities comprise of the continuity of healthcare services, clear and accurate communication, flexibility and adaptability of response measures, and the effective use of resources (WHO Europe, 2009).

WHO regional office for Europe has developed a comprehensive list of key elements required to attain preparedness in hospitals against influenza as well as other public health emergencies. The checklist serves as a guide to hospital managers and planners regarding the current status of implementation of

specific elements. These elements include: command structure, communication, continuity of patient care, surge capacity, human resources, logistics, essential equipment, infection control practices, and clinical case management (WHO Europe, 2009).

5.3.5.2 Non-health sector

Business continuity planning is essential part of pandemic preparedness as pandemic impact could go beyond health. Non-health sector planning should focus on essential services important for civil society and social order. Priorities differ across different countries but most business continuity plans include police, fire, water, power, and transport personnel. Planning should be done by businesses themselves as part of their emergency preparedness activities, but they can get technical and operational support from the national and sub-national stakeholders (Dalton, 2006).

The awareness of business continuity planning has increased for many organizations and facilities to ensure the continuity to function under emergency conditions. However, pandemic influenza has many different aspects including its gradual onset and long duration. In an earthquake, for instance, organizations might experience a shortage of staff, supplies, or communication but assistance can be provided from the unaffected regions (Dalton, 2006). However, this is unlikely to happen during influenza pandemic as almost everyone is going to be impacted. Three main areas in this kind of planning are: staff, supplies, and building. These should be identified beforehand and plans should be exercised regularly. The planning

process requires managerial and financial support to begin and follow up on the planning activities (Cabinet Office, 2011).

5.3.6 Communication

Clear, accurate and, timely communication during pandemic planning and response is essential to attain the coordinated and evidence-informed actions. Communication is another essential element in pandemic planning and it is essential to reduce confusion and unwanted disruption during response to pandemic (Paget and Aguilera, 2001).

5.3.6.1 Internal communication among stakeholders involved in the pandemic response

Coordination group at national level is mandatory to gather and disseminate information relevant to pandemic to all sub-national and local levels in all phases. This group may consist of stakeholders from the ministry of health, ministry responsible for the civil emergency response, and primary and secondary healthcare workers. This group needs to ensure exchange of information with international organizations such as WHO and other United Nations departments (WHO, 2005b). The main role of this group is to ensure a rapid and consistent share of information between national sub-national authorities. Using a variety of communication channels including audio and video techniques, electronic mailing systems, fax, and websites are mandatory to disseminate messages during planning and response of pandemics (Collins, 2009).

5.3.6.2 Communication with the public

In the planning phase a communication with the public plan need to be in place, this discusses target groups such as media, general public and healthcare workers. This needs to determine the nature of messages that will be communicated to the public, communication and dissemination networks, and spokespersons. Media training to spokespersons and other staff is mandatory to give confidence when speaking to reporters and the media. Communication planning is required to be a dynamic process and to be exercised and revised regularly in line with new technologies, knowledge or organizational reforms. Lessons identified as a result of these communication strategies should be incorporated with the section of communication within the national pandemic plan (Collins, 2009).

Furthermore, the plan needs to highlight the importance of ensuring consistent key messages during response and relevant material (flu websites, posters and leaflets) and communication channels to be used to target the population at risk. These channels can be the official national or sub-national influenza pandemic websites. To guarantee consistent messages and recommendations during the response to pandemics, governments need to nominate a spokesperson at the national and sub national levels. These will be presenting at media press conferences and to other wider community presentations. During pandemic media briefings need to be held regularly and sometime daily briefings are needed when pandemic is active locally (Gupta et al., 2006).

Planning for different forms of communication channels will ensure an effective communication with the public during the pandemic response. This will ensure that messages will reach as far and accurate as possible. Examples of various communication channels include television, radio, official websites, and recorded information for those phoning the organization. In addition, leaflets and other public education materials can also be used both before and during pandemic response (Abraham and Pople, 2013).

We live in the information technology age and the Internet and social media access have engulfed us, Internet is the most accessible source of information during pandemic and this is why authorities are required to create and update their websites. Moreover, national and local pandemic websites are required to be tested regularly since the numbers of site visitors are going to increase considerably during pandemic. It is required to test for any broken links and make sure the webpage is linked to other websites with further information and guidance (Abraham and Pople, 2013).

5.4 International vs. National pandemic planning

Pandemic influenza planning and preparedness require a close collaboration within different administration levels in the health sector and with other emergency responders within the same country as well with the wider international community (Cox et al., 2003).

5.4.1 International Planning

As described earlier, WHO has been authorized by the World Health Assembly (WHA) to provide member states with leadership, advice, and

technical assistance. The essential role of WHO is to achieve international coordination state in the following areas:

5.4.1.1 Coordination

The International Health Regulations (2005) are legally binding laws that were legislated by the WHA in 2005. IHR present an international legal structure for communicable disease prevention and control. IHR oblige countries to inform WHO of all cases of influenza caused by a novel influenza strain in their regions according to WHO case definition (WHO, 2008). There is an extra obligation to inform WHO of any evidence of influenza cases in other countries. IHR gives the power to WHO to declare that a Public Health Emergency of International Concern is taking place. If this happens, the Director-General will make a decision regarding issuing temporary recommendations to nations on the measures required to control the transmission of the virus to reduce its morbidity and mortality (WHO, 2008).

In order to comply with the IHR (2005), national governments will have to develop and implement influenza surveillance measures in order to detect, identify, and monitor the spread of influenza pandemic and to sustain and build capacities around airports, ports, and other points of entry. These required close cooperation between WHO and countries' national health authorities as well as inter-sectoral collaboration within the countries themselves. This comprises partnership and coordination among different administrative levels at national and local levels. The revised IHR version

addresses the issue of interoperability between neighbouring countries, economic partners, and other member states with mutual relationships (Rodier, et al., 2007).

5.4.1.2 Pandemic vaccine

Once a novel influenza virus causes sustained outbreaks in human population, WHO has the role to recommend the production of pandemic influenza vaccine instead of seasonal vaccine. The process of producing pandemic influenza vaccine is dependent on how rapid the first affected countries could share influenza viruses with WHO through the Global Influenza Surveillance Network and WHO collaboration centres (WHO, 2007a).

5.4.1.3 Containment of pandemic influenza

Containment operation is the responsibility of national authorities in each country with the support of WHO to control the spread of the pandemic as soon as possible following its initial recognition. Evaluation of the situation by experts will determine whether countries will implement containment measures. Containment activities are not recommended by experts when the virus has sustained human-to-human transmission and spread widely in the population. WHO will offer advice and support on organization and scientific aspects of the containment process. In addition, WHO supports coordination of international activities such as the distribution of expert teams, mobilizing and dispatching antiviral medications and other materials during containment phase (WHO, 2007b).

5.4.1.5 Situation monitoring and assessment

WHO has an essential responsibility is to gather, analyse, and distribute data on the global spread of the virus and this is achieved through collaboration with countries. In addition, it provides support and tools for detection and reporting of influenza-like illness and it provides advice to countries with human cases of influenza as well as assisting in developing systems to assess the burden of seasonal and pandemic influenza (Heymann and Aylward, 2006).

5.4.2 National planning: a whole-of-society approach

Countries national planning activities start by forming a national pandemic planning committee at national or federal levels. This committee must have coordinators and representatives from different stakeholder groups. National goals and priorities must be clearly determined in advance and these include reduction morbidity and mortality, continuity of health and non-health essential services, and lessen pandemic economic and social consequences. During the inter-pandemic period, national plans and all related guidelines have to be implemented and need to be in place. Pandemic preparedness activities consists of increasing seasonal influenza uptake among risk groups and HCWs, enhancing surveillance system, stockpiling antiviral drugs and undertake research that will support the pandemic response (Mounier-Jack and Coker, 2006).

National pandemic plans as recommended by WHO usually include sections on surveillance, vaccine, antiviral agents, command and control, civil

emergency response and communication. Since WHO adopted "The Whole Society Approach" in 2009, the planning involved now all non-health related sectors such as private businesses, university, etc. (WHO, 2009g).

5.4.2.1 Leadership and political commitment

Pandemic planning process starts by creating a national pandemic planning committee to coordinate and lead the process. Representatives from the national government usually chair this committee. This is essential to ensure that the preparedness stays high on the political agenda to ensure on-going funding and commitment. This committee has many activities including signing off the national pandemic plan, revise and modify policies, and monitor capacity building activities. Political commitment is a fundamental part of the planning process in order to maintain financial and human resources available (Cox et al., 2003).

5.4.2.2 Non-health sectors

In addition to preparing the health sector, national authorities should be committed to support and fund business continuity planning activities. The collapse in business continuity during a pandemic could cause further social and economic consequences due to improper and ineffective planning activities. Developing well-organized preparedness and business continuity plans may reduce economic and social consequences of pandemic (Simpson and Sellwood, 2009) In addition, non-governmental organizations (NGOs) that have direct contact with the public are often well placed to increase public awareness, provide updates, and supplies. NGOs should have clear

roles and responsibilities during pandemic planning and response phases. These community-based groups can work collaboratively with other stakeholders (WHO, 2009g).

5.5 Conclusion

This chapter describes how pandemic preparedness and planning developed since the emergence of avian influenza A/H5N1in 1997 and how it was recognised as a high priority for all national and international bodies working on communicable diseases prevention and control. In addition, it stated the major six elements of pandemic preparedness; these are: planning and coordination, surveillance, pharmaceutical and non-pharmaceutical public health measures, sustaining health and non-health services, and communication. Responsibilities of international and national bodies were explored in the last section. This chapter gives a good overview of what is needed to be in place before pandemic and what pandemic preparedness activities needed to be implemented to ensure rapid and effective response.

Chapter 6: Methods

6.1 Introduction

The chapter starts by discussing the qualitative research methods used to conduct this evaluation and discusses the reasons behind this choice. Also, it highlights the process of selection of countries using the stratified random sampling procedure. The data collection tools and processes, and the inductive approach used in the data analyses were discussed too. It is important to highlight before starting with the method chapter that this research was a collaborative effort between the WHO regional office for Europe and the Health Protection and Influenza Research Group at the University of Nottingham in the UK. Both of which regarded this research as `service evaluation' of pandemic responses.

National and sub-national health authorities responded to influenza A (H1N1) pandemic in 2009, many draw on plans and experience gained from several years of pandemic preparedness activities and through the response to outbreaks of avian influenza A (H5N1). WHO Regional Office for Europe has been extensively involved in these activities in the region and decided to assist countries in evaluating the usefulness of their pandemic planning activities such that this will guide their future planning and response activities. Although officially designated as a service evaluation by WHO, it had nevertheless decided to collaborate with the University of Nottingham in order to increase the academic rigor of the project and to add independence to the findings. Therefore, the researcher would like to start with describing the

involvement of each member of the collaborative team in this study at different steps of this study.

Table 1 Team participation by stage of the research project

Step	Contributors
Protocol design	Ahmed Hashim (the researcher), Jonathan Van-Tam, Caroline Brown, Michala Hegermann-Lindencrone
Interview guides writing up	Ahmed Hashim, Jonathan Van-Tam, Caroline Brown, Michala Hegermann-Lindencrone, Ian Shaw
Sampling of countries	Ahmed Hashim, Puja Miles
Data collection (stakeholders interviews)	Ahmed Hashim 17 interviews, Jonathan Van-Tam 5, WHO experts 14, External experts 13
Transcription	Ahmed Hashim, WHO interns, research assistant
Data analysis	Ahmed Hashim, Lucie Lucie Jean-Gilles
Result writing up	Ahmed Hashim
Data interpretation	Ahmed Hashim

6.2 Qualitative evaluation methodology

Qualitative evaluation methods have evolved in various ways and many social scientists offer different ways to design, undertake, and analyse qualitative data (Denzin and Lincoln, 2007). The Evaluation Checklists Project by Patton states that qualitative techniques are often used in evaluation of health programmes because they tell the story of the programmes by listening to staff experience and attitude (Patton, 2003). Qualitative evaluation involves individual interviews, focus group

discussions, narrative data, field notes, and documentary analysis. An evaluation can be conducted exclusively by qualitative research methods but the choice of which research methods to use is completely dependent on the circumstances and the objectives of a given evaluation (Patton, 1980).

Evaluation of programmes aims at understanding and revealing the processes of programme functionality rather than its outcome. Process evaluation studies target the following topics. What are the processes and procedures that make the programme working? What are the useful and less useful aspects of the programme? What is the area of improvement in the programme? What could have done differently to change the outcomes of the programme? (McDavid and Hawthon, 2005).

Process evaluation requires a comprehensive description of programme operations. These descriptions maybe based on observations and/or interviews with stakeholders at different administrative levels. Moreover, process evaluation may focus on how the programme is perceived by the staff, clients and programme administrators (Patton 1980). This type of evaluations starts by describing the overall process of programme operations and it is characterized by being dynamic, adaptable, and inductive. The researcher explores successes, shortcomings, and areas of improvement in a give programme (McDavid and Hawthorn, 2005). In other words, process evaluation examines unusual sequences and patterns of a given programme by looking at programme planning and implementation (Patton, 2002).

Qualitative research methods are compatible with process evaluation because it looks at the internal operational aspects of the programme without prior assumptions regarding the weakness and strengths of the programme. Such an open-ended approach using interviews or observations allows successes and failures to emerge from qualitative data analysis rather than prior hypotheses and expectations of the programme evaluator (Patton, 2002). In addition, the programme processes are very complex in nature and interdependent, which makes their understanding difficult using quantitative-deductive approach. In other words human services/programmes have more uncontrolled and complex variables in play that cannot be captured by quantitative method. This understanding needs in depth understanding of human knowledge, experience, actions, and perception at different situations. In qualitative evaluation, the focus is on the uniqueness of human experience and to avoid attempts to force categories or structures to these experiences. Qualitative evaluation attempts to construct from these experiences upwards while leaving the opportunity towards the new or unexpected (McDavid and Hawthorn, 2005). The approach used in this kind of evaluation is an inductive approach that starts with data and not with prior assumptions or hypotheses. This approach helps the evaluator to construct an understanding of the programme using narrative, direct and indirect observations, communication with programme stakeholders, documentary evidence and other sources of information.

A naturalistic approach is another key issue while conducting qualitative evaluation this means that the researcher is going to observe the naturals setting of the programme without trying to intervene to change the programme. This is a contextual investigation to naturally occurring components of a programme (Willems and Raush, 1969). The evaluator works with stakeholders as they interact with or perform their duties in relation to the programme or each other. In addition, naturalistic refers to natural language used by the evaluator- the same word used by the participants themselves. Therefore, naturalistic approach is an observational approach that is different from clinical trails where the investigator tries to control the setting to see the difference between exposed and non-exposed groups to measure the effectiveness of a given intervention.

A holistic view is the third key feature (after being inductive and naturalistic) of qualitative evaluation; the evaluators do their best to understand the programme as a whole. In order to get a holistic understanding, evaluators examine different aspects of the programme under study. They tend to examine documents, interview people, review programme's descriptions in order to get a comprehensive knowledge and understanding about the programme (Patton, 1980).

Furthermore, as this was a novel approach to evaluate effectiveness of pandemic preparedness activities prior to influenza A (H1N1) pandemic in 2009, there was a necessity to explore the issue in depth. Facts related to any issue about which little is known can be explored using qualitative research

(Strauss and Corbin, 2007). Qualitative research can reveal things that are incompatible with prior hypotheses related to a given research topic under question and can answer question regarding the mechanisms and operations of a given programme rather than trying to get programme statistics (Murphy et al., 1998).

Moreover, qualitative methodology gives the opportunity for more in-depth discussions, consequently providing detailed information of research questions that are difficult to answers for using quantitative methods (Patton, 1980). It aims to understand facts in a holistic approach that take into account different point of views on the programme, its internal dynamics, and its effect on stakeholders. Therefore, an evaluation is not just conducted from the programme manager's point of view but considers into account participants' opinions as well as other stakeholders' views. This holistic-naturalistic-inductive approach aims at exploring and describing a given event while the deductive reasoning tries to examine a particular hypothesis.

6.3 Selection of countries

6.3.1 Countries stratification

WHO regional office for Europe serves the WHO European Region, which comprises 53 countries, covering a vast geographical region (including Central Asian countries) from the Atlantic to the Pacific oceans. Fifty-three countries within the European Region were assigned by the WHO Regional Office for Europe to one of three broad categories that represented those that had 'well-advanced' pandemic plans by March 2009 (i.e., category A, 10

countries), those 'less well-advanced' (i.e., category B, 31 countries), and those that had plans still directed mainly toward an avian influenza A (H5N1) zoonotic threat (i.e., category C, 12 countries). The allocation of countries into these categories was performed confidentially by the Influenza and other Respiratory Pathogens Team of the WHO Regional Office for Europe and based on its sustained dialogue with the Member States and a series of pandemic preparedness assessments and country (Caroline Brown, personal communication, March 03, 2010).

6.3.2 Sample size

Patton in his qualitative evaluation checklist states that there is no formula to calculate sample size for qualitative research (Patton, 2003). Ritche and colleagues claimed that sample sizes for qualitative research are much smaller than those use in quantitative methodology. They stated that in qualitative research context frequency of data does not necessary lead to more information and new occurrence and recurrence of themes are more important to the researcher than their actual numbers. Qualitative research is a hypothesis–generating methodology that aims at understanding meanings and interpretations and not used for generalization of evidence as in quantitative methodology. Moreover, qualitative methodology results in large volume of data that makes the transcription and analysis processes challenging and resource intensive. Therefore, choosing a large sample size can make data repetitive and less useful (Ritchie et al., 2003). The team agreed to include

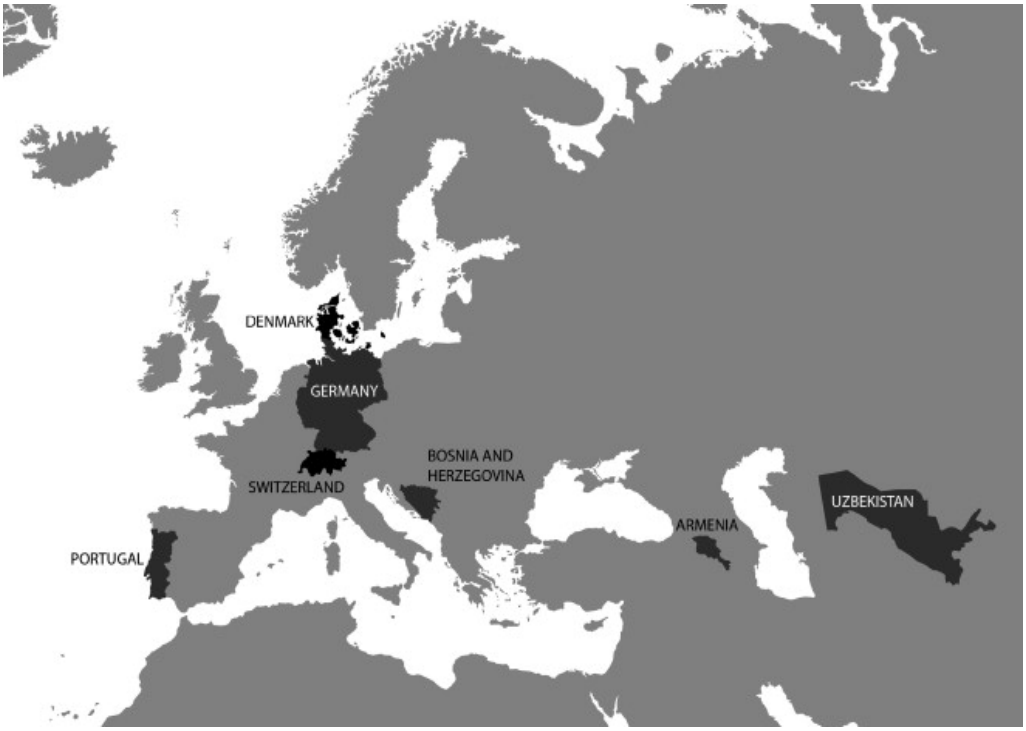
two countries from each category on the basis of methodology, scope, timelines and feasibility of this evaluation.

6.3.3 Stratified random sampling

This sampling method involves the separation of a large group into smaller subgroups called "strata" based on shared features or attributes. Then a random sampling occurs within each stratum to get the final sample size. This sampling method is useful when sampling a group with diverse and different characteristics in order to get subgroups that are relatively more homogenous (Collins et al. 2007). The aforementioned classification was then passed on to an independent statistician who assigned a sampling order, based on stratified random sampling within the three categories. On 24th February 2010, the researcher received a list of six countries from the statistician to contact initially (two per category) and a further list of six 'reserve' countries to be contacted in case any country from the first list declines to participate. By applying this procedure it was possible to select six countries for participation along with Denmark that independently agreed to act as the venue for the pilot study. This classification has been used exclusively for the selection of countries to participate in the study. The categorization has not been shared with the participating countries or with any persons external to the study team. This was a very sensitive issue on the political level; especially when the less well-prepared countries perceived this evaluation as an inspection on their performance during the actual response. Stratified randomization as described above led to the inclusion of a sample of six countries. Of the six

countries initially approached in March 2010, five agreed and one did not agree. That country did not participate because they had an election that coincided with the proposed country visit in 2010. A second-choice country from the same category "a reserve country" replaced this country. This was done to reduce the likelihood of bias since both countries belonged to the same category of pandemic preparedness. The six countries, in alphabetical order, who agreed to participate after official invitation letters (attached in the appendix) were sent on the 8th of March 2010 were: Armenia, Bosnia and Herzegovina, Germany, Portugal, Switzerland, and Uzbekistan (Fig. 1).

Figure 1 Map of Europe and Central Asia highlighting the seven countries selected for the study.



6.4 Data collection

6.4.1 Identifying key stakeholders for pandemic preparedness

One of the aims of qualitative research is to explore stakeholders' point of view. This means that stakeholders participating in the study are asked to report their perception on what was important for pandemic planning. The selection of the stakeholders was based on the study objectives and practicality. In addition, WHO input was sought in order to determine the key stakeholders who are vigorously involved in inter-governmental coordination during pandemic planning and response. These stakeholders were selected because they represent the minimum required administrative levels in a country to prepare and respond to pandemic influenza, as recommended in WHO pandemic preparedness guidance checklist published in 2005 and 2009 (WHO, 2005a, WHO, 2009f.) There are far more stakeholders involved in the pandemic planning and response; including private sector, pharmaceutical companies, and the public but these were outside the scope of this study.

Representatives from the following stakeholders of each participating country were interviewed separately: Ministry of Health (MOH), Ministry of Civil Emergency Response (CER) (or equivalent), National Public Health Authority (NPHA), Subnational Government tier (SNG), primary and secondary healthcare workers (HCWs). The national governments agreed to participate in the study, and s nominated official representatives as interviewees. Stakeholders group numbers by participating countries is shown in table two. The number of participants in each category per country was determined by the national health authorities based on the role played during

pandemic planning, involvement in the actual response, availability, and seniority. As discussed earlier, qualitative research aims at providing rich and comprehensive understanding regarding certain aspects of human experiences and not to generalise the finding to the larger population. Therefore, the small numbers of participants interviewed in a focus group setting was optimal to achieve this goal.

6.4.2 Interview setting: Focus groups

Focus groups involving more than one interviewee usually explore particular topics in depth. This means the interviewees are stimulated to speak to one another instead of asking single person to answer one question. This allows interviewees to exchange experiences, comment on each other statements as well as challenging each other's ideas. Also, it is a practical way to collect information from quite a few people at the same time.

Focus groups can provide a platform to investigate ways in which participants as a larger group can understand a specific issue and it is useful to explore critical and sensitive topics (Morgan, 1997). The group communications generate ideas and assist in brainstorming that enable the participants to see and discuss their point of views in a way different to individual interviews (Kitzinger, 1995). During a given focus group interview, participants are encouraged to reflect more deeply about the topic, and build new ideas and alter existing ones. Focus groups interviews are casual in which participants are asked to talk about their own views regarding a specific issue in a less

stressful and friendly setting. This can make participants at ease and motivate them to share their views and opinions unreservedly (Punch, 2005).

The possibility of dominance by some participants during the conversation is one of the potential drawbacks of this type of interviews. This means that some participants remain silent or keep echoing their managers' views (Darlington and Scott, 2002). To overcome this, interviewers tried to encourage silent and less active participants to answer questions and share their views and experiences. This was mainly used in the less prepared countries and this will be discussed further in the discussion chapter. The use of one on one interview setting could have overcome this limitation but at the same time would have impaired the interactions and brainstorming required to get a proper and in depth knowledge about complex programmes such as pandemic preparedness. Another issue related to focus groups is that there a possibility for discomfiture with sensitive issues that can make participants reluctant to share their personal intakes on critical topics (Darlington and Scott, 2002). Confidentiality breach is another limitation in this kind of research as other participants in the group will also hear sensitive and confidential information (Kitzinger, 1995).

6.4.3 Structuring data collection instruments

Qualitative data collection of programme evaluations is structured to some extent. It is very unusual to conduct interview without at least a general agenda of topics. Additional topics can be anticipated during interviews;

however, interviews are focused and semi-structured because of time and financial constrains.

Qualitative data collection instruments generally use open-ended questions, in contrast to quantitative surveys, which typically use predetermined closed-ended questions. In March 2010, six interview guides were developed for the six stakeholder groups; Ministry of Health, Civil Emergency Response, National Public Health Authority, Subnational Government, Healthcare Workers. However, the questions being asked were tailored according to the stakeholder group. These interview guides were therefore semi-structured with a good deal of flexibility and were derived from the available literature, they were subdivided mainly into four sections, section A consists of a set of questions about the planning process, section B is regarding implementation of the pandemic activities prior to pandemic, section C is about the use of the plan before the pandemic and finally section D explores the reflection on what could have been done differently in the planning phase. The full set of interview guides is provided in appendix B.

Before and after each country visit there was a briefing and debriefing respectively. During the briefing sessions, the team presented the study objectives, expected outcomes, why participants were selected, voluntary participation, confidentiality of the results, recording interviews, as well as promised to organise a workshop to get stakeholders' input and endorsement. The research team allowed for stakeholders to raise questions and all were answered professionally. Finally, participants were asked to fill in the role

profile forms that implied their consent to participate. A copy of the role profile from is included in the appendix F.

6.4.4 Information gathering before country visit

Information was obtained in two stages: before the country visits and during the visits. Before each country visit, the team of interviewers assessed the entire available national, regional and other pandemic plans and associated guidelines. These included collection of relevant documents developed as part of pandemic preparedness activities and documents developed after the start of pandemic 2009. Interviewers therefore became familiar with the documents and guidelines prior to the interviews. Moreover, during the data analysis step, these documents helped the researcher to construct ideas in relation to pandemic planning and preparedness and to understand the setting where these activities were planned and implemented. The stakeholders were also asked to answer a set of selected questions prior to being interviewed. They were asked to provide the following information by email:

1. A description of three successes and three challenges in pandemic preparedness activities Description of five key tasks/responsibilities for stakeholders at national, regional and local level during planning process and five key tasks/responsibilities in the response to the influenza A (H1N1) pandemic in 2009.

2. Key pandemic preparedness activities documents available at the start of the influenza A (H1N1) pandemic in 2009, as well as any document developed by stakeholders after the start of the pandemic.

6.4.5 The pilot study

Denmark, which hosts the WHO Regional Office, unilaterally agreed to act as a pilot country. University of Nottingham and WHO regional office for Europe staff as a collaborating team visited Copenhagen in the period from 27th April to 29th April 2010. The team interviewed five groups of stakeholders from the Ministry of Health, National Board of Health, regional tier, primary and secondary health care workers. Stakeholders responsible for civil emergency preparedness DEMA (Danish Emergency Management Agency) declined participation in the study because of staff unavailability as the agency was conducting an emergency response exercise during the time of visit in April 2010

6.4.5.1 Preparations before the interviews

1. The team had frequent and prolonged meetings to discuss the six interview guides and went through them one by one to agree on the final format of the questions. A good input was received from a colleague from the DPR (disaster preparedness and response). Some questions were left to be tested during the interviews to see their appropriateness.

2. The team discussed the role of each member in the interviews and who will meet whom and the role of each one during the interviews.

3. There was no briefing session on the morning of the 27th April due to staff unavailability. The briefing session aims to present the objectives, rational and expected outcomes.

4. The audio recorders were tested to make sure they work properly.

6.4.5.2 Interview analysis

Five interviews were performed with the ministry of health (MOH) and National Board of Health that represent the national public health authority in Denmark (NPHA), subnational government tier (SNG), primary and secondary healthcare workers (HCW). Two interviews were done in parallel (NPHA and secondary healthcare workers). The primary healthcare workers interview was done by phone. MOH interview took 60 min (the ministry was not able to provide 2 hours), NPHA lasted for 110 min, SNG was the longest one taking 120 min and both the primary and secondary healthcare interviews took about 60 min.

Wording of some questions needed revision as well as some questions were removed and some were added. Section B was the most problematic section during the interviews as stakeholders did not understand the concept of implementing planning activities before pandemic and it took some time to explain to them what meant by implementing pandemic activities before pandemic and particular example were given to promote their answers such as antiviral drugs stockpiling, advance vaccine purchase agreements and seasonal influenza surveillance.

6.4.5.3 Post interviews

1. The team met after each interview to plan for the final report presentation (debriefing). There was an agreement to present four slides as per sections of

the interview guides. Each slide represented key messages/ recurrent themes identified or the most important outcome from all interviews.

2. Team leader debriefed the main findings in a professional way and highlighted the main finding, which came out from all interviews. Comments from the participants were received and the discussion went as planned. All comments were taken into account and were discussed later on.

3. All the audio files were stored in a safe folder preparing for the transcription.

4. The team thanked the stakeholders for their time and hospitality and promised to invite them to a workshop to present the final aggregated report.

5. Next step was to refine the interview guides before the next mission to Germany.

The interview guides after the pilot study in Denmark were re-evaluated and edited. As the methodology was tested in Denmark, the input was fed into the multi-sectoral interview guides. It was a post-hoc decision to include the findings from Denmark in the findings due to the high quality of data obtained during the interviews.

Last but not least, the researcher prepared a Standard Operating Procedure (SOP) document, which helped interviewers to follow during the interviews as attached in the appendix D.

6.5 Data analysis

6.5.1 Data transcription

Following each country visit, the recorded audio files were transcribed word for word and then later word-processed. A number of WHO interns, research assistants, and the researcher participated in the transcription process that was a very time consuming process. The researcher prepared a Standard Operating Procedure for transcribing audio file for the transcribers to use to assist them in the process. Afterwards, the researcher double checked audiotapes cross the transcripts to make sure that they were precisely transcribed to protect the meanings of stakeholders' answers. Each single interview file was printed and stored as a backup in addition to the electronic copies. The 90 hours of information took around 350 hours of transcription as well as extra time to double check the accuracy of the transcripts.

6.5.2 Organizing data

NVivo software was used to facilitate the data coding process. This includes organizing and labelling data into themes and subthemes. NVivo is very useful in organizing the text and managing the coding process. It allows the search for conflicting statements in order to protect against data misunderstanding (NVivo, 2008).

Interview texts were imported into NVivo for analysis after editing and formatting the transcripts. Data analysis implicated searching for concepts and attempting to investigate similarities and differences in addition to seek for understanding the relationship and connection between them. These concepts are called 'nodes' that allow the researcher to organize similar

information in one space and relate them to other information. Concepts that are unique and irrelevant to other facts can be put in ‘free nodes’, while text that is relevant to each other in certain way can be structured in hierarchy of ‘tree nodes’. Data coding is a continuous and iterative process that allows the transformation of free nodes into tree nodes and vice versa.

6.5.3 Data coding

Data analysis was driven by the research objectives which highlighted topics to be investigated which included description of pandemic planning activities, describing major successes, breakdowns, areas of improvement and expectation from WHO for future pandemic planning. An inductive approach is compatible with qualitative evaluation methodology and was used to code data in this project. This means that findings emerged directly from analysing raw data as well as it was influenced by research objectives without prior assumptions or hypotheses. Inductive approach is useful to explore inter-dependent and complex aspects of health programmes and can be used to generate hypotheses, which can be tested later by deductive-quantitative approach. Once the text has been ready for analysis, the raw text has been read in detail for multiple times until the researcher was familiar with the content and his understanding was increased in relation to data content. Most of the upper-level or more general themes were derived from evaluation aims and objectives. However, the more specific themes were identified from multiple readings of the raw data when recurrent regularities appeared in the data. Similar text that is identified similar to each other was organized into

distinct categories and subsequently under subthemes and themes. For example, initially electronic plan dissemination was set as a free node but later on the researcher identified that there are many ways of pandemic plan communication which then set as sub-categories for plan dissemination which included electronic, postal, seminars and posters.

Finally the conceptual framework emerged and the researcher kept reviewing the text to ensure that all relevant texts were assigned to their corresponding category.

6.6 Credibility of the findings

The World health Organization regional office for Europe, invited all the countries that agreed to participate in this study to a workshop to discuss the findings of the evaluation and to get countries endorsement before publishing the final report (The purpose and scope for this workshop is attached in Appendix D). The researcher travelled to Denmark and stayed at WHO office in Copenhagen for two weeks to prepare for the event which was held in the period between 20th and 22nd October, 2010. Participants and other experts who may have special interest in pandemic preparedness and response were sent the final draft of evaluation report to comment on or assess its findings, interpretations and conclusion. During the workshop stakeholders' delegates were asked if the major themes and subthemes are related to their personal experience and if they have any comments and concerns regarding the evaluation findings. Finally, the endorsed findings were published on WHO

Europe website as “Recommendations for Good Practice in Pandemic Preparedness” (WHO Europe and University of Nottingham, 2010).

6.7 Ethics

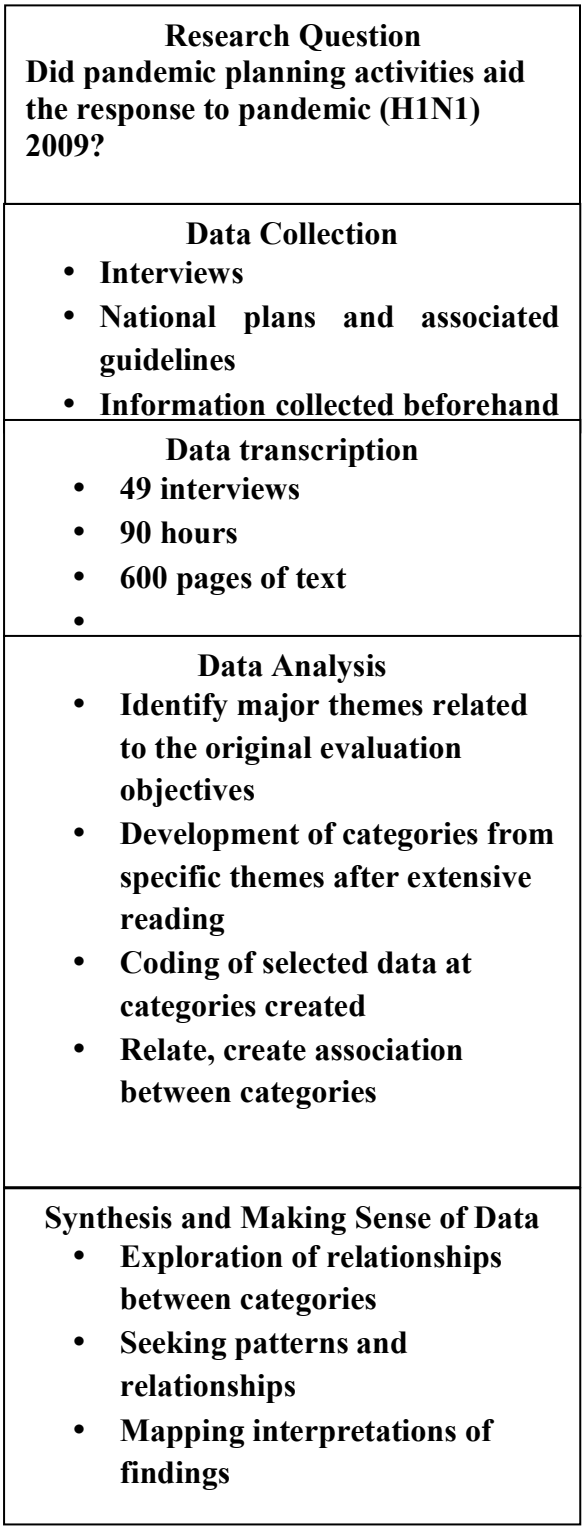
This work was a service evaluation, to determine how useful the pandemic preparedness activities driven by WHO had been in preparing countries for the 2009 pandemic. Interviewees provided information as part of their official roles; they were nominated to take part by their respective governments, in their capacity as government officials/employee and not as patients or volunteers. Here is a quote form the NHS Health Research Authority website “….where a project is considered to be solely audit or service/therapy evaluation, it will not be managed as research within the NHS or social care. Such projects do not require ethical review by a NHS or Social Care Research Ethics Committee or management permission through the NHS R&D office. Under these circumstances, there is no need to submit applications to the NHS Research Ethics Committee (REC) or NHS/HSC R&D office” (NHS Health Research Authority website, n.d.). As such, the study protocol lies outside the scope of institutional review board consideration. An official letter from WHO Regional Office for Europe confirming that the project was a service evaluation is attached in Appendix G.

6.8 Summary and conclusion

The chapter went over the main points of the methods used in this study. It started by highlighting the notion of qualitative evaluation as well as the significance of inductive approach concept in this kind of evaluation. It also

described the selection of the study participants; interview guides development and data collection methods. Towards its end, it illustrated how data were collected and analysed. The findings of the analysis are presented in the next chapter.

Figure 2 Qualitative data analysis flow chart



Chapter 7: Findings

7.1 Introduction

The aim of this chapter is to describe the characteristics of the study participants and the nature of country visits. Subsequently, the findings identified from the stakeholders at different administrative levels are presented. This evaluation identified six thematic domains that shape pandemic preparedness and planning and influence the usefulness of planning activities across countries. These major themes were further subjected to thematic analysis to form subthemes that built the conceptual framework mentioned in the previous chapter. The major themes emerged were: communication, coordination, capacity building, mutual support, leadership, and adaptability and flexibility.

7.1.1 Characteristics of study participants

The study team interviewers interviewed six stakeholder groups across the seven countries independently. These were: Ministry of Health (MOH), Civil Emergency Response (CER), National Public Health Authority (NPHA), Subnational Government authority (SNGA), primary healthcare workers (primary HCWs), and secondary healthcare workers (secondary HCWs). Table 2 illustrates the stakeholders' group numbers by participating countries. The study team interviewed 177 stakeholders in all the participating countries. All interviews were focus group interviews but we conducted three personal interviews due to staff unavailability in two countries. The number

of participants per country ranged from 17 to 32 and group size ranged from 1 to 8 across the countries.

Table 2 Stakeholders group numbers by participating countries

Country	MOH	NPHA	CER	SNGA	Primary HCW	Secondary HCW
Armenia	5	7	6	4	7	3
Bosnia	4	6	6	4	6	4
Denmark	1	6	-	8	1	1
Germany	5	6	3	4	3	2
Portugal	5	7	7	4	5	2
Switzerland	5	6	2	4	5	4
Uzbekistan	5	1	3	4	1	5
Total	30	40	27	31	28	21

Table 3 Background information by stakeholder group

Stakeholder	No.	Age Range	Job title (number)
MOH	30	34-63	Director General 6, National Epidemiologist 5, Virologist 7, National Influenza Centre 5, Drug regulatory authority 4, experts in animal influenza viruses 3
NPHA	40	36-48	Epidemiologists10, Virologists 8, veterinary authorities 5, Public health doctors 7, influenza planning experts 6, Vaccine logistics advisor 1, press spokesman 2
CER	27	28-55	Military services 12, Ministry of interior 7, Civil Emergency specialists 8
SNG	31	41-57	Regional government officials 12, Regional planning directors 8, Regional drug authority 3, Pharmacists 5, Regional academic advisors 3
Primary HCW	28	29-53	General practitioners 24, representatives of physicians' associations 4
Secondary HCW	21	33-61	Infectious disease specialists 6, Hospital directors 5, Nurses 4, Hospital lab director 5, paediatrician 1

Table 3 shows the attributes of the study participants by stakeholder group. It gives the number of participants per each stakeholder group, their age range, and job title as per the role profile forms filled in before the interviews. The highest number of stakeholders was that of NPHA with 40 while the lowest was secondary HCWs with only 21 participants. The participants were from different professional backgrounds including academic and technical positions, civil emergence response personnel, government senior officials, clinical staff, and other policy makers involved in pandemic planning and preparedness process.

7.1.2 Country visits

Seven country visits were conducted over a period of 8 weeks from April 27th to July 1st 2010 as shown in table 4. It is important to mention that each country visit lasted for three days with three to four members of the team participating in each visit. The team made sure that at least one of the contributors to the study design and methodology to be present in all of the seven country visits to ensure consistency and make sure that all audio recorders to be checked and collected after interviews, role profile forms to be collected before leaving, and to answer all queries during each visit. Interviewers were drawn from the University of Nottingham, WHO Regional Office for Europe, European Centre for Disease Prevention and Control, and experts from Member States. English language was used in the interviews in four countries, Russian was used in Uzbekistan and Armenia and the local language was used in Bosnia and Herzegovina. Consecutive translation was the method used during the interviews in non-English-speaking countries.

Non-English interviews were translated and transcribed by the translators themselves. Afterwards, the researcher double-checked audiotapes cross the transcripts to make sure that they were precisely transcribed to protect the meanings of stakeholders' answers. Subsequently, raw data files consisting of transcripts of the recorded interviews were prepared and cleaned; transcripts from 41 interviews constituting 90 hours of information which resulted in around 600 pages of text which were formatted into common content structures.

Table 4 Timetable of country visits

Country	**Dates**	Interviewers	**Language**
Denmark	27-29 April 2010	Ahmed Hashim, Jonathan Van-Tam, Caroline Brown, Michala Hegermann-Lindencrone	English
Germany	25-27 May 2010	Ahmed Hashim, Peet Tüll, Caroline Brown, Thomas Hofmann	English
Switzerland	8-9 June 2010	Ahmed Hashim, Peet Tul, Caroline Brown, Un-Yeong Go	English
Portugal	8-9 June 2010	Jonathan Van-Tam, Jo Newstead, Pasi Penttinen, Ana Paula Coutinho	English
Bosnia and Herzegovina	23-24 June 2010	Caroline Brown, Peet Tul	Local Language
Armenia	21-24 June 2010	Ahmed Hashim, Liana Martirosyan, Irina Papieva	Russian
Uzbekistan	29June-1 July 2010	Ahmed Hashim, Peet Tul, Mark Witschi, Dmitriy Pereyaslov,	Russian

7.2 Theme one: Communication

Communication was the most recurring theme during the interviews across all levels in all countries. This is mainly due to the high importance of communication in managing infectious disease outbreaks. Precise, appropriate and multi-levelled information was vital in order to minimize unwanted and unforeseen social, inter-organisational and intra-organisational disruptions, and economic consequences associated with the pandemic.

It is important to mention that stakeholders' quotes presented here are rephrased, when appropriate, in order to protect the confidentiality of the participants.

7.2.1 Multi-sectoral participatory planning

7.2.1.1 Participatory planning at national level

"I want to add that a working group was created to develop the plan, including epidemiologists from NPHA, virologists, representatives from the Ministry of Agriculture, CER, and SNGA", commented an MOH stakeholder, category A.

"It was a joint effort between the SNGA and the NPHA. We worked through monthly meetings and even more frequently if necessary", commented a SNGA stakeholder, category A.

''Did you participate in the national planning for pandemic influenza? No, it was done at a national level'', commented a SNGA, category B.

"But did MOH send you the plan for comments or feedback? A: No, only the final version was provided to us when pandemic preparations started", commented a SNGA, category C.

Category A countries reported that their pandemic planning committees involved a wide range of central and sub-national representatives, including healthcare workers, actively participated and communicated with each other during the planning process. Moreover, epidemiologists, virologists, expert groups, and other public health officials supported the pandemic planning process. These multi-sector activities were also maintained throughout the implementation and response phases of the 2009 pandemic. In contrast, countries in categories B and C reported less participation of SNGA stakeholders in the planning process at the national level.

7.2.1.2 Intra-communication channels

"The plan was developed and it was done together with (diverse) stakeholders, and we had continuous meetings, on a regular basis, weekly, to get everyone on-board", commented an MOH stakeholder, category A.

"We used different ways of communication including emails, correspondence, telephone communication, and direct presentation on the TV. What was the frequency of your meetings? We met twice in the past two years", commented a NPHA, category B.

"*The national pandemic planning committee used to meet once a year before the pandemic but after the pandemic we started meeting more frequently to cope with things", commented an MOH stakeholder, category C.*

Stakeholders interviewed at the national level in category A countries reported that participatory planning meetings were an important success factor during the planning process before the pandemic. They reported a

variety of means of communication during the planning process; these included regular face-to-face meetings, round-table discussions, teleconferences, workshops, seminars, conferences and videoconferences. On the other hand, countries in category B and C reported less frequent meetings. The meetings were reported to be an opportunity to meet each other and to discuss roles and responsibilities during the planning and response phases.

7.2.1.3 Participatory planning for non-health sector

"It is impossible to make a local contingency plan without other stakeholders input, like airport authority, port authority, airlines and so on. This is very important for us", commented the Head of CER, category B.

Countries across all categories reported that CER and other relevant stakeholders participated in writing up and implementing the non-health sector plan before the pandemic. Category B countries reported that inter-minstrel panels from the MOH, Ministry of Interior, Ministry of Transport, Ministry of Agriculture and Ministry of Education were formed and had regular multi-sectorial meetings.

7.2.1.4 Participatory planning at sub-national level

"We collaborated with our partners at the NPHA and MOH. We worked through regular meetings", commented a SNGA stakeholder, category A.

"So, actually, this plan was developed with the participation of different physicians from the region, epidemiologists, infectious diseases specialists, immunologists, paediatricians, and representatives of NPHA", commented a SNGA, category B.

Sub-national plans were developed across regions in all categories prior to influenza A (H1N1) pandemic in 2009. Sub-national planning committees with various multi-sectoral representations developed these plans. Coordination activities and meetings were held on a regular basis at sub-national level with direct support and follow up from national stakeholders, facilitated by effective upward communication and channels for feedback.

7.2.2 Plan dissemination channels and target groups

7.2.2.1 The national plan

"The plan was placed on the MOH website. In addition we have an official bulletin where we publish all new government decrees, laws and other legal acts. We have distributed the plan by mail to public health units in regions. It was provided to all managers who were responsible for organization of health response activities. Was it disseminated to the non-health sector? Answer: No", commented NPHA, category C.

"NPHA published the plan on their website and of course it was sent directly by mail to municipalities, primary and secondary health care, and non-health institutions", commented an NPHA stakeholder, category B.

" We distributed the national pandemic plan to all health professionals by email and this was an effective way to reach our healthcare providers. However, in rural areas most physicians do not have Internet connection and this was a big concern," commented a NPHA stakeholder, category C.

Countries in categories A and B reported disseminating their national pandemic plans and other associated policy documents to all health and non-

health stakeholders involved in the planning and response via national influenza pandemic web sites. National plans were also actively disseminated through e-mail and regular mail during their development and implementation. The targeted groups were primarily comprised of the following: sub-national government, primary and secondary healthcare settings and non-health institutions. In contrast, category C countries distributed their plans to the health sector only.

7.2.2.2 Non-health sector plan

"Emergency planning checklists were sent to police, fire departments, and airports", commented a CER stakeholder, category A.

"We sent information to all schools and kindergartens as well as public and private business," commented a CER stakeholder, category B.

"Q: Did you support BCP in businesses and private sector in your jurisdiction? A: No, they were supposed to do the work themselves and if they need support we can give our advice", commented a CER stakeholder, category C.

During the planning process, the non-health sector business continuity plan was actively disseminated to sub-national authorities, airports, small and medium enterprises, public and private businesses, schools and non-governmental organizations by countries in all categories via email or post. However, category C countries reported no dissemination of BCP as this was to be done within businesses independently. National decrees, regular meetings, public awareness, human resource and financial support were

reported to be facilitating the development and implementation of business continuity plans in all countries.

7.2.2.3 The distribution of the sub-national plan and related guidelines

"*Everything was disseminated to all health facilities primary and secondary via our regional website as well as holding several meetings with the media representative in our region", commented a SNGA, category B.*

"The plan for our region was disseminated mainly to health institutions and we realized later that this had to go beyond the health sector to include some of non-health institutions", commented SNGA category C.

"We relied on passive dissemination via our websites but we needed to do more outreach communication by meeting people", commented SNGA category C.

Sub-national authorities communicated with relevant stakeholders at the local level; these included primary and secondary healthcare workers, local public health units and representative of the national government in each region. In addition, the sub-national authorities in category A and B countries sent their plan to both health and non-health institutions including the public, the media, and scientific, political, religious and academic organizations via film, reports, bulletins and other publications. On the other hand, sub-national authorities of countries in category C disseminated their plans and guidelines locally to health institutions only; including primary and secondary healthcare professionals and various specialized medical facilities. Channels used for disseminating the sub-national plan were both active and passive ways of

communication. Active channels were mainly email, mail, telephone, official letters, regular meetings and workshops.

7.2.3 Useful actions for effective communication

7.2.3.1 Communication with the public during the implementation phase

"We distributed a number of booklets and flyers with videos on prevention of flu and we highlighted the importance of hand wash in reducing the spread of flu", commented an NPHA official, category A.

"We provided good media coverage even before pandemic. Our purpose was to ensure that every citizen knows about influenza in terms of symptoms, spread, and prevention", commented primary HCW, category C.

Specific factors considered to have facilitated the implementation of the pandemic planning activities before the pandemic; this included raising public awareness through pandemic-related television programmes and campaigns, which were reported to have increased awareness among the public during the response.

7.2.3.2 Communication with the public during the response

"We communicated with the public regarding self isolation and hygiene measures and how to avoid spreading this disease. NPHA established a national call centre that can be used by the public to get information", commented primary HCW, category B.

"How did you as NPHA ensure consistency of information provided to the public? A: In the initial period I personally gave three press conferences, radio, TV live programmes, and information clip. We had a communication

plan since the time of avian influenza. Spokespersons were identified in the plan", commented a NPHA stakeholder, category C.

***"**We had predetermined spokesperson in our office to speak to public during crises, we did not allow anyone to speak to the public, the words should have weight, so it should be a representative of the NPHA, people with knowledge, position and respect", commented NPHA, category C.*

All countries reported that communication with the public was a useful pandemic preparedness practices during response. Stakeholders commented that educating the public about pandemic influenza symptoms and personal hygiene was essential to raise public awareness during the response. Communication activities were implemented through media campaigns; such as the distribution of flyers and posters in hospitals and primary health clinic, giving press conferences, and national call centres. This was all done to ensure the consistency of message to the public.

7.2.3.3 Communication with healthcare professionals

"We faxed information to our physicians, hospitals, and emergency rooms with all relevant information. In addition, we posted updates on staff intranet with clinical guidelines", commented NPHA, category A.

"There was a line specific for flu. It was a special one, because our chief medical officer believes that it was crucial to have a line for educating professionals", commented secondary HCW, category B.

"We provided our staff with Questions and Answers document before the pandemic and we updated it during the pandemic and it was useful in

reducing confusion among HCWs in our region", commented a SNGA, category B.

Two countries in category B designed hotlines for healthcare professionals in order to guide them during the response regarding case definition and clinical management protocols. Stakeholders from these countries mentioned that influenza lines were very effective way to guide healthcare doctors regarding management of patients during the response. Other countries used email contact lists, faxed information, intranet, and Q and A documents as way of communication with HCW during the pandemic.

7.2.3.4 Feedback communication channels in place

"Sub-national and national experts were listening, we could call or email if something needed changing," commented primary HCW, category A.

"No specific channels for feedback. Authorities tried to formalize but did not work, so mainly informal", commented secondary HCW, category B.

"We were not asked to give our input both before and during the pandemic. I personally faced challenges regarding clinical management of hospitalized patients. It was a mess", commented secondary HCW, category C.

Countries in category A and B mentioned having formal and informal upward communication systems in place for feeding back issues and suggestions from the frontline health workers to the sub-national and national authorities. These communication channels allowed comments and suggestions to be fed into national and sub-national planning revisions and updates. While category C

countries demonstrated the lack of such channels both formally and informally.

7.2.4 Areas of under planning and communication difficulties encountered

7.2.4.1 Communication difficulties with primary healthcare professionals during preparedness and response phases

"Were you involved in the development of the national pandemic plan? A: No, neither I nor other doctors did participate in the development of pandemic plans; we are the implementers", commented a primary HCW, category A.

"Q: your input in the regional and national plans was minimal? A: Yes mainly it came from top to us. And then the regional adapted from the national and the local adapted from the regional. It was that way", commented a secondary HCW, category B.

"This was done at high level and doctors in our region and other regions as far as I know were not consulted", commented a secondary HCW, category B.

"In our region, primary HCWs are not familiar with the Internet and rarely use e-mails and we needed to increase their awareness during the response but that was not possible," commented a SNGA stakeholder, category C.

"We also missed part of the cooperation with the primary health care as we didn't have full contacts with those before the pandemic and we tried to set things up during the pandemic in our region. I don't know for the other

regions if they had planned enough regarding this", commented a SNGA stakeholder, category C.

While multi-sectoral participatory planning was considered to be highly effective, there was a consistently identified lack of primary care representatives' awareness or contribution of pandemic preparedness activities during pandemic planning, implementation and eventual response in all countries. This problem was reported at both national and subnational levels. Failed communication channels between primary care professionals and other regional and national levels contributed to this problem. Important communication channels such as the Internet, phone and e-mails were necessary for efficient and rapid delivery of information related to pandemic preparedness and response. However, in category C countries and certain category B countries, some primary HCWs lacked internet and e-mail access at work.

7.2.4.2 Poor communication with the media

"It didn't work very well with media I think. The media in general had different and conflicting information all the time, and this caused confusion to the public regarding vaccine safety and effectiveness. I think it is one of the reasons why vaccination rate went so low in our country", commented an NPHA official, category A.

" I think we at NPHA needed more media planning and training to respond and coordinate effectively with the media during crises environment", commented an NPHA stakeholder, category B.

"A coordination group during the implementation phase was required to bring media and health officials closer. We have to address this in the revised plan", commented a SNGA stakeholder, category B.

Category A and B countries signalled that their communication with the media did not work well during the response and a more comprehensive media planning should be incorporated into the wider communication plan. In addition, stakeholders from category A countries claimed that it is essential to establish a coordinating group during the implementing phase to facilitate the communication with the media and ensure consistent messages during the response phase. Countries underestimated the impact of media on the population and the negative consequence of some of its misleading messages on the vaccine uptake rates among the public.

7.2.4.3 Poor communication between healthcare providers

"Primary HCWs in the region failed to provide the requested history data for patients with severe flu and were not responding to multiple requests made by our hospital HCWs," commented a secondary HCW, category B.

"We had formal communication channels between HCWs in our region but it was not functioning properly as we did not test them beforehand" commented a SNGA, category B.

Category B countries mentioned that poor communication was recognised during the response between secondary and primary healthcare workers since primary healthcare workers failed to provide requested clinical information to hospitals upon referral. Communication channels between HCWs should be

testes regularly as mentioned by SNGA stakeholder. No data available for category A and C countries.

7.2.4.4 Under planning for risk communication with healthcare workers

"We faced many difficulties regarding how to convince hospital personnel to get the vaccine. We at the office discussed how we communicate the risks and the benefits of the vaccine. We tried to put some pressure on them to do this", commented an MOH stakeholder, category A.

Communication during pandemic with healthcare workers was challenging because of the uncertainties associated with the novel virus and its severity. There was a big demand from our HCWs for information and updates", commented a NPHA stakeholder, category B.

"Our physicians required a better risk communication and education regarding the importance of wearing personal protective measures while caring for flu patients", commented a SNGA, category C.

Healthcare workers in countries across all categories reported deficiencies in the risk communication process between the national and sub-national authorities and healthcare workers regarding vaccine safety and the importance of wearing masks. Stakeholders commented that this have had negative consequences, for example, the vaccine acceptance rates among HCWs were quite low in most of the countries surveyed.

7.3 Theme two: Coordination

The second most recurring theme reported by stakeholders was coordination. It was a fundamental component of pandemic planning activities in order to enable vibrant and timely decisions; coordination is required for a uniformed action plan or policy to be implemented efficiently by all stakeholders involved in pandemic planning and preparedness activities. Best pandemic response outcomes can be envisaged when essential activities are coordinated in a seamless fashion through effective communication, leadership and support. Certain preparedness activities were considered to be useful and can have a great impact on pandemic preparedness through effective coordination between various sectors and stakeholders prior to and during a pandemic. The below-mentioned key sub-themes were considered to have a great impact on coordination prior to and during the pandemic.

7.3.1 Timelines of coordinated pandemic planning activities

7.3.1.1 National pandemic planning activities

"The real process started in 2001. The draft of the plan was there in 2004. It was discussed for roughly a year with different committees at sub-national level. It was finally published in 2005", commented an MOH stakeholder, category A.

"Pandemic planning activities started in 2007 (2--3 years before H1N1 pandemic in 2009) and was published in early 2009", commented a NPHA stakeholder, category C.

Organized and coordinated pandemic planning activities commenced in the period between 1995 and 2001 in category A countries and two category B

countries while they were initiated at later stage, in the period between 2005 and 2007, in the other countries. These activities were finalised between 2005 and 2007 in countries that started their planning process at earlier stage compared to 2009 for countries that started their pandemic planning at later date.

7.3.1.2 Non-health sector planning activities

"Influenza emergency preparedness in private sector started in late 2006 after consultations with national and subnational health authorities", commented a CER stakeholder, category A.

"The plan was published and sent out to people in late 2008", commented a CER stakeholder, category A.

"The emergency planning committee met in 2008 to start the process and we disseminated the plan in 2009, just before the pandemic hit our country", commented a CER stakeholder, category B.

"We initiated our coordinated activities to develop a non-health pandemic plan in January 2009, and we finalised it in October of the same year", commented a CER" stakeholder, category C.

The non-health sector pandemic preparedness activities were initiated in 2006 by a category A country and two category B countries, in 2008 by a category A country and a category B country, and during the start of 2009 by category C countries. These activities were finalised in late 2008 for countries which started in 2006 while countries which started their planning in 2008 finished

in early 2009. However, countries in category C did not finish their planning when the pandemic unfolded in March 2009.

7.3.1.3 Sub-national planning activities

" We used to do things independently since we started in 2006 and people in ministry supported us financially and technically but they were not involved directly with our processes," commented a SNGA, category A.

"Sub-national pandemic planning activities were initiated in 2006 when WHO asked countries to plan and were finalized in 2008 July," commented an MOH stakeholder, category B.

"We started sub-national preparedness in late 2006 and we had many meetings with the officials in our MOH and NPHA to give them updates about the progress and they visited our region to follow up on the implementation of different activities", commented a SNGA, category C.

Sub-national pandemic planning activities started since 2006 and were finalised before 2009 in six countries. Only a category C country did not finalise their sub-national pandemic planning activities before March 2009 (prior to the pandemic). In some category B and C countries, the national health authorities were following up with regions to make sure that things are in progress. In category A countries, planning was more independent and national authorities supported local activities financially and technically.

7.3.2 Useful coordination activities

7.3.2.1 Command and control structure

"Having a clear command structure during the preparedness phases was very instrumental for the response itself. It assisted stakeholders understanding roles and responsibilities of each other. Preparing for this in advance will save us the hassle later in the response", commented a NPHA stakeholder, category A.

"The plan was a priority document as it defines who is supposed to do what. It coordinated everybody's activities all over the country. Actually any activity, pandemic or different, needs to be arranged like that", commented a MOH stakeholder, category B.

"Because our plans are mainly based to respond to avian influenza outbreaks, we did not plan the command structure between health and other emergency sectors", commented a NPHA stakeholder, category C.

Category A and B countries mentioned that having a clear command and control is crucial during the planning process since numerous stakeholders and institutions are involved in the pandemic preparedness and management activities. This structure defines roles and responsibilities and will ensure effective and smooth coordination between different players during the response. While countries that based their planning activities on avian influenza did not plan outside health sector and they reported lack of command structure between health sectors and other non-health emergency stakeholders.

7.3.2.2 Coordination groups for implementation at the national level

"A special team was created, the so-called core implementation team to ensure proper implementation of pandemic plans at all times", commented an MOH stakeholder, category B.

Countries in categories A and B established a designated coordination group within the national level that was responsible for the implementation of pandemic preparedness activities. This group was responsible for defining the command and control structure, monitoring and following up the implementation of the national pandemic plan, and ensuring that the plan is active at all times. The presence of this group was not reported in category C countries

7.3.2.3 Coordination activities at the sub-national level

"A sub-national coordination board was created in 2007 chaired by the governor. It was called Board on Prevention and Fighting Avian Flu", commented a SNGA stakeholder, category B.

At the sub-national level, all countries had their own influenza-coordinating committees. Category C countries stated that more inter-regional coordination was needed for these committees to implement their pandemic plans better in order to achieve an even response. These committees facilitated multi-sectoral verbal discussions and played an important role in the development and implementation of the sub-national planning activities.

7.3.2.4 Coordination activities at the hospital level

"Broad representation of our hospital planning committee and expert input were essential in preparing our hospital, as well as the MOH follow up and legislations", commented a secondary HCW, category A.

"Reference hospitals were important to coordinate our efforts; it's impossible to have 80 hospitals prepared at the same time, but to have 3-4 and then other hospitals can follow", commented a NPHA, category B.

Countries across all categories mentioned that experts input, joint hospital planning efforts between the national level and individual hospitals, and frequent hospital meetings were very useful factors. In addition, a category A country stated that the binding legislations and decrees were very important factors to oblige hospitals to prepare for pandemic influenza. A category B country prepared a number of hospitals and called them reference hospitals.

7.3.3 Exercises related to pandemic preparedness

7.3.3.1 Exercises at the national level

"We did some exercises on directions of operations and how decisions would be made. It was quite important because we had to deal with the emergency stakeholders from other sectors and having them in the decision process would make our lives much easier during the response. We´ve been practising decisions on mass vaccinations, and taking notes of our experience during previous outbreaks", commented a MOH stakeholder, category A.

"In 2007, there were two table top exercises and in 2008 there was a field exercise with the involvement of all stakeholders, including agriculture,

epidemiology, emergency service and sub-national partners. It was obvious from 2007 exercises that the Ministry of Health and the Ministry of Agriculture did not cooperate well, so the exercise highlighted the importance of cooperation between agencies. The other lesson was that we need to have common knowledge, good communication, and well-organized information exchange channels," commented an NPHA stakeholder, category B.

"We were planning to conduct our first national pandemic exercise but unfortunately pandemic was earlier than what we all anticipated. Given the fact that pandemic was mild, we can consider it as a real life exercise. We learned many lessons that we are going to incorporate in our next version", commented an MOH stakeholder, category B.

Stakeholders from all the countries that participated in the study, except a category B country and category C countries, described undertaking exercises at the national. Specific elements of the pandemic plan related to communication systems and organizational structure were tested via table top, command post exercises, and field exercises. Lessons learned from these exercises were fed back into the pandemic plan as mentioned by the interviewees. These lessons include multi-stakeholder level consensus facilitation, adaptation of a good communication medium between stakeholders, and local and international coordination within and between countries.

7.3.3.2 Exercises related to non-health sector

"I was personally responsible to carry out these exercises and they had a scenario, when someone brought this infection from a neighbouring country. It was an exercise jointly with the Ministry of Emergency Situations, Ministry of Interior, and Ministry of Agriculture. We carried out two times this exercise at a national level in 2008 in link with the flu. I have a video of these exercises," commented a CER stakeholder, category B.

"We had two different exercises in the airport about having a flight coming in with patients with infectious disease and how would we had managed them, we thought that our plans were just right. And we learned and changed procedures and that was not only the health authorities but also together with the police", commented a CER stakeholder, category A.

The non-health sector plan was tested in exercises in all countries except two countries from category B and C. The Ministry of Sanitation, Ministry of Agriculture, MOH, Ministry of Transport, Ministry of Defence and police participated in these exercises. These exercises were based particularly on the scenario of avian influenza outbreak. Lessons learned from these exercises were incorporated into the plan; these comprised improved coordination between key stakeholders, proper planning for command structure, inter-sectoral cooperation, tackling weaknesses effectively, and defining required capacities for the implementation of the pandemic preparedness activities.

7.3.3.3 Exercises at the sub-national and hospital levels

"There was an exercise held in the region to test communication and command system; lessons were clear that there should be changes in command structure due to many problems perceived during the exercise", commented a SNGA stakeholder, category A.

"In our paediatric department we had exercises for nurses to explain their steps and how they have to work with parents of children and explain that the number of visits will be restricted. Each department of our hospital has such exercises", commented a secondary HCW, category C.

Category A countries participated in sub-national pandemic exercises, as a result of these pandemic exercises, command and organizational hierarchy proved to be underdeveloped as well as the organizational structure of quite a few departments required certain degree of modification. Hospitals in a number of countries conducted exercises and found them to be a useful preparatory activity.

7.3.4 Areas of under planning in terms of coordination

7.3.4.1 Vaccine procurement

"I would like one thing to happen in a different way, it was the question of vaccine. It was very sad that each country in Europe had its own politics and its own connection and contracts with companies. This was not the right way and it was the reason of some discredits, it was the politics within the vaccine process. And this is shame and this was the worst that happened during the pandemic. There were a lot of comparisons on TV; this country bought this

vaccine, this country did this and this country did that, countries can join, can choose together, they can have common contract with companies. Leadership and coordination was really needed", commented an NPHA stakeholder category A.

" Future contract agreements should be more flexible and should include sections about the possibility to change and return excess vaccines", commented an MOH stakeholder category A.

" We would like to see a joint procurement strategy coordination by WHO and ECDC as this will provide high access, low cost, and less variability across countries", commented a NPHA stakeholder category B.

Countries stated that planning for vaccine procurements was different across Europe before the pandemic and coordinated procurement strategies should be adopted in the future to achieve a better coordination of activities and to ensure universal access to vaccine across Europe. Joint contracts with pharmaceutical companies were mentioned to be a good solution to bridge this gap.

7.3.4.2 Vaccine logistics

"A lot of planning in logistics was completely given as a responsibility to the sub-national authorities, we would try now to have a more comprehensive and a much more centralized approach, obviously we delegated too much to the districts," commented a CER stakeholder, category A.

" More robust operational planning for vaccine logistics was required before the pandemic. We had long discussions during the pandemic regarding

vaccine distribution, transportation, syringes and we were not sure about who was supposed to do what. It was tough to be honest with you," commented a NPHA stakeholder, category B.

Category A countries mentioned problems in planning for vaccine logistics of distribution and delivery across their sub-national regions. They reported that the process needed to be more centralized and comprehensive as there was confusion as where the responsibility of national government stops and when regions start their authority. Two category B countries reported the need for a more comprehensive vaccination planning before the pandemic to reduce the chaos during the response.

7.4 Theme three: Capacity Building

The third major theme emerged from the interview was capacity building. Multiple capacity facets need to be assessed and addressed prior to a pandemic and monitored during the response in order to properly plan useful pandemic preparedness activities and to achieve effective pandemic response goals, respectively. Financial, equipment, medicine and human resource capacities were particularly needed to increase pandemic preparedness efficiency. Activities related to capacity building before the pandemic were considered important to respond adequately to a pandemic. These were further analysed into four subcategories:

7.4.1 Training as a useful activity before pandemic

All countries reported that staff training was a crucial pre-pandemic requirement. This training was specific to a generally low baseline knowledge concerning potential differences between pandemic and seasonal influenza.

7.4.1.1 Staff training on laboratory diagnostics

"We trained our virologists on diagnostic techniques including virus isolation in cell culture and rt-PCR. In addition, we trained them on types of specimens, transportation, and disinfection practices, and antiviral sensitivity screening to detect resistant strains", commented a SNGA stakeholder, category A.

"We renovated three laboratories, purchased equipment (some were donated), and then we started training our virologists. Although they have good experience, the virologists from regions did not have expertise concerning PCR technique. Therefore, the virologists had several PCR and biosafety trainings, and the trainings courses were conducted several times to provide the sufficient knowledge", commented a secondary HCW, category C.

Training on laboratory diagnostic techniques was mentioned to be crucial pandemic preparedness activity for all countries. These activities were performed to build hospitals capacity regarding influenza virus laboratory confirmation, antiviral sensitivity, and laboratory surveillance reporting networks.

7.4.1.2 Healthcare workers training

"By March 2006 the sub-national health administration at the central part of the country began a training course in order to provide training and technical guidelines to health care workers, clinical and non-clinical staff. We provided the core training and clinical guidelines to more than 1000 health care workers during 2006-2007", commented SNGA stakeholder, category B

"Our MOH conducted staff awareness campaigns to educate us on the basic differences between seasonal and pandemic influenza, use of antiviral medication as treatment and prophylaxis, infection control practices in outbreak setting, and ethical considerations", commented secondary HCW stakeholder, category C.

Sub-national authorities in all countries realised the importance of healthcare workers training on case definition, clinical management, and the use of pharmaceutical measures. Sub-national authorities with the support from national government and the World Health Organization provided training sessions and clinical management guidelines to primary and secondary healthcare workers to increase their capacity to diagnose and treat pandemic influenza.

7.4.1.3 Training on business continuity planning

"We have a colleague who is on vacation now, she spent a lot of time going to companies to make informative sessions, education sessions, to help them

to make their own contingency plans," commented a CER stakeholder, category B.

"We at CER recognised the differences between influenza pandemic and other types of disasters. We trained our clients on the importance of having a BCP and about the importance of testing and updating it regularly. We focused on the complexity of pandemic influenza and how this should be addressed during the planning and response stages. We trained staff on the importance of identifying key personnel and the significance of staff resilience during health emergences", commented a CER stakeholder, category A.

National authorities organized training sessions on non-health sector planning in companies and other businesses to assist them in their pandemic planning activities. A category B country organized regular visits to small and medium enterprises to monitor their pandemic planning progress and gave some input and feedback regarding their performance. Category A countries raised staff awareness regarding BCP and how this should work before and during influenza pandemic.

7.4.2 Useful activities implemented before the pandemic

7.4.2.1 Surveillance as an important infrastructure

"We have a comprehensive system of influenza surveillance. We use data from a variety of sources such as primary healthcare physicians, emergency rooms, national and local labs, and hospital data on mortality and morbidity. Seasonal influenza in our country forms the basis for pandemic influenza.

However, during the pandemic we used the same system; though the objectives were different. Therefore, we did not get data on time and we missed important information too. We needed to establish a flexible system that can be adapted according to the situation", commented a NPHA stakeholders, category A.

"Surveillance system was used to detect and monitor new cases of pandemic. Next time we would collect less but more comprehensive data important for policy and decision makers", commented a SNGA stakeholders, category B.

"In January 2009, we established a sentinel surveillance system in three regions in our country. The sentinel surveillance system works fully in two regions now. In addition, the lab in the third region will start working soon. So currently we have one in north and one in south, "commented an MOH stakeholder, category C.

National authorities in all seven countries identified surveillance of seasonal influenza as a basic capacity building activity to detect and monitor healthcare burden of pandemic influenza. This means that having a well organized and efficient surveillance system in place for seasonal influenza will assist to respond to future pandemics. Category A and B countries reported that a more flexible surveillance system was needed before the pandemic to allow for timey and accurate data collection.

7.4.2.2 Antivirals, antibiotics and personal protective equipment (PPE)

"One of the most useful things we did before the 2009 pandemic was antiviral stockpiling. It could be used for treatment in secondary and primary care as

well as prophylaxis in the community. We devolved this to our SNGA but this needed to be more centralized in the future" commented an NPHA stakeholder, category A.

"We implemented certain activities at the national level before the pandemic such as antiviral and antibiotic stockpiling as well as personal protective equipment which helped us a lot during our response to pandemic influenza last year", commented an MOH stakeholder, category B.

" Antiviral, PPE, ventilators, oxygen tubes, and antibiotics stockpiles were useful activities before the pandemic because I can't imagine starting from scratch during the actual pandemic. Delivery systems did not work properly at the start of pandemic and there were significant delays and as you know antiviral need to be administrated within 48 hours to be most effective. We need to look at this in the next step", commented an MOH stakeholder, category C.

Antibiotics and PPE were distributed to national and sub-national medical centres and hospitals during the pandemic (H1N1) in 2009. Countries reported that antiviral stockpiling before the pandemic was a very useful action as these stockpiles are the only therapeutic and prophylactic measure against widespread infection since influenza vaccine production and distribution can take several months. Operational guidelines pertinent to antivirals distribution and delivery need to be addressed before the pandemic to ensure timely arrival to clients in hospitals and outpatient clinics.

7.4.2.3 Advance vaccine purchase agreements

"We were the first country in Europe to have an advance purchasing contract for a pandemic vaccine with the pharmaceutical companies in our country", commented an MOH stakeholder, category A.

"We initiated joint procurement agreements after the pandemic and this should be coordinated beforehand to ensure solidarity among member states", commented a NPHA stakeholder, category B.

"Our vaccination programme relied entirely on donations from donor governments and vaccine manufacturers", commented an MOH stakeholder, category C.

Acquirement of advanced vaccine agreements was considered to enhance the capacity for a good pandemic response because several months are needed before a pandemic vaccine become available and distributed to the global community. However, stakeholders stated that these contracts should have been more flexible and this need to be addressed in the revised plans. Less prepared countries reported reliance on donations from other countries and industry.

7.4.3 Useful actions for enhancing capacity building

7.4.3.1 Expert groups

"The most important thing is that we have expertise to plan and respond to outbreaks professionally. We built on years of experience gained from SARS and avian influenza preparedness and planning", commented an MOH stakeholder, category A.

"Our national pandemic committee was supported by a group of experts. This group gave us technical input and helped us review the scientific evidence of pandemic influenza", commented an MOH stakeholder, category B.

" Experts from MOH supported pandemic planning initiatives as part of their day to day duties and we did not have dedicated experts to help us. They were overwhelmed sometimes", commented a NPHA stakeholder, category C.

Expert groups were considered by all countries as an important asset to direct the process of capacity building during pandemic planning and preparedness period. Category A countries dedicated expert groups to write up and revise pandemic national plans and related guidelines; this step increased the potency of country-specific capacity building activities supported by the plan.

7.4.3.2 The national plan act as a framework to sub-national and hospital planning activities

"The hospital plan flows from the National Plan and is adapted to the specifics of the given hospital", commented a SNGA stakeholder, category A.

" The plan provided us with tools and checklist rather than hundred of pages. We found this useful when we developed our region's plan", commented a SNGA, category B.

All countries reported that national pandemic plan provided an overarching strategy and framework for the lower administrative levels to ensure more effective planning happens at sub-national and local levels. Stakeholders found checklists and tools are more important than the detailed plans that cannot be followed exactly.

7.4.4 Under planning of certain capacity building activities

7.4.4.1 Lack of hospital surveillance for severe outcomes

"Q: So can I ask the last question here about the surveillance in hospitals? A: It was not implemented despite the fact it was in part one of the national framework plan. The infrastructure to do it might have been there, but it was not identified until the situation really arose," commented an NPHA stakeholder, category A.

" We overlooked collecting data in secondary healthcare setting and this impaired our capacity to monitor the impact of the pandemic in terms of mortality and morbidity. In addition, this diminished our capacity informing policy makers regarding high-risk groups. This needs to be addressed in the next plan", commented a MOH stakeholder, category B.

National health authorities in all countries reported the lack of surveillance capacity for hospitalized patients. Hospital surveillance is an important preparedness measure to identify risk groups eligible for vaccination during a pandemic. Category A countries started collecting data on hospitalised cases and deaths as soon as the pandemic unfolded; however the network was not working properly since the system to collect and analyse data was not in place before the pandemic in 2009.

7.4.4.2 Shortage of Intensive Care Unit (ICU) equipment

"On hospital level; ICU machines were lacking as they are expensive. Currently, we are trying to increase the number of ventilation equipment" commented a secondary HCW stakeholder, category B.

"There seems to be lack of ICU equipment for children. Few hospitals in our region have them, but many other hospitals do not," commented a SNGA stakeholder, category A.

" A number of kids died in our hospital because we were not able to offer them ICU beds because we lack the capacity", commented a secondary HCW stakeholder, category C

Planning for ICU capacity building before the pandemic was underdeveloped in all countries. The lack of ICU equipment particularly for children had a negative impact on the management of the hospitalised cases and led to a higher mortality rates among children in a number of countries.

7.5 Theme four: Mutual Support

Support was identified as a fourth theme during interviews. International and national support can be obtained and provided in different forms. The below mentioned key sub-themes were considered important:

7.5.1. Guidance documents were useful pandemic activities before and after the pandemic

7.5.1.1 Support from the international organizations and other countries

" We and our neighbouring countries exchanged plans and related guidelines to ensure inter-operability," commented a CER stakeholder, category A.

"We received guidelines and support through WHO country office and ECDC", commented NPHA stakeholder, category B.

"We looked at other plans. I still have some old French plans in my office. We looked for sure at the Canadian plans," commented an NPHA stakeholder, category B.

"Mainly we used the WHO global plan and checklist along with CDC Atlanta guidelines. In addition, expert groups provided us some examples of other countries that had developed a plan, as an example for us to see," commented an MOH stakeholder, category C.

Pandemic preparedness support provided by guidance documents was considered highly essential for good pandemic preparation and response. National stakeholders received guidance documents and checklists from international organizations that provided support for pandemic planning and preparedness. Category C countries were supported by the WHO, European Centre for Disease Prevention and Control and United States Centre for Disease Control and Prevention pandemic guidelines. However, countries in categories A and B were less dependent on support from international organizations. The WHO guidance documents for pandemic planning, clinical management and methodological and technical guidelines were widely used by national stakeholders as a framework to develop country-specific plans. This guidance continued after the start of the pandemic. In addition, countries from category B and C reported that the ability to access published pandemic plans from other countries, such as the United Kingdom, Canada, and proximal neighbours, was also useful to address inconsistencies. Category B

countries reported working with other countries to ensure plans are interoperable.

7.5.1.2 Support from national authorities

"Since planning is delegated at our region, we have a WHO liaison person and she provided us with planning guidelines, answered queries, and even provided us with epidemiologic updates on the global status of the pandemic", commented SNGA, category A.

" We shared our plans and policy documents with our neighbouring region and we found this useful exercise and we would like to do more inter-regional coordination in the future", commented a secondary HCW, category A.

"Did the MOH provide input to the development of the non-health sector plan? A: Yes, of course. They sent us all the technical documents we asked for and they supervised our planning activities in a direct way", commented a CER stakeholder, category B.

"Q: Did the MOH also help the regions to develop sub-national capacities before the pandemic? A: Yes, of course. Q: What kind of support did you receive from MOH? Methodological guidance was provided, instructions, technical guidance documents, orders, booklets with description of influenza that we distributed among the health facilities and the population, bus stops, kindergartens, etc.", commented SNGA stakeholder, category C.

Sub-national tiers in all countries relied mainly on technical and methodological guidelines, frameworks, strategy and policy documents provided by their national tiers but also made direct use of the support

materials from the WHO, European Centre for Disease Prevention and Control, and neighbouring countries. In countries where planning was devolved, SNGA worked with each other as well as they received direct support from international organizations. In terms of non-health planning support, interviewees reported that MOH and NPHA provided important guidelines and support for the development of business continuity plans.

7.5.1.3 Supporting healthcare workers

"MOH published on intranet the clinical management guidelines and treatment protocols to support HCWs. We received case definition, recommendations on clinical specimens, and how to use antiviral drugs in different age groups", commented a secondary HCW stakeholder, category A.

"We provided technical guidelines to healthcare workers and clinical staff in our region. It was important to provide information during peacetime, and when the war began we were quite prepared," commented a SNGA stakeholder, category B.

"We supported our healthcare professionals via technical guidance documents and protocols on infection control and respiratory precautions practices during outbreaks of influenza" commented a SNGA, category C.

Healthcare workers received different treatment guidelines before the pandemic start and they were found to be useful in guiding treatment and infection control practices in hospitals. These were national and sub-national

plans, other pandemic guidelines, WHO guidelines, vaccination plans and treatment protocols.

7.5.2 Under planning of financial support

"We funded an independent expert group of consultants to write up the national pandemic plan and to coordinate the planning process across different organizations. This included exercising and revising plans too. This group was a devoted group to pandemic preparedness and they showed real commitment to this job", commented an MOH stakeholder, category A.

"There is no finance allocated for development of the plan. It is done free of charge. It is part of our day-to-day job", commented an NPHA stakeholder, category B.

"We have made financial allocations to implement our pandemic plans, these funds were used to buy antiviral stockpiles and personal protective equipment", commented an MOH stakeholder category C.

The countries in categories B and C stated that preparation of the plan and guidelines was not financially supported by international, national or sub-national government bodies and was considered a routine activity to be included within existing budgets; only category A countries funded dedicated expert groups to prepare their national plans. However, all countries allocated funds for plan implementation and inter-pandemic phase activities, such as surveillance networks, personal protective equipment, vaccines and antiviral drugs.

7.5.3 Under planning for support in certain areas:

7.5.3.1 Political support in funding pandemic preparedness

"Next time, I would like to see more involvement of the finance committee in the parliament in order to make them aware and involve them actively in the tough decisions regarding the risk of overspending and the risk of under protection", commented an NPHA stakeholder, category A.

"Our government showed a great deal of interest and commitment to pandemic preparedness. But when it comes to money regarding antiviral medication stockpiling and immunisation contracts, we face objections and challenges all the time", commented an NPHA stakeholder, category B.

"We realize that we have a long list of competing and urgent priorities. A high-level political involvement and commitment is necessary to ensure dedicated budget lines both for development as well as implementation of the plans", commented a NPHA stakeholder, category C.

A number of countries mentioned that more political support was needed regarding financing the planning activities and to involve politicians in some critical decisions on money spending issues. Countries stated that government showed interest and put pandemic preparedness high on the political agenda but financing the preparedness and planning activities was an issue in certain countries.

7.5.3.2 More support is required from the WHO regarding data sharing

"There was a problem with receiving data on new cases and the total number of cases. And, unfortunately, neither WHO nor other sources provided this

information in a timely manner", commented an NPHA stakeholder, category A.

" We would like to see timely collection and sharing of surveillance data in a more standardized and coordinated patterns to ensure appropriate and evidence informed decision making", commented an MOH stakeholder, category A.

" Next time we would like to get more guidance on how to conduct a proper risk assessment and what is the minimum data set required to do this", commented an NPHA stakeholder, category B.

Category A countries reported poor support and delays from the WHO and other international organizations in providing real-time clinical and epidemiological data during the pandemic response. Country B countries asked for more support on how to document proper risk assessment using surveillance data to inform decision-making and outbreak response management.

7.6 Theme five: Leadership

Leadership was identified as an important part of country's pandemic preparedness and planning efforts during interviews across all level of preparedness. For successful pandemic preparation and responding to a pandemic, coordinated actions and communications by all levels of government and all segments of society from the countries need to be undertaken through a variety of different, but complementary, leadership

roles. Issues and activities considered important for pandemic preparedness leadership among countries are discussed below.

7.6.1 Sectoral lead roles during pandemic preparedness planning

7.6.1.1 Pandemic planning committee as a useful planning activity

"The pandemic committee at the national level consists of the best of our scientists and policy makers who started the process of developing, exercising, maintaining, and translating those documents into practice. Their role was fundamental to get our preparedness activities started", commented a NPHA stakeholder, category A.

"We started our pandemic planning activities by creating a national pandemic planning committee which was responsible for leading on organizing, implementing, and exercising the national pandemic plan" commented an MOH stakeholder, category B.

"National pandemic committee was essential to ensure even preparedness across the country and was essential to bring health and non-health sectors from different administrative levels together", commented MOH stakeholder, category C.

Countries across all categories mentioned that national pandemic preparedness starts by creating national pandemic planning committee from various stakeholders to supervise, organize, and lead on the writing and implementation of the pandemic plans and associated guidelines. This group is instrumental to decide on the mechanisms of pandemic planning and planning process.

7.6.1.2 Lead roles during national pandemic planning

"Expert group within NPHA led the planning process", commented an NPHA stakeholder, category A.

"The lead institution was NPHA during national pandemic planning," commented an NPHA stakeholder, category B.

"It was agreed that MOH leads on BCP regarding preparing non-health institutions to pandemic influenza and this worked very well during 2009 because of the mild nature of pandemic. I don't know what could have happened if the pandemic turned to be more severe", commented an MOH stakeholder, category B.

" MOH supported by the NPHA led the national pandemic planning activities ", commented an MOH stakeholder, category C.

" Our CER agency led the planning and response phases for BCP in airports and ports", commented a CER stakeholder, Category C.

The institution that led the pandemic planning committee and the other preparedness activities at the national level was the MOH and/or NPHA in all countries except a category A country where an independent group of experts was leading the planning process. It is worth saying that NPHA in a number of countries in the WHO European Region is working under the umbrella of the MOH or as a department within the MOH according to the organizational structure of the healthcare system in each county. The business continuity planning for non-health services was led by the Ministry of the Interior in

category C countries and the NPHA and MOH countries in categories A and B.

7.6.1.3 Lead roles during sub-national and hospital planning

"Governor of the region was leading the planning process in our locality", commented a SNGA, country A.

" We are a big country, leadership was devolved to SNGAs and we provided funding and technical support. We feel that certain decisions and responsibilities should be more centralized. We should have exercised the plan to discover these areas", commented NPHA stakeholder, category B

"The lead institution was the NPHA. They headed both the planning and preparedness and infectious diseases control teams. This works well in our small country to keep things tight and focused, "commented a SNGA stakeholder, category C.

Sub-national planning leadership varied between countries, with the central government authorities assuming leadership roles in category C countries, and regional government mostly leading sub-national pandemic preparedness actions in countries in categories A and B. Country A countries reported that certain elements should have stayed more centralized; these were decisions to implement mass vaccinations and antivirals and vaccines logistics. Countries in categories A and B commended the effective role of the sub-national government on leading hospital planning activities in terms of on-going follow-up and introducing legislation to require hospital preparedness.

7.6.2 Actions considered useful by countries for effective pandemic preparedness planning through leadership

7.6.2.1 Political commitment

"Do you think there was enough political commitment to the preparedness activities? A: Yes. There was sufficient assistance and support from the government to enforce all our policy decisions like school closures ", commented an NPHA stakeholder, category B.

" Political commitment was instrumental to facilitate the planning and implementation processes. The government officials kept following up with us via MOH regarding the status of our country preparedness and they issued decrees and orders to make it a legal obligation for all sectors to be involved actively to make the nation well prepared. We had a comprehensive approval process", commented a SNGA stakeholder, category C.

Countries across al categories stated that strong government political commitment combined with efficient governmental approval processes through orders and decrees were useful factors.

7.6.2.2 National government following up sub-national planning activities

"The MOH was following up on our sub-national planning process. We developed, for instance, the first draft, submitted it to the Ministry of Health and in the Ministry there was a special working group or commission as they call it, and they revised it and sent it back to us," commented a SNGA stakeholder, category B.

"Every region and every municipality have to send regular updates to the NPHA about what are they doing regarding pandemic planning and how are

they preparing to do it and it is then checked in here for missing or unclear sections,", commented a NPHA stakeholder, category B.

At sub-national level, countries stated that having orders and decrees; strict supervision and close follow up of the leading group of experts at the national government to be instrumental during sub-national planning process. The national pandemic planning committee also provided comments and technical feedback to the sub-national authorities regarding their pandemic planning activities.

7.6.2.3 Strong sub-national leadership on hospital planning

"Sub-national administration obligates hospitals in certain region to do things in certain time frame to work and was the case in our region. While in other regions, this process was optional and they have many problems during the response in their hospitals," commented a secondary HCW stakeholder, category A.

Hospital doctors mentioned that solid leadership and direction by sub-national planning committee were major success factor during hospital planning process. Moreover, countries in categories A and B reported on the effective role of the sub-national government on leading hospital planning activities in terms of on-going follow-up and introducing legislation to require hospital preparedness

7.6.3 Expectation from WHO as a leader on pandemic preparedness

7.6.3.1 WHO data collection and reporting network

"I think more simple reporting system was needed. We do not need to go to three databases during the pandemic. It's WHO Europe, WHO Geneva, and ECDC", commented an MOH stakeholder, category A.

"The other thing on the management part is that we don't need the WHO to give us so much information. We were overloaded but we need the WHO to give us distilled and up to date detailed information", commented an NPHA stakeholder, category B.

Category A and B countries reported being confused during the response phase because of complex reporting system with poor guidelines on data sharing. Moreover, they complained of information overload during the response and asked for distilled and up to date detailed information. No data is available for category C countries.

7.6.3.2 WHO reaction to the pandemic

"Less panic from WHO was required and we think it was an overreaction", commented an MOH stakeholder, category A.

Category A countries criticized the leading role of the WHO during the response and reported that the WHO overreacted to the 2009 pandemic and that there should have been more field investigation prior to announcing phase 6. Moreover, category A countries requested additional transparency regarding scientific advice that was provided. This was not reported in category B and C countries.

7.6.3.3 WHO leadership role for future pandemic preparedness

" We want WHO to coordinate and regulate joint procurement for antiviral and immunisation", commented a MOH stakeholder, category B.

"We were just discussing this issue. For the future, I think we need WHO support to help us building our pharmaceutical capacity. We require more training from WHO particularly on specific issues such as communicable diseases control and risk communication. In addition, we need WHO contribution to the translation of important documents", commented an NPHA stakeholder, category C.

" We wanted WHO to help us buying antiviral medications and coordination donations for vaccinations next time. All donated vaccines arrived late in pandemic", commented a secondary HCW, category C.

Countries in category C and a category B country expected WHO to lead on capacity building matters such as antibiotics, antivirals and vaccine related issues for future pandemic planning. While, the rest of countries asked for more training on risk communication mainly with media and how to build trust with the public and HCWs, workshops, technical guidelines and translation of technical and operational documents.

7.7 Theme six: Adaptation and flexibility in pandemic planning

The effectiveness of pandemic plans can be measured according to their adaptability and flexibility. Pandemic plans need to be flexible in the sense that they allow for adaptation of appropriate measures to be undertaken during the response according to the actual situation on the ground rather than

documented scenarios and geographical spread. The below-mentioned points demonstrate different aspects of pandemic preparedness activities, plans and guidelines in which flexibility was necessary for countries to respond effectively to the 2009 pandemic.

7.7.1 Revision of pandemic plans before the pandemic

"The plan was revised because of multi-stakeholders meetings we had about pandemic. We clearly needed a new guidance for the new type of influenza virus, a document that would bring together activities of multiple agencies. We used the expertise from local and international experts", commented an MOH stakeholder, category B.

"It was a dynamic document which is revised regularly", commented an NPHA stakeholder, category A.

National pandemic plans for two countries from category A and two countries from category B were revised before the pandemic at the national level. The revision of the plan was triggered by stakeholders' discussion regarding aspects of the plan needed to be changed to increase its usefulness. Plan revision by countries in category A was considered to be an on-going and dynamic process. Whereas, plan revision by category B countries was triggered by vaccination logistics problems identified from national pandemic exercises.

7.7.2 Planning scenarios

"We also studied international experience and made our approximate estimations. We expected 70-80% attack rate and that approximately 50% of infected would die", commented an NPHA stakeholder, category C.

"Different range of planning scenarios from our previous outbreak experience was adopted", commented an MOH stakeholder, category B.

All countries included the worst-case scenario from 1918 pandemic in their pandemic planning scenarios. Category C countries based their planning on a scenario of a 30% and a 70-80% attack rates. A category B country based its plan on multiple scenarios of 30%, 40% and 50% clinical attack rates and additionally used excess hospitalization capacity as a scenario. Two other countries from category B mentioned using a mixture of scenarios for pandemic planning without giving exact estimates. Similarly, category A countries reported using flexible and adjustable planning scenarios without mentioning exact figures.

7.7.3 Useful actions for flexible planning and response

7.7.3.1 New documents developed during the response

"You know an important thing was, when WHO provided us with the clinical treatment protocols for pregnant women or children, those protocols did not work here. So our specialists had to use the WHO guidance to develop a new guidance for us", commented an MOH stakeholder, category B.

During the pandemic response, new documents and strategies were created during the pandemic response, as they were not envisaged during the planning stage. Two countries form category A and category B developed

new protocols for vaccination logistics and specific clinical guidelines for new risk groups (pregnant women and children). They said WHO guidelines were too long and complex for frontline health practitioners and they had to produce more condensed documents with flow charts on indications, contraindications, dosing, and severity of illness. These were more acceptable and worked well in hospitals and clinics. Pandemic (H1N1) information updates and clinical guidance for diagnostic differentiation were also developed by countries from category B and C.

7.7.3.2 Adaptation of pandemic plans

''Well, it really doesn't matter which declared phase we are in, we had to take measures that were appropriate and are based on the actual situation [in the country] and not in Mexico or elsewhere'', commented a primary HCW stakeholder, category A.

" Because the impact of the pandemic was milder than what we anticipated and planned for, we had to rewrite our influenza immunisation strategies during the pandemic. Consequently, primary HCWs were to immunize high-risk groups rather than setting up flu clinics to implement mass immunisation for the whole population, This caused some confusions as this was not something we discussed before the pandemic", commented a SNGA stakeholder, category B.

" Since the start of the pandemic, we realized that mass immunisation campaigns would not be needed and therefore we tweaked the plan to allow

primary HCWs to do it for certain risk groups", commented a primary HCWs, category B.

National authorities were forced to adapt their plan framework to the context of the 2009 pandemic, which was milder than that which had been anticipated and planned for. The issue of mass vaccination logistics was a recurrent problematic theme encountered at national and sub-national levels that had access to pandemic vaccine. Countries in categories A and B originally planned to vaccinate their entire population via mass campaigns. During the pandemic these countries modified their strategies to vaccinate only those groups at risk of severe disease. This was done because it was obvious that the pandemic was milder than what had been expected. This modification indicated, for example, that the responsibility for vaccinating the public devolved from the national level to the primary healthcare sector. Hence, vaccination strategies were rewritten during the pandemic. Moreover, case definition and treatment protocols were regularly adapted to prevailing clinical circumstances; many hospitals adapted their own plan into a more concise and user-friendly version. No data was available for category C countries.

7.7.4 Under planning in certain areas

7.7.4.1 Lack of flexibility in WHO phases

"WHO phases were too strict and was reflecting geographical spread not severity, this caused confusion to our response activities", commented an NPHA stakeholder, category A.

"We developed our own risk assessment during the pandemic based on our local data and we used WHO data to inform our decision making and response measures", commented a primary HCW stakeholder, category B.

" We followed the WHO phases to the letter and we found this very detailed and challenging and irrelevant to the flu activity in our region. It is better to have less details and more than one planning assumption to be implemented at different times in different places in a same country. An example on this would be containment strategies", commented a secondary HCW stakeholder, category C.

The lack of flexibility in WHO phase criteria and the countries' national plans was a recurrent issue throughout the pandemic. Measures applicable to each pandemic phase were overly specific and focused on the global situation to be relevant within an individual country. Stakeholders at the national level from countries in categories A and B adjusted their response according to the actual situation and did not adhere to the WHO phases and requested a more flexible guidance document for future pandemic planning from the WHO. In contrast, category C countries followed the WHO phase guidelines precisely and faced the aforementioned challenges.

7.7.4.2 Containment phase was difficult to be continued for a long time

"Containment activities such as contact tracing and contact management were very difficult to be carried out for a long time as the sub-national resources were exhausted. We also heard this from our colleagues in the UK", commented a NPHA stakeholder, category B.

"Containment was not feasible because the novel virus was already spreading and causing outbreaks in the population. We followed the WHO phases precisely during containment but this did not work for us as different countries were at different stages", commented a primary HCW stakeholder, category C.

During the response to the pandemic a number of countries highlighted the problem of long containment phase that was both time and resource intensive. Stakeholders at national and sub-national tiers who share this view mentioned that resources required for containment activities and contact tracing need to be identified beforehand.

7.8 Conclusion

The findings identified a number of consistent themes, which highlight areas of good practice and areas where further development is needed in the aftermath of the 2009 pandemic. These were distributed across six major recurring and interdependent themes. The findings suggest that in general these were mostly in place prior to the 2009 pandemic and they did aid the response to influenza A (H1N1) pandemic in 2009. However, it was equally clear from our analysis that a subset of pandemic preparedness activities did not work well or were under developed when the 2009 pandemic occurred. Table 5 provides a summary of the good practices and shortcomings in all of the countries that participated in the study.

Table 5 Summary of good practices and gaps identified in the study

Theme	Successes	Challenges
Communication	• Raising Public awareness • Multi-sectoral meetings • Plan dissemination	• Communication Primary HCW • Poor risk communication • Communication with the media
Coordination	• Command and control structure • National and sub-national coordination group • Exercises	• Inter-regional coordination • Vaccine procurement and logistics
Capacity Building	• Training • Expert groups • National plan • Surveillance, antivirals, and PPE	• Hospital surveillance • Advanced vaccine contracts • ICU equipment
Mutual Support	• Guidance documents • Finance implementations • Different administrative levels support	• Funding planning activities and expert groups • WHO data sharing
Leadership	• Political commitment • Pandemic planning committee • National and sub-national leading roles	• WHO data collection and reporting network • WHO reaction to pandemic
Adaptability/Flexibility	• Revision of plans • New documents • Adapting response to the actual situation	• Lack of flexibility in WHO phases • Containment activities • Pandemic planning scenarios

Chapter 8: Discussion

8.1 Introduction

The pandemic in 2009 was the first pandemic to have occurred in the era of modern pandemic planning. Although at the time of writing many evaluations of pandemic response have now been performed or are underway (European Centre for Disease Prevention and Control, 2012), to the best of our knowledge this is the only evaluation that has explicitly focused on the usefulness of pandemic preparedness activity planning, rather than the response measures themselves. We intentionally used a randomized sampling framework and accepted social science evaluation methodologies to maximize the rigor of the study findings.

The following discussion sections are based both on the key findings from the evaluation derived from the stakeholder group interviews and on the results that have been discussed and endorsed by the participant countries during the workshop on the evaluation of how pandemic preparedness activities aided response to the influenza A (H1N1) pandemic in 2009 in countries in the WHO European Region held in Copenhagen (Denmark), 20-22 October 2010. Delegates participated in the workshop were derived from the same stakeholder groups interviewed for this study, and therefore the aggregated findings presented and discussed in the workshop were similar to their opinions. Their input was used to refine the results before publishing the WHO recommendations for good practice in pandemic preparedness.

8.2 Development of public health management of communicable diseases

Infectious disease outbreaks in the past have led to a gradually coordinated centralised approach to disease control and prevention. Literature describes how care for sick people evolved beyond family and religious authorities into the responsibility of governments and public health authorities on central and local levels (Cipolla, 1973). In the Middle Ages, the Black Death was recognised as a contagious disease, and the only countermeasure employed was quarantine. During that period, patients were considered as public jeopardies and were expelled from the community. This was the basis of what is known now as public health countermeasures that is implemented to prevent the spread of infectious diseases (Porter, 1999). At that time authorities started building capacitates to report all infected victims and deaths to central and local authorities. The history of reporting infectious diseases is connected to the history of public health surveillance.

Venice was the first state in Europe to attempt a coordinated public health response to epidemics of plague at that time (Simpson, 2010). The city council was responsible for the administration of day-to-day community activities as well as they provided leadership on disease prevention and protection of the community. The government of Venice determination and political commitment had led to the setup of a board of officials to supervise the health of the city which was the precursor of boards of health that were implemented centuries later (Porter, 1999).

The joint actions to protect public health that were implemented at that time show patterns that are very much in existence in our current public health programmes; interventions aimed at population health improvement, involvement of national and regional authorities, and potential for violation of individual rights to protect the public. It is clear from the literature that the ruling classes and authorities during early history and the Middle Ages did not have proactive and functional preparations to respond to public health emergencies. Response countermeasures were predominantly immediate reactions to epidemics and they were directed at addressing only ill patients. There was no prior planning or clear vision of how to implement these public health response measures. While each country was trying to protect itself without communication or coordinating with the neighbouring countries, quarantine requirements were often redundant, imposing a great burden on commerce and travel. The nature of these epidemics helped to define the public health approach to disease later since they cannot be prevented successfully by addressing only ill persons (Nelson and Williams, 2007).

In the recent centuries, public health authorities around the world based their response measures to outbreaks on scientific facts as well as on measures used to prevent and control outbreaks in medieval time to control the Black Death. The concept of contagion was the basis of most of the public health measures used at that time including quarantine and banning public gatherings. With more advances in epidemiology and microbiology fields,

health authorities implemented more advanced measures such as vaccinations and infection control campaigns in the previous two centuries (Spink, 1979).

During the first pandemic of the twentieth century, public health systems were put under huge pressure as many of the prevention and control measures that were used previously proved to be futile in decreasing the mortality and morbidity rates in 1918-1919 pandemic. National and public health stakeholders in the United States and Europe implemented different public health countermeasures to stop the spread of the pandemic. They were able to notice the nature of human-to-human transmission via air and droplets and they based most of the measures taken at that time on this notion. They implemented quarantine measures as well as they tried to reduce mass gatherings and encouraged social distancing. It was believed by public health professionals that good ventilation was the best of all preventive measures especially during public and mass gatherings. As a result, public health measures such as quarantine or isolation were implemented. These signalled the start of provocative and authoritative interventions in terms of closing public organizations during outbreaks (Billings, 2005).

In the Unites States and Europe, local health authorities varied in their power of authority that in turn led to the variability in strictness of implementation of these public health measures. In the Unites States, the American Public Health Association (APHA) recommended to restrict any form of mass gathering including sport events, ceremonies, bars, theaters and cinemas. However, religious ceremonies in churches were exempted and authorities

believed that only the least services should be carried out (American Public Health Association, 1918). On the other hand, measures in the UK were less strict as health officials allowed mass gathering in music performance, for instance, for a maximum of three hours with sometime between shows to allow for air circulation (Anon., 1918a). In Switzerland, sport events, music hall performance, ceremonies, and theaters were all banned during the pandemic that caused panic and fear among the public (Anon., 1918b).

Health authorities started public health education campaigns to raise public awareness regarding ways stop the transmission of the virus and the importance of hand washing in reducing the spread of infection (Billings, 2005).

In terms of the more advanced public health preventive measures, mass vaccination was available for the first time during the following pandemics in 1957 and subsequently in 1968. As concluded by Meiklejohn, three years after the 1957, vaccination programmes implemented during the pandemic were not effective to reach the level of protective immunity in the population. He suggested that two doses were required to protect vaccines with a 4-weeks interval (Meiklejohn, 1961).

In contemporary history, international and national authorities executed pandemic preparedness activities for the past ten years due to increase awareness of the need of coordinated action and unified response to cross-border public health threats. The re-emergence of avian influenza strain and SARS outbreak motivated countries to invest considerably in these activities.

These events produced high mortality and morbidity and caused severe social and economic consequences around the world. These events gave the impression that countries were unprepared yet for a global international health emergency and motivated the international community to implement the new International Health Regulations (IHR) (WHO, 2008, Penn, 2011).

8.3 Core principles for pandemic preparedness

Developing, improving and maintaining preparedness for influenza pandemic is a high priority for all national governments and supra-national bodies responsible for communicable disease control and prevention. The European Centre for Disease Prevention and Control and WHO support countries in improving their national pandemic influenza preparedness (Nicoll, 2010, Brown, 2013). WHO and European Centre for Disease Prevention and Control on their websites release updates and recommendations for good practice in pandemic planning and preparedness and conduct individual country assessments and workshops to enhance member states' capacity to respond and manage pandemic influenza and other public health emergencies (European Centre for Disease Prevention and Control official website, n.d., WHO Europe official website, n.d.).

The broad aim of pandemic preparedness activity is to reduce transmission, hospital admissions, and mortality, maintain essential services, and reduce socioeconomic consequences (WHO, 2009f). The planning cycle starts with writing up and developing national plans and associated operational guidelines, exercising these plans regularly and to incorporate lessons into the

planning process, and translate into action these plans at different administrative levels.

In the aftermath of the pandemic (H1N1) in 2009, individual countries started evaluating their own pandemic response and in the light of this, revise and re-issue updated plans and frameworks, as well as continuing to undertake further pandemic preparedness actions (European Centre For Disease Prevention and Control, 2012). This study has been conducted in the WHO European Region to evaluate the extent to which pandemic planning activities proved useful and efficient and to identify areas of under planning. The overall outcome was to ensure that activities collectively identified and documented (across a majority of countries) as worthwhile elements of pandemic planning are incorporated more or less as standard essential items across all countries' pandemic plans. However, we did not assess the adequacy of individual country responses and public reflections as these were outside the scope of this study.

Despite differences in the level of their preparedness prior to 2009 (European Centre For Disease Prevention and Control, 2007, Mounier-Jack and Coker, 2006) and considerable geopolitical and political diversity between countries (Central Intelligence Agency official website, n.d.), we identified a number of consistent themes, which highlight areas of good practice and areas where further development is needed. These were distributed across six major recurring and interdependent themes. These findings suggest that it is possible to define essential elements for effective pandemic preparedness, namely:

multi-sectoral, cross-disciplinary approaches; political commitment; expert technical input (from individuals and supranational organizations); public awareness, the use of exercises and simulations; staff training; stockpiling in advance for drugs and personal protective equipment; regional and local tier involvement in pandemic planning and strong leadership. Our findings suggest that in general these were mainly in place prior to the 2009 pandemic. However, it was equally clear from our analysis that a subset of pandemic preparedness activities was under developed when the 2009 pandemic occurred. The lack of flexibility in national pandemic plans and the poor linkage of WHO phases to practical action thresholds within individual countries are both illustrative of a general anticipation of a probable avian influenza pandemic. Paradoxically, however, the threat from H5N1 has not decreased and it would be unwise to modify plans to cope with only a mild pandemic event (World Health Organization, 2014).

Moreover, countries' guidelines and protocols changed too often and became too complex for end-users, regional and local plans, especially hospitals, were not well developed enough. In addition, operation planning pertinent to vaccine logistics including distribution and delivery was not adequately planned out. This has been highlighted in other reports and can be addressed by improved operational planning and the use of exercises especially at a sub-national level (Nguyen-Van-Tam et al., 2010b, Mcllwain, 2010).

Last but not least, it is widely documented that at the start of pandemic timely and high quality data on the emerging situation in Mexico and other early-

affected countries were inadequate (Hashim et al, 2012). Accurate data on community cases were sparse, and reported data mainly from hastily assembled case series on hospitalized patients with severe H1N1 disease were lagging (Kumar et al, 2009, Nguyen-Van-Tam et al, 2010a). Paradoxically, the heath impact of the 2009 pandemic was mostly observed in secondary care settings. Our data illustrate widespread concerns that hospital surveillance of severe acute respiratory infection had been inadequately addressed during the pandemic planning process and required urgent remedial development. This deficiency had a negative impact during the pandemic response when critical data from secondary care were unavailable or unreliable. Surveillance of severe acute respiratory infections (SARI) is important to assess and monitor the mortality and morbidity of the pandemic in hospitals. The absence of these systems during the pandemic made it challenging to give regular updates to clinicians, decision makers, media, and the public. Data on mortality and patients who required intensive care were slow and inaccurate in countries interviewed for this study. Countries reported that these systems have to be in place during the inter-pandemic phase and should be tested every year. A minimum dataset on clinical, epidemiological, and demographic characteristics of the most severely infected patients has to be agreed upon in advance. The following sections represent areas of good practice and core elements in pandemic preparedness:

8.3.1 Leadership and national pandemic planning committee

Pandemic influenza has the potential to cause high mortality and morbidity on international and national scales as well as potentially causing wide social and economic disruption. Therefore, solid leadership and political commitment in conducting pandemic preparedness activities are essential to cope with the complexity and impact of pandemic influenza. National health authorities may recognise pandemic preparedness as a priority on their political agendas with dedicated finance and human resources throughout the whole cycle of planning, implementation, and evaluation. However, this may be challenging for most governments since there are more urgent and competing priorities that may be prioritised over pandemic influenza. In category A and B countries, governments showed a high degree of commitment to support the planning and implementation of pandemic preparedness activities. Category C countries relied heavily on the support and donations provided by other countries and international organizations. All countries reported on the need of more engagement of politicians to ensure continuous and dedicated funding for pandemic preparedness.

Emergency planning and response management is, of necessity, a hierarchical and top down process. Pandemic preparedness starts by creating a national pandemic planning committee at the government level to create the national pandemic preparedness policy (i.e. the national pandemic plan). Afterwards, the national plan and associated guidelines is disseminated to the lower authority levels for implementation. Countries reported that a top-down approach was essential to achieve effective and even response across all

regions. Countries also reported on the importance of having feedback channels in place to ask questions and to be actively involved with the decision making process (i.e. bottom-up approach).

The responsibility of the national pandemic planning committee is crucial during planning and response phases (Mounier-Jack and Coker, 2006). The committee functions as a coordination body to prepare or continuously revise the national pandemic plan and relevant guidelines. During the planning phases, the committee works with all stakeholders to ensure a proper management process, well-structured chain of commands, and secure a dedicated budget for implementation of planning activities. The committee writes up the operational guidelines to aid health and non-health institutions to attain an effective and timely response (WHO, 2005a). Supporting the committee by providing adequate human and financial resources is essential to its work and productivity

It is essential for the committee members to meet and communicate regularly throughout the planning process and discusses the process and steps to implement the pandemic planning activities. The implementation of the national pandemic plan serves as a comprehensive strategy to reduce the potential impact of pandemic influenza and it can serve as a framework to guide sub-national and local planning activities.

8.3.2 Participatory planning

The findings demonstrate that participatory planning is a useful and effective preparedness activity. This includes the involvement of multiple sectors from

health and non-health organization at different administrative levels in planning and response phases. The whole process of the national influenza pandemic planning process requires broad communication and collaboration across different stakeholder groups. The organization of such efforts is essential to assure a more feasible national approach through implementation of a comprehensive response at both national and local levels (Gensheimer et al., 2003). Because pandemic influenza can cause wide social and economic disruption as well as health consequences, representation from different sectors are required to participate in pandemic preparedness and response activities (WHO, 2009f). National pandemic planning committees consist of a core planning group (health and non-health sectors) that is responsible for writing the plan and engaging other stakeholders to develop specific chapters of the plan, and an expert group, which gives technical support to the committee.

National governments interviewed mentioned that working through a multi-sectoral and inter-ministerial planning committee with partnership to reflect the wide range of partners and stakeholders improves the planning and delivery of effective response measures. The evaluation of Sweden response showed that the coordination group functioned well as a forum for solving the coordination challenges faced by the responsible authorities in cases where there was an overlap of responsibility between two or more organisations (National Board of Health and Welfare and the Swedish Civil Contingencies Agency, 2011). These coordination bodies and pandemic planning

committees create the platform for stakeholders across all administration levels to work in partnership with health officials and policy makers, organize what information will be disseminated, and decide how this will be accomplished.

8.3.3 Financial support to preparedness and planning activities

Participants across all countries reported that financial support is an essential and useful preparedness activity to maintain and keep the dynamicity of the process. Dedicated budget for pandemic preparedness and planning is considered a useful practice to fund expert groups and other staff tasked with writing up and revising national plans. Therefore, funding the planning activities is as important as funding their implementation as reported by the participants of this study. Funding is crucial to build capacities relevant to antiviral stockpiles, vaccination contracts, surveillance networks, communication systems, and hospital preparedness.

8.3.4 Communication and coordination

Pandemic planning and response encompass a wide range of expertise, stakeholders, and administrative levels. Robust communication mechanisms are required between different governmental tiers in order to coordinate planning activities at the different administrative tiers. Moreover, sharing pandemic plan with neighbouring countries and international community is a useful coordination activity that can facilitate the inter-operability of pandemic plans. Stakeholders at different administrative levels during the pandemic will need situation updates and risk assessments in order to make

evidence informed decisions in terms of interventions to be implemented during the response.

Attention has already been drawn to a large number of communication difficulties that occurred during the 2009 pandemic. Our findings identified challenging communications between central health authorities and frontline healthcare workers. Difficulties in accessing guidance, information overload and a lack of HCW involvement in pandemic planning were all highlighted. These data suggest that planning for internal communication within the health sector requires improvement in future pandemic planning (Hashim et al., 2012). Effective emergency management coordination can be achieved when communication is clear, accurate and timely. One of the most frequent challenges to the communication system is conflicting and inconsistent messages and information overload of the frontline healthcare workers. In the United States, health professional faced the same issue of rapidly changing information and conflicting recommendation (Locatelli et al., 2012). Findings highlight the importance of developing and exercising a comprehensive communication plan to improve coordination between stakeholders across organizations and reduce confusion among responders and the public. Lessons learned from the interviewees in this study could be used as lessons to be incorporated in future responses to public health emergencies. These lessons include better planning for risk communication; improve the communication networks between different stakeholders, and more engagement of healthcare workers in planning and response phases.

8.3.5 Command and control structure

The literature highlights the significance of having a command and control structure in place before the pandemic. Organizations at all administrative levels including the ministry of health, national and local public health authorities and primary and secondary healthcare facilities are part of this structure (Krumkamp, 2009). This underscores the need for preparing administrative structures that ensure smooth and effortless information flow and exchange among these institutions during a pandemic. Communication within a country's healthcare system has to be improved. The command structure with predetermined roles and responsibilities of different stakeholders is necessary to maintain a smooth flow of information among authorities (Krumkamp, 2009).

Avian influenza outbreak experience in Turkey in 2006 revealed that organizational structure and command system was not quite ready to respond to public health emergencies. Authorities reported on the poor connection and coordination between the MOH and Ministry of Agriculture (Sarikaya and Erbaydar, 2007). In the evaluation of Sweden response, stakeholders felt that they were not sufficiently informed about the allocation of roles between them and what their expectations of each other should be and with regard to the demarcation of which issues fall under which department (National Board of Health and Welfare and the Swedish Civil Contingencies Agency, 2011).

8.3.6 Communication with the public

Communication with the public is a crucial element during planning and response to a public health emergency. Communication with the public aims at preventing further morbidity and mortality, reduce panic among the community and to stimulate confidence in operational response (Gupta et al., 2006). Risk communication is an essential element during emergency response as it can be used to educate the public and raise their awareness on pandemic influenza and provide people with relevant health information and advice about what to do at different stages of pandemic (Hine, 2010). This type of communication can engage people to protect the wider community by following for example hand hygiene and disposing of used tissues in the right way (Reynolds and Quinn, 2008).

Stakeholders across countries interviewed highlighted the importance of communication with the public to ensure an effective and smooth response by engaging the public in prevention and control strategies. A variety of communication channels were implemented before and during the pandemic to educate the public about influenza disease and prevention. These communication channels include the use of official pandemic influenza websites, leaflets and posters, hot lines and media spokespersons. In addition, countries with advanced pandemic plans mentioned having communication specialists to interact with media and public as part of press office or a public relation team. This team is responsible to ensure consistency and transparency of messages and public education material so they can be easily understood and perceived by the public (Reynolds, 2006).

Findings suggest that communication planning for pandemic influenza is an essential pandemic preparedness activity because it determines the set of messages to be shared with the public during the response and the communication channels that will be used and spokespersons. It is considered good practice to integrate the communication plan with the pandemic plan. The national and the regional level, and also any other actors felt to have a role to play, should be involved. It is best to have a flexible plan to be adaptable to the actual situation.

Planning for communication tools and infrastructure before the pandemic will enhance countries' ability to cope with the rapid and intense demand for information during pandemic. These include pandemic websites and information hotlines for the public and healthcare workers. CDC reports on the importance of establishing information hotlines to respond to outbreaks of smallpox (Centres for Disease Control and Prevention, 2002). This is applicable to other public health emergencies including pandemic influenza. Hotlines are necessary to be established before the pandemic in order to be able to deal with the immediate and sustained demand for information from the public and healthcare workers. The plan highlights the importance of providing the hotline staff with the most up-to-date and accurate information to be able to respond to the public's demand for information (Centres for Disease Control and Prevention, 2002).

Communication training is an essential activity to be implemented beforehand to ensure that spokesperson is confident and comfortable to speak in press

conferences or broadcast. Exercising the communication plan on a regular basis is highly recommended and this can be done using exercise scenarios and getting stakeholders feedback on how to revise the plan in line with new developments.

During the response it is crucial ensure consistency of messages that target the public (Reynolds and Quinn, 2008). The source of information and the content of messages need to be consistent throughout all stages so that general public do not get confused and know which advice and information to follow. Uncertainty and the unpredictable course of influenza pandemics play an important role in delivering inconsistent and controversial messages to the public. Consequently, this will make the response to the novel virus challenging and complex. The World Health Organization communication guidelines focus on building trust between the public and the lead organization, announcing updates at early stage, provide information whether good or bad as soon as possible, sharing precise and full information transparently, listening to public fears and concerns, and planning for communication.

Stakeholders from sub-national authorities mentioned that communication at the local level was different from those at higher levels. This is mainly due to pandemic can affect different areas at different times with different severity. For example, schools in one region can be closed before the rest of the country because the rates of influenza infection are higher. This mandates a direct communication with the public in that region to update them about this

localized situation and to answer their concerns. Local websites and media can be utilized to deliver such information to the target populations but this will be challenging in low-income countries such as category C countries with limited access to computers and the Internet.

8.3.7 Flexibility and adaptability of pandemic plans

It is important to acknowledge that emergencies including pandemic influenza can create dynamic changing environments, and therefore it is not feasible to anticipate all the details relevant to the impact and severity of a future emergency (Frosdick, 1997). Despite the fact that the pandemic plan will direct the response, the ongoing risk assessment will determine the pandemic severity and the appropriate response measures. This occurs when the local disease severity does not reflect what has been written in the plan or what is happening internationally.

All countries surveyed in this study included the 1918 pandemic worst-case scenario as a possibility in their pandemic planning assumptions. Category C countries based their assumptions entirely on a scenario similar to that of 1918 pandemic as well as on the avian influenza case fatality rate. Other countries reported using multiple scenarios but without giving exact figures. Plans that take into account a range of scenarios would be more adaptable.

Countries mentioned that planning for more than one scenario will enhance plans adaptability and flexibility to choose response measures in accordance with disease severity as determined by risk assessment tools. This means that some measures will be escalated in case of severe pandemic while others

might not be needed due to the mild nature of pandemic. An evaluation of Sweden's pandemic preparedness concluded that plans should be flexible and be composed of three different levels of pandemic severity: mild, intermediate or severe. This is meant to be a tool for grading the outbreak at an early stage, while retaining enough flexibility to adapt if the pandemic develops in a way that calls for different strategies and measures (National Board of Health and Welfare and the Swedish Civil Contingencies Agency, 2011).

All countries mentioned that the trigger to activate their pandemic preparedness measures relied largely on the WHO phases instead of measuring the severity of pandemic on the ground. Countries were confused about the use of WHO phases and reported on the lack of guidance during the pandemic on how to use them. WHO six phases were designed to describe the global and geographical spread of the novel virus, not the impact or severity of the pandemic which can be different across countries or even across regions within the same country (World Health Organization Europe and European Centre for Disease Prevention and Control, 2011).

Doshi argues that there was no proper definition by WHO before the pandemic and WHO and member states defined pandemic on the basis of global spread and not on the actual impact and severity on the healthcare systems (Doshi, 2011). Barnett supported Doshi views and commented that risk assessment should make the basis of decision-making, which can be informed by the global spread of pandemic influenza (Barnett, 2011).

However, different parts of the world could face severity differently and this is because of the variation in the course of the spread of pandemic, different surveillance systems, and differences in vulnerable populations. The severity of pandemic H1N1 in 2009 differed considerably across the world with a higher morbidity and mortality documented in the Americas in comparison to Australia, New Zealand, and Europe (Simonsen et al., 2013).

National and local levels reflected on the importance of conducting continuous risk assessment during the pandemic. This can facilitate the decision-making regarding escalation and de-escalation of response measures and allow for variable severity in the same country which in turn allows more flexible response measures within the same country (World Health Organization Europe and European Centre for Disease Prevention and Control, 2011).

In connection to flexible pandemic planning, stakeholders from national authorities reported several challenges in relation to vaccine purchase agreements, identifying risk groups, logistics of distribution and delivery. National authorities had to adjust vaccination plans due to the mild nature of the pandemic, from conducting mass vaccination to vaccination of priority groups only. Accordingly, vaccination strategy was adjusted from the national mass vaccination operation to the local vaccination approach through primary healthcare workers (World Health Organization Europe and European Centre for Disease Prevention and Control, 2011). Findings from interviews highlighted inadequate operational planning relevant to vaccine delivery and

logistics. The capacity building of different public health systems within the health organization, down to the sub-national level is essential to conduct nationwide immunisation campaigns as well as other large-scale distribution of antivirals and PPEs.

8.3.8 Sub-national planning

In countries categorised A and B, governments dedicated operational planning to sub-national authorities while countries in the category C kept sub-national operational planning at national level control. Countries reported that the national pandemic plan was a useful document and it served as a framework for sub-national and local strategies. In addition, stakeholders reported that planning checklists and scenarios facilitated the local planning process since these documents provided specific details on how primary and secondary healthcare services will be managed and details on business continuity of essential non-health services. The main programme and policy planning happens at the national level but the implementation of these measures occurs at a local level. Collaboration across different regions is important to ensure organized approaches. National planning committee has an essential role in sub-national planning activities by providing technical support as well as training and exercise. Vice versa, the contribution of sub-national pandemic planning stakeholders to national pandemic preparedness activities will enhance the quality and feasibility of the national pandemic plan (Brown and Hegermann-Lindencrone, 2013).

8.4 Review of national and multi-national evaluations

A number of published national and international evaluation reports have been reviewed in order to give a comprehensive overview of how countries evaluated their pandemic preparedness and response as well as to relate their results to the findings and themes emerged from this study.

These reports concluded that planning activities implemented before the 2009 pandemic were useful and worthwhile and this conclusion is in line with the findings of this study. In general, these activities were worthwhile and effective for the response made in 2009. However, there are still areas of weakness and further planning that will have to be addressed for future pandemic preparedness activities. Five evaluation reports from Europe, one report from Canada, and one international report were reviewed. These are Germany (Krause et al., 2010), Norway (Directorate for Civil Protection and Emergency Planning, 2010), the UK (Hine, 2010), Switzerland (Nguyen-Van-Tam et al., 2010b), Sweden (National Board of Health and Welfare and the Swedish Civil Contingencies Agency, 2011), Canada (Standing Senate Committee on Social Affairs Science and Technology, 2010), and IHR review report (Fineberg, 2010).

Most countries in their evaluation reports have reviewed the way their pandemic plans were structured so they can understand the pandemic planning activities that did not go well during the pandemic. All the reports highlight the importance of having had a pandemic plan to follow; especially in the initial stages of the outbreak, the plans provided valuable direction and

support. However, one major deficiency is that the plans were set up for a more severe pandemic in comparison with pandemic (H1N1) in 2009. The findings from these evaluations were in parallel with our results and the national plans were found to be too rigid with little or no flexibility. As a result, the adaptation of these plans to the local situation was found to be challenging during the response phase. Public health authorities in the countries included in this study operated in accordance with their plans, and not in response to the existing actual situation.

Furthermore, communication with the media was described in several reports to be a major challenge during the pandemic. In this study, countries in category A and B reported poor communication with the media and stated that a more comprehensive media planning is required for future pandemic planning. The issue was that there were no clear guidelines determining which authority had the overall responsibility for communicating with the media particularly. Moreover, there were also shortcomings with regard to the collecting and presenting of information for publication; the result of this was that a lot of the information was presented in an inconsistent way. This caused confusion among the public. An example of this comes from Norway, where the National Institute of Public Health and the National Directorate of Health presented the public with different assessments of the severity of the pandemic. This generated a great deal of uncertainty among the public. The first press conference on April 27 by the National Directorate of Health communicate the risk of the worst case scenario and this would be quite

severe pandemic while three days later the spokesperson of the National Institute of Public Health presented more conservative estimate. This had consequences on public opinion and engagement during the pandemic. (Directorate for Civil Protection and Emergency Planning, 2010).

Coordination emerged as an important theme from this research and the other reports too (Directorate for Civil Protection and Emergency Planning, 2010, National Board of Health and Welfare and the Swedish Civil Contingencies Agency, 2011). It is essential to establish a coordination team during the planning and implementation phases that is given the responsibility for co-ordinating and publishing all official information in the form of press releases. This will help health authorities to deal with the information requirements in future crises in a way that safeguards its credibility.

In regards to the severity of the pandemic of 2009 and the effectiveness of the pandemic planning activities undertaken before 2009, the Norwegian and German reports, in contrast to this study, stated that the reason why the pandemic could be dealt with so well was that it turned out to be mild in nature and not as severe as planned for. The result would probably not have been as positive if a more severe pandemic scenario had developed: there would not have been enough beds available in intensive care units, laboratories would have been buried with samples, and smaller hospitals would have less capacity to cope with the high volume of patients seeking care (Krause et al., 2010, Directorate for Civil Protection and Emergency Planning, 2010).

On the other hand, Dame Deirdre Hine evaluated the UK response to the 2009 pandemic and arrived at a conclusion similar to this study that the wide range of pandemic preparedness activities including the capacity building of antiviral stockpiles and pandemic vaccine purchase to cover the entire UK population were worthwhile. The report states that these preparedness measures were cost-effective. The report commends the UK government's crises management committee that was successful in supporting and maintaining the decision making process during periods of uncertainty during the pandemic. The first recommendation was "Ministers should determine early in a pandemic how they will ensure that the response is proportionate to the perceived level of risk and how this will guide decision-making. This approach should be reflected in the revised pandemic-specific Concept of Operations by summer 2011" (Hine, 2010).

The reports commented on the role of the coordination group that facilitated the organization of response measures and reduced inconsistencies and variability across the four nations. A and B countries established such groups to ensure and monitor pandemic planning and response activities (Hine, 2010) In the report, interviewees criticised the UK containment phase in a similar way category A and B public health authorities criticised long and resource intensive containment phase activities such as contact tracing and contact management. In line with the findings of this study, the UK evaluation report highlighted the pandemic flexibility stating that UK authorities struggled to adapt and flex response measures to fit the local circumstances. In terms of

communication, similar to stakeholder views from this study, the UK evaluation report concluded that public health education campaigns were successful in increasing public awareness regarding pandemic influenza spread and prevention measures (Hine, 2010).

The Standing Senate Committee on Social Affairs, Science and Technology reviewed Canada's response to the 2009 pandemic. In parallel to other evaluation reports, the committee concluded that pandemic preparedness activities that commenced few years ago proved to be efficient and useful in reducing the pandemic impact in terms of mortality and morbidly. The report highlighted the importance of financial support for both planning and implementing pandemic plans (Standing Senate Committee on Social Affairs Science and Technology, 2010). In this study, category B and C countries reported the lack of financial support during the planning phase since it was considered part of their day to day responsibilities and so this illustrates the importance of financial support for the writing up of the plan and related guidelines as well as funding expert groups. Similarly, the Canadian report mentioned that the Canadian government should continue funding pandemic preparedness activities. Furthermore, several themes emerged from the Canadian evaluation including roles and responsibilities of different public health administrative levels (federal, provincial, local levels), the national pandemic plan for Canada, communication, pharmaceutical measures, surveillance, collaboration, First Nation and Inuit, and research. Coordination including command and control themes emerged from the Canadian report

and the committee reported that more coordination at different government administrative levels was required to create a more even response across all jurisdictions (Standing Senate Committee on Social Affairs Science and Technology, 2010).

Internal communication issues with healthcare workers were also reported by Canadian public health stakeholders as challenges and concerns were stated in respect to pandemic response. Therefore, the committee suggested that communication plan to be revised to clarify the command and control structure of the different administrative tiers in Canada. One of the most important deficiencies identified in this study was the lack of healthcare workers engagement in the planning activities at the national and sub-national levels in all countries. The Canadian report identified the same problem in terms of participatory planning and collaboration of healthcare workers (Standing Senate Committee on Social Affairs Science and Technology, 2010). The committee called for wider participation of primary and secondary health workers in pandemic planning and preparedness. Stakeholders interviewed in this study across all administrative levels stated that here was a consistently identified lack of primary care contribution and awareness of pandemic planning activities during pandemic planning, implementation and eventual response. Last but not least, research and development emerged as an important theme from the Canadian evaluation report response to the pandemic of 2009. Influenza research emerged as an important theme in the Canadian report as the committee recommended ongoing financial support to

research and development initiatives pertinent to pandemic preparedness (Standing Senate Committee on Social Affairs, Science and Technology, 2010). The Swiss government reviewed its federal immunisation strategy and the reviewers identified challenges in regards to vaccine delivery and logistics (Nguyen-Van-Tam et al., 2010b). These were consistently highlighted by our data in category A and B countries. Improved operational planning and the use of simulations and exercises, especially at a sub-national level, could address these challenges.

The issue of pandemic severity was highlighted in the WHO evaluation report on the implementation of the International Health Regulations (2005), the evaluation in its third conclusion which contrast the finding of this study claimed that "*The world is ill-prepared to respond to a severe influenza pandemic or to any similarly global, sustained and threatening public-health emergency. Beyond implementation of core public-health capacities called for in the IHR, global preparedness can be advanced through research, reliance on a multi-sectoral approach, strengthened health-care delivery systems, economic development in low- and middle-income countries and improved health status"* (Fineberg, 2011). The report recommends four actions to address its third conclusion. First, countries should establish a reserve staff of public health professionals to support countries and provide advice and technical assistance. Second, member states have to create an emergency fund for public health threats. This funding would support surge capacity and could be during a declared Public Health Emergency of

International Concern (PHEIC). Third, member states need to collaborate regarding sharing viruses for vaccine manufacturing and establish joint procurement strategies to reduce cost and improve access to all countries The Review Committee recommends Member States and WHO complete consultations on sharing of influenza viruses and access to vaccines. The last recommendation focused on the need to establish a comprehensive influenza research and evaluation programmes, which is similar to the Canadian report recommendation (Fineberg, 2010).

The report of the IHR Review Committee, together with the aforementioned national pandemic evaluation reports, offers a strong groundwork for improving international and national preparedness for influenza pandemic and other public health emergences. In addition, the World Health Assembly (WHA) in 2011 approved a Pandemic Influenza Preparedness (PIP) framework that combines the identification, characterization and sharing of novel viruses (WHO, 2011c).

8.5 Evaluation issues and study limitations

Although this evaluation can assist countries in the revision of their pandemic plans and improve their preparedness through the identification of good practice models, specific issues and limitations related to the methodology also need to be discussed. Notably, the political, environmental, geographical, economic, social, cultural or circumstantial context under which these thematic domains were presented during each pandemic stage could have

determined how pandemic preparedness activities in the Member States were executed:

8.5.1 Thematic interdependency

The relationship between the identified major themes and sub-themes is complex and highly inter-dependent. Thus, the full extent of the inter-dependency of these themes may not have been reflected in the results as only the themes considered to have the most impact on pandemic preparedness have been assessed to date. Thus, it is possible that because of this correlation between identified themes, the results as presented are limited in providing a clearer picture on other issues or factors that could also have been important for improving pandemic preparedness and planning. Therefore, a more in-depth evaluation with more specific objectives is recommended to understand the full implications of this association.

8.5.2 Organisational structure

Organisational structural differences varied considerably across countries and this may dictate what is considered good practice or not. Organizational structures may affect the way pandemic planning, implementation and response activities are conducted and their perceived effectiveness. In all countries interviewed emergency management structures were hierarchical and command oriented structures with a top-down model. However, category A and some of category B countries devolved certain responsibilities to the subnational and local tiers in order to give a greater degree of flexibility and transparency in the decision making process. In this model, the top level

develops plans and policies and the bottom level has the responsibility to implement or modify these policies Consequently, this might lead to differences in coordination and communication strategies which may not be suitable for other countries. In category C, centralized and command oriented structures were noted and these were rigid structures that did not allow local authorities to change or modify policies because they were not part of the decision making process.

For example, when HCWs want to change or modify what is in the national plan; this can be considered a good practice in some countries but it might not be acceptable practice in the other countries with more centralized and tight structures. Similarly, seeking frontline workers' input and feedback regarding the planning process is considered a good practice in certain countries while they are seen as the "implementers" in counties with more centralized administrative structures. Each model has its pros and cons and each country adopt the model that fits their scope of work and organizational culture. Another example is vaccine logistics, some category A and B countries devolved this to the lower levels and found this to be inappropriate during the response, while this was already centralized in category C countries and proved to be working. These examples show the impact of the administrative structure on the perceived usefulness of pandemics preparedness activities.

8.5.3 Nvivo in data analysis

The use of computer-assisted qualitative data seawares (CAQDAS) has transformed the way social scientists analyse textual data. There is an on-

going controversy about using these packages in the analysis process. Therefore, it is essential to highlight these views in the context of this evaluation.

On one hand, the opposing group of social scientists claim that CAQDAS has made the process of qualitative data analysis more rigid and automatic. They claim that these packages ignore the context and meaning of the text during data analysis. Also, they argue that CAQDAS pay more attention to the occurrence and frequency of words on the expense of meaning which might lead to give more attention to quantifying data rather than focusing on recurrent themes (Murphy et al., 1998, Bryman, 2012).

On the other hand, other social scientists point out to the importance of using CAQDAS to facilitate the data coding process when dealing with a large volume of text. This can save the researcher time and effort to examine data in depth rather than trying to organize and label them manually. They add that these packages allow the evaluator to identify trends and pattern in data and subsequently add more quality in the analysis process. In addition, it adds to the reliability of the analysis process by making it more transparent to other researchers (Fielding and Lee, 2002).

8.5.4 Intrinsic Limitations

The following issues may have impacted on the evaluation results and their subsequent interpretation:

a) Lower and medium income countries are more dependent on WHO and rely on external support. This may lead to an increased level of acceptance of

external views and WHO recommendations. Whereas, higher income countries are more independent and have more capacity to implement required plan adaptations.

b) Countries may want to portray themselves in a positive light, afraid of being judged for inappropriate action or lack of action (though this was explicitly not within the remit of the study). More time to implement probing techniques during the interviews is required to allow the true nature of the responses to emerge. Trust between parties takes time but is also needed as some countries (Category C) may think of the evaluation as an inspection or a scale against which their own country is being graded or rated, though this was explicitly not within the study remit.

c) For the maintenance of consistency (i.e. evaluation context, questions, probing to get behind the scene), time for training interviewers was needed along with good briefing of evaluation intent.

d) The level of public health infrastructures and surveillance vary greatly across countries in the EU region in terms of case definition, reporting systems, and facilities and diagnostics capacities (European Centre For Disease Prevention and Control, 2007). Therefore, the amount of data from which relative severity can be judged may have been different across countries, and a low number of confirmed cases or deaths might reflect, in certain cases, a lack of accurate reporting rather than a lack of infections.

e) It is important to note that the scope of evaluation was wide and certain areas such as (surveillance, antivirals, risk communication and vaccinations)

were not explored in depth. We tried to cover as many topics as possible and asked around 40 questions in two hours time and this was on the expense of getting deep understanding about how particular planning activities were implemented and how stakeholders perceived their usefulness.

8.6 Alternative approaches

If I started the project over, I would develop more specific research objectives in order to collect in depth data to get a better understanding on certain issues in pandemic preparedness and planning. The project ended up collecting too much information that covered a variety of topics. The interviewers did not use probe or follow up questions so often to get a greater understanding about certain activities including vaccination, antivirals, surveillance, etc. Moreover, I would try to get more homogenous participants in each focus group to overcome the issue of dominance of high level and senor staff over their subordinates and might even reduce the number of participants to a maximum of three in each focus group. This was a major problem in category C as the more senior staff tried to dominate the interviews and did not give the opportunity for the subordinates to reflect on their experiences. This project was an urgent response to the pandemic in 2009 and WHO Regional Office for Europe wanted to publish guidelines for the first winter in the post-pandemic phase. Therefore, the study team did not have time to train the interviewers who kindly contributed to the data collection process and this was a fundamental limitation in the context of this evaluation. The use of

probe and follow up questions were lacking in a number of interviews and this led to shallow data in certain areas.

8.7 Future work

Future work can be conducted on the basis of the findings from this research project. Firstly, a quantitative survey to evaluate the usefulness of the pandemic preparedness activities across all the member states within the WHO Euro region is worth doing. As mentioned in the methods section, qualitative evaluation is an exploratory method to generate hypotheses. An evaluation using quantitative methods can test these hypotheses and produce more generalizable and representative findings. For example, our findings revealed lack of primary HCWs in the countries participated in our study, this can be considered a hypothesis that can be further tested and examined using observational studies. Secondly, another round of interviewing would be worth doing since this evaluation was an urgent response to the pandemic in 2009. The timing of the interviews was within the pandemic itself and even before the announcement of the post pandemic phase by the WHO. This might not have allowed for enough time for stakeholders to explore all the issues pertinent to the preparedness and response to the pandemic. Interviews could focus on countries' reflections as well as any sort of revisions and updates to their national and sub-national pandemic planning strategies based on the lessons learned from the first pandemic in the twenty first century.

8.8 Recommendations

National level

- Strong political commitment and government involvement are essential in the pandemic preparedness process.
- National authorities should ensure accessible and on-going financial support to pandemic preparedness activities.
- Participatory planning from different stakeholder groups across different administrative levels proved useful during the pandemic.
- Improve operational planning regarding vaccine procurement and logistics across different stakeholder groups.
- National authorities should adopt more flexible and adaptable plans in order to be prepared to respond to different scenarios in regards to pandemic severity.
- More careful planning to hospital surveillance should be undertaken in the post pandemic phase.
- It is essential to have a risk communication plan with healthcare workers beforehand as this was found to facilitate the process of communicating the vaccine effectiveness and safety with frontline healthcare workers during the pandemic.
- Exercising the national and sub-national plans is essential and should include all stakeholders and lesson should be fed back into the plans.

Sub-national level

- The sub-national health authorities should use national plans and associated guidelines as a framework to develop more local plans.

- Sub-national pandemic preparedness planning activities and meetings should be an on-going process with continuous support and follow up from the national levels.
- Effective communication channels for comments and feedback from frontline HCWs facilitate sub-national pandemic preparedness process.
- Increasing public awareness before and during the pandemic is an essential task.
- Subnational health authorities should invest in training and educating HCWs on pandemic preparedness.
- Subnational tiers should follow up and support healthcare workers in regards to hospital pandemic preparedness activities.

Healthcare workers

- Healthcare workers should be actively involved in the national and sub-national pandemic planning process and their views and input should be given a considerable weight during planning and implementation phases.
- Communication channels between the national tier and healthcare workers and between the primary and secondary health workers should be established and tested in the inter-pandemic phase.
- Training healthcare workers on treating influenza cases, laboratory diagnostic skills and on the main difference between pandemic and seasonal influenza are essential preparedness activity.
- Balanced approaches that combine both bottom up and top down models are required during preparing and response to pandemic preparedness activities.

8.9 Conclusions

1. It has been possible using a qualitative methodology to review the extent to which pandemic preparedness activities proved useful during 2009–2010 influenza A (H1N1) pandemic and to identify areas of under planning that require further improvement in the future.

The findings from this evaluation were in line with other national and international reviews; it has been found that the overall pandemic preparedness activities that were undertaken before the pandemic in 2009 were worthwhile and appropriate to the level of severity of the 2009 influenza pandemic. In general, multi-sectoral participatory planning, political support, national pandemic planning committees, dedicated funding for pandemic planning, experts' input, simulation exercises, capacity building activities, and staff training were the core principles of pandemic preparedness activities.

Planning for certain pandemic preparedness activities were underdeveloped and required rectification in the post pandemic phase; these were planning flexibility and the need to plan for multiple scenarios, the involvement of the healthcare workers in the planning and response process, comprehensive planning for risk communication with the public and healthcare workers, vaccine procurement and logistics, and hospital surveillance.

2. Despite the differences between the seven countries in terms of pandemic preparedness activities and public health infrastructures, it was possible to identify six consistent, recurring and interdependent themes that reflected

good practices as well as shortcomings in regards to pandemic preparedness. These are communication, coordination, capacity buildings, mutual support, leadership, and flexibility. It was obvious from the findings that the planning process of developing, implementing, exercising, maintaining, and evaluating the pandemic plans at different administrative levels were more important than the documents and plans themselves.

3. This evaluation methodology using accepted social scientific principles is the first of its kind to focus on the utility of the pandemic preparedness activities compared with the eventual response, rather than the response itself. It can be replicated to study particular pandemic planning activities in depth in the European region as well as other regions. In fact, the WHO regional office for Europe has already successfully replicated and used this methodology to evaluate pandemic preparedness activities in the national influenza centres (NIC).

4. The findings from this study provide several hypotheses for future research. Based on the results, quantitative surveys can be used to test these hypotheses in order to generalise the findings to the larger population not only for pandemic influenza but also for other public health emergencies that might have international public health concerns.

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APPENDICES

Appendix A Study Protocol

How pandemic preparedness activities aided the response to the pandemic (H1N1) 2009: A study in countries of the WHO European Region

Introduction

On 11 June, 2009, WHO declared pandemic phase 6 due to a new strain of influenza A(H1N1). Countries across the globe are responding to the pandemic. Many draw on the experience gained from several years of pandemic preparedness activities (PPA) as well as the response to outbreaks of avian influenza A (H5N1).

Pandemic preparedness activities aim to reduce transmission of the pandemic virus strain, decrease cases, hospitalizations and deaths, maintain essential services and to reduce the economic and social disruption of a pandemic. These activities include the whole planning process of development, exercising, maintaining, revising and translating into actions the national pandemic preparedness and response plans. Plans can be developed at national and regional levels to ensure a good quality response.

WHO EURO has been extensively involved in PPA in the Region during the past few years, and, as a next step, will perform an evaluation of how countries' PPA contributed to the response to pandemic (H1N1) 2009. It is important to understand how countries' PPA supported the pandemic response as this will guide and strengthen the preparedness planning component of the further response of the Member States to pandemic (H1N1)

2009, as well as to other future health emergencies. This will also inform further WHO EURO activities and guidance in the area of preparedness planning. This study will not evaluate the actual response to pandemic (H1N1) 2009, nor the effectiveness of implementation of individual measures.

Aim and objectives

The aim of this evaluation is to identify how pandemic preparedness activities aided the response to pandemic (H1N1) 2009 in order to identify good practices for future pandemic planning.

The main objectives of the evaluation will be to:

- Describe the process of pandemic planning and how it aided the response.
- Describe how well pandemic preparedness activities were translated into action during the response; and identify difficulties faced by member states.
- Identify what could have been done differently in pandemic preparedness to improve the usefulness of these activities during the response.

Methodology

The evaluation will be conducted through country visits carried out by a WHO team of four pandemic preparedness experts. The team will interview relevant stakeholders at different administrative levels and from different sectors. The proposed timetable for the visit can be found at the end of this

document. The interviews will take place in one city (the capital) and if stakeholders from local/regional level need to travel to reach the place of interview, WHO will cover the costs.

Prior to the visits, the country focal point will be asked to provide relevant documents developed as part of PPA as well as any new documents developed after the start of the pandemic to WHO. The stakeholders to be interviewed will receive examples of interview questions.

Stakeholders to be interviewed

Interviews will be conducted with stakeholders from the central and regional/local government, public health authorities and healthcare system. Each stakeholder will be asked to include 2-4 key persons who will be interviewed together.

Stakeholders to be interviewed should be involved in pandemic preparedness and response activities and be representatives from:

1. The Ministry of Health
2. A key ministry responsible for civil response and involved in pandemic preparedness and response, e.g. Ministry of Interior or Ministry of Emergency.
3. The public health authority
4. Local or regional tier
5. Secondary health care staff (preferably medical front line doctors from hospitals from different regions with responsibility for the clinical management of pandemic H1N1 patients).

6. Primary health care staff (looked after pandemic patients - preferably from different regions)

Preferably, the above stakeholder groups should together be able to cover the following areas of pandemic preparedness and response: command and control, business continuity planning, surveillance, non-pharmaceutical public health measures, clinical management, antiviral drugs, vaccine, communication and legal and ethical aspects.

Debriefing

Preliminary findings will be presented during a debriefing on the last day of the mission. It is preferable to have as many stakeholders as possible present during both the briefing at the start of the mission and the debriefing on the last day.

Expected outputs

Following the six country visits, all participating countries will be invited to take part in a workshop where findings will be discussed, and a report containing a set of recommendations will be prepared. It is the intention that these recommendations should form the basis for future WHO guidance on pandemic preparedness activities.

Expected outcome

Improvements in Member States of the WHO European Region in pandemic preparedness, reflected in national pandemic plan revisions, as well as the ability to respond to potential future waves of pandemic (H1N1) 2009 and other emerging pandemic viruses.

Appendix B Interview guides

Guide for National tier (MOH and NPHA)

Section A: The planning process *(25 minutes)*

1) Describe how the pandemic plan was developed (in brief), including:

a. persons involved in the actual writing process

b. When activities were initiated/ finalized?

c. Ways of working: frequency of meetings etc.?

d. Lead institution and person

e. Necessary finances to implement plan identified

2) Was guidance sought from international organizations (WHO guidance documents) or neighbouring countries?

3) What was the approval process of the plan? Status of plan as of March 2009?

4) Has the plan been revised/evaluated before the pandemic? What were triggers for revision of the plan?

5) Was a specific scenario used as basis for the pandemic plan?

6) To which stakeholders was the plan disseminated (actively)?

7) Which factors were important for developing the national pandemic plan?

8) Did you give input or support to development of the non-health plan/BCP and regional plans? If yes, what support was given?

Section B: Implementation of plan before the pandemic *(25 minutes)*

9) Did the plan identify specific actions that required putting in place before the pandemic?

a. Which were they? What got implemented? What specifically facilitated their implementation?

b. Were things implemented before the pandemic that with hindsight need not have been implemented?

10) Were there things needed/implemented in the response that should have been implemented beforehand? What were they? Why were they not implemented before the pandemic?

11) Was the pandemic plan tested in exercises?

a. Which elements were tested?

b. At which level was the plan tested (national, local/regional, hospitals)?
c. How were lessons learned incorporated into the pandemic plan/pandemic preparedness activities?

Section C: Use of the plan in the response to the pandemic (H1N1) 2009 ***(40 minutes)***

12) Did you use the plan you had written in the response to the pandemic? Did you use other documents? Which?

13) At the start of the pandemic, what was the trigger to activate the plan? What exactly did you do to activate the plan?

a. Which parts of the plan were used?

b. What did you disseminate and to whom?

14) If the plan, or components of the plan, were not used, why not?

a. What was implemented instead?

b. What could have been in the plan to make it useful?

15) Did you need to develop any new documents or response strategies that were not envisaged in the plan? How were they disseminated?

16) Did your plan include triggers for action and/or de-escalation?

a. What were the triggers based on? Were they used during the pandemic?

b. If no triggers in plan, what was the basis for deciding on actions?

c. Where did you obtain information from on triggers? How did you distil all the available information? Where you able to make timely decisions?

17) Were there communication channels that did not work? Were there communication channels that were not anticipated but that proved important?

18) What were the main things that were done differently in the response than envisaged in the planning process?

Section D: Reflection on what could have been done differently in the planning phase ***(30 minutes)***

19) Which pandemic preparedness activities were the most useful to your response to the pandemic? Why?

20) Which pandemic preparedness activities were the least useful your response to the pandemic? Why?

21) If you had to start again, what would your plan/ pandemic preparedness activities? include/look like? Who would you engage with/involve?

22) What are your next steps (evaluation, revision of plan)?

23) What do you expect from WHO for future pandemic preparedness activities?

Guide for Civil Emergency response (CER)

Section A: The planning process *(25 minutes)*

1) Was a pandemic specific or generic business continuity or civil response plan developed prior to the pandemic (H1N1) 2009?

2) If yes, describe how the plan* was developed (in brief), including:

a. persons involved in the actual writing process

b. When activities were initiated/finalized?

c. Ways of working: frequency of meetings etc.?

d. Lead institution and person

e. Necessary finances to implement plan identified

3) Did MOH or the public health authority or the regional tier give input to the development of the civil response plan/BCP? If yes, what support was given?

4) What was the approval process of the plan?

5) Did you support businesses (public and private) in developing BCP's?

6) Was guidance sought from international organizations (WHO guidance documents) or neighbouring countries for development of the plan?

7) Has the plan been revised/evaluated before the pandemic? What were triggers for revision of the plan?

8) Was a specific scenario used as basis for the plan?

9) To which stakeholders was the plan disseminated (actively)?

10) Which factors were important for developing the BCP/civil response plan?

11) Were you involved in the development of the plan? If yes, what was your role?

Section B: Implementation of plan before the pandemic *(25 minutes)*

12) Did the plan identify actions that required putting in place before the pandemic?

a. Which were they? What got implemented? What specifically facilitated their implementation?

b. Were things implemented before the pandemic that with hindsight need not have been implemented?

13) Were there things needed/implemented in the response that should have been implemented beforehand? What were they? Why were they not implemented before the pandemic?

14) Was the civil response plan tested in exercises?

a. Which elements were tested?
b. How were lessons learned incorporated into the plan/ pandemic planning activities?

15) Were you involved in exercises at national level? If yes, what was tested?

Section C: Use of the plan in the response to the pandemic (H1N1) 2009 ***(40 minutes)***

16) Did you use the plan in the response to the pandemic? Did you use other documents?

17) What was the role of your ministry in the response to the pandemic? Was this similar to what was envisaged in the planning process?

18) At the start of the pandemic, what was the trigger to activate the plan? What exactly did you do to activate the plan?

a. Which parts of the plan were used?

b. What did you receive from MOH?

c. What did you disseminate and to whom?

19) If the plan, or components of the plan, were not used, why not?

a. What was implemented instead?

b. What could have been in the plan to make it useful?

20) Did you need to develop any new documents or response strategies?

21) Which services proved to be essential/ critical in the response to the pandemic? Was this similar to what was anticipated?

22) Did your civil response plan include triggers for action and/or de-escalation?

a. What were the triggers based on? Were they used during the pandemic?
b. If no triggers in plan, based on what were actions taken?

c. Where did you obtain information from? How did you distil the available information?

23) Were there communication channels that did not work? Were there communication channels that were not anticipated but that proved important?

24) What were the main things that were done differently in the response than what was envisaged in the planning process?

Section D: Reflection on what could have been done differently in the planning phase *(30 minutes)*

25) Which civil response planning activities were the most useful? Why?

26) Which civil response planning activities were the least useful? Why?

27) If you had to start again, what would your plan/pandemic planning activities include/look like? Who would you engage with/involve?

28) What are your next steps (evaluation, revision of plan)?

29) What do you expect from WHO for future pandemic preparedness activities?

Guide for sub-national government authority (SNGA)

Section A: The planning process *(25 minutes)*

1) Was a regional pandemic plan developed prior to the pandemic (H1N1) 2009?

2) If yes, describe how the regional pandemic plan was developed (in brief), including:

a) persons involved in the actual writing process

b) When activities were initiated/finalized?

c) Ways of working: frequency of meetings etc

d) Lead institution and person

e) Necessary finances to implement plan identified

3) Did MOH give input to the development of the regional plan? If yes, what support was given?

4) Did MOH keep track/follow up on the development of the regional plan?

5) Was guidance sought from international organizations (WHO guidance documents)

6) Did you coordinate or collaborate with other regions and/or neighbouring countries for development of the regional plan?

7) What was the approval process of the plan? What was the status as of March 2009?

8) Has the plan been revised/evaluated before the pandemic? What were triggers for revision of the plan?

9) Was a specific scenario used as basis for the pandemic plan?

10) To which stakeholders was the plan disseminated (actively)?

11) What was important for developing the regional plan?

12) Were you involved in the national planning process? If yes, to what extent?

Section B: Implementation of plan before the pandemic *(25 minutes)*

13) Did the plan identify specific actions that required putting in place before the pandemic at regional level?

a) Which were they? What got implemented and what specifically facilitated their implementation?

b) Were things implemented before the pandemic that with hindsight need not have been implemented?

14) Were there things needed/implemented in the response that should have been implemented beforehand? What were they? Why were they not implemented before the pandemic?

15) Was the regional pandemic plan tested in exercises?

a. Which elements were tested?
b. How were lessons learned incorporated into the pandemic plan/ pandemic preparedness activities??

16) Were you involved in exercises at national level? If yes, what was tested?

Section C: Use of the plan in the response to the pandemic (H1N1) 2009 *(40 minutes)*

17) Did you use the regional and/ or national plan in the response to the pandemic? Did you use other documents? Which?

18) At the start of the pandemic, what was the trigger to activate the plan? What exactly did you do to activate the plan?

a. Which parts of the plan were used?

b. What guidance/ documents did you receive from the central government?

c. What did you disseminate from the regional level and to whom?

19) If the plan, or components of the plan, were not used, why not?

a. What was implemented instead?

b. What could have been in the plan to make it useful?

20) Did you need to develop any new documents or response strategies during the pandemic? How were they disseminated?

21) What information or support did you need from national level during the pandemic? Did you get it?

22) Did your regional plan include triggers for action and/or de-escalation?

a. What were the triggers based on? Were they used during the pandemic?
b. If no triggers in plan, what was the basis for deciding on actions to be taken?
c. Where did you obtain information from? How did you distil all the available information? Were you able to make timely decisions?

Was it clear from the national plan what was expected of you at regional level during the pandemic?
23) Were there communication channels that did not work? Were there communication channels that were not anticipated but that proved important?

24) What were the main things that were done differently in the response than what was envisaged in the planning process?

Section D: Reflection on what could have been done differently in the planning phase *(30 minutes)*
25) Which regional or national pandemic planning activities were the most useful? Why?

26) Which regional or national pandemic planning activities were the least useful? Why?

27) If you had to start again, what would your plan/pandemic planning activities include/look like. Who would you engage with/involve?

28) What are your next steps (evaluation, revision of plan)?

29) Is there anything specific that the regional level would expect from WHO for future pandemic preparedness activities.

Guide for primary and secondary Healthcare workers (HCWs)

Section A: The planning process *(25 minutes)*

1) Were you familiar with the national/regional pandemic plan before the pandemic (H1N1) 2009?

2) How were you informed about national or regional pandemic planning?

3) How did you prepare for a pandemic at hospital level? Was a pandemic plan for the hospital developed? What was important for developing the pandemic plan at hospital level?

4) Was the hospital plan developed unilaterally or in response to a request from regional/national level?

5) Where you involved in the development of the national/regional/hospital plan? If yes, what was your role?

6) What information did you receive from national or regional level during the planning process?

7) Were you familiar with the planning assumptions on which the pandemic plan was based?

Section B: Implementation of plan before the pandemic *(25 minutes)*

8) Did the plan identify actions that required putting in place before the pandemic in secondary healthcare setting?

a. Which were they? What got implemented? What specifically facilitated their implementation?

b. Were things implemented before the pandemic that with hindsight need not have been implemented?

9) Were there things needed/implemented in the response that should have been implemented beforehand? What were they? Why were they not implemented before the pandemic?

10) Were you involved in pandemic exercises at hospital/regional/national level?

a. Which parts were tested?
b. How were lessons learned incorporated into the pandemic plan/pandemic planning activities?

Section C: Use of the plan in the response to the pandemic (H1N1) 2009 *(40 minutes)*

11) At the start of the pandemic, what was the trigger to activate the hospital plan?

a. Which parts of the plan were used? Was national/regional plan used?

b. What did you receive from MOH/regional level? Did you use this?

12) If the plan, or components of the plan, were not used, why not?

a. What was implemented instead? Which new documents developed?

b. What could have been in the plan to make it more useful?

13) What information or support did you need from national/regional level during the pandemic that you did not get?

14) Where did your information come from? How well did you distil the available information? Where you able to make timely decisions?

15) Were triggers for action/de-escalation during the pandemic clear to you?

16) Was it clear what was expected from you at different stages of the pandemic?

17) Were there communication channels that did not work? Were there communication channels that were not anticipated but that proved important?

18) Were there mechanisms in place that allowed you to feed back problems from the front line to relevant authorities at regional/national level?

19) What were the main things that were done differently in the response than what was planned?

20) Thinking about your expected role during a pandemic, how did your actual role play out in comparison?

Section D: Reflection on what could have been done differently in the planning phase *(30 minutes)*

21) Which regional or national pandemic planning activities were most useful at secondary health care level? Why were they useful?

22) Which regional or national pandemic planning activities were least useful? Why?

23) If you had to start again, what would your plan/pandemic planning activities include/look like? Who would you engage with/involve?

24) What are your next steps (evaluation, revision of plan)?

25) What do you expect from WHO for future pandemic preparedness activities?

Appendix C Invitation letter to participate in the study

Date: 08 March 2010

WORLD HEALTH ORGANIZATION
REGIONAL OFFICE FOR EUROPE
BUREAU RÉGIONAL DE L'EUROPE
REGIONALBÜRO FÜR EUROPA
ЕВРОПЕЙСКОЕ РЕГИОНАЛЬНОЕ
БЮРО

Head office:
8, Scherfigsvej, DK-2100
Copenhagen Ø, Denmark
Telephone: +45 39 17 17 17; Fax: +45 39 17 18 18;
E-mail: postmaster@euro.who.int

Dear Sir,

Evaluation of how pandemic preparedness activities aided the response to the pandemic (H1N1) 2009 in countries of the WHO European Region

The World Health Organization, Regional Office for Europe is organizing a study of how pandemic preparedness activities aided the response to the pandemic (H1N1) 2009. The study will be conducted through interviews with relevant stakeholders involved in pandemic preparedness and response activities in six selected countries. This initiative is a continuation of the efforts of the Regional Office for Europe to support Member States in strengthening their pandemic preparedness for future waves of the pandemic and for other possible outbreaks of infectious diseases. The initiative is being coordinated with other ongoing evaluations in Europe.

I have the pleasure of inviting your country to participate in the study since your country has been randomly chosen to be included in the study. Additional information about the study can be found in the enclosed scope and purpose. If you agree to participate in the study, we will provide further information to the focal point for this activity in your country, which we kindly ask you to nominate.

We would appreciate your confirmation of your country's participation in the above by 26 March 2010. If we do not hear from you by this date we will assume that you are not interested in participating and will proceed with contacting alternative countries. At the same time, we would appreciate to receive the name and contact details of the focal point.
Ms Michala Hegermann-Lindencrone, Technical Officer, Communicable Diseases Surveillance and Response, is the WHO Technical Officer responsible for this activity and it would be appreciated if you would address your reply to her (fax + 45 39 17 18 69, e-mail: mhl@euro.who.int).

Nedret Emiroglu, M.D., Ph.D.
Director a.i.
Division of Health Programmes

Appendix D Scope and purpose of the evaluation workshop

WORLD HEALTH ORGANIZATION
REGIONAL OFFICE FOR EUROPE

WELTGESUNDHEITSORGANISATION
REGIONALBÜRO FÜR EUROPA

ORGANISATION MONDIALE DE LA SANTE
BUREAU REGIONAL DE L'EUROPE

ВСЕМИРНАЯ ОРГАНИЗАЦИЯ ЗДРАВООХРАНЕНИЯ
ЕВРОПЕЙСКОЕ РЕГИОНАЛЬНОЕ БЮРО

Evaluation of how pandemic preparedness activities aided the response to pandemic (H1N1) 2009 in countries in the WHO European Region

100717

Workshop on 20-22 October 2010

14 July 2010
Original: English

Scope and purpose

The World Health Organization Regional Office for Europe is organizing a workshop to discuss the findings from the evaluation of how pandemic preparedness activities aided the response to pandemic (H1N1) 2009 in countries in the WHO European Region. The workshop will take place from 20-22 October in Copenhagen.

Four persons from each country visited during the evaluation will be invited (one representative each from the Ministry of Health and/or the Public health authority, regional authority, secondary health care and primary health care). In addition consultants and external experts who took part in the evaluation visits will be invited. The objective of the workshop will be for participating countries to agree on the content of the aggregated evaluation report and its publication and to provide input on how to improve future WHO pandemic preparedness guidance.

The content of workshop will be:

Day 1: Presentation of aggregated findings from country visits: to agree on good practices and gaps identified and conclusions

Day 2: Discuss solutions to the issues identified by means of case studies. This work will be conducted in smaller groups the composition of which will be determined according to the specific issues.

Day 3: Based on the findings from country visits and conclusions from the break-out sessions, the content of current and future WHO guidance will be discussed.

Appendix E Interview Standard Operating Procedure

Preparation before the interview

1. Interview teams will comprise of a minimum of 2 individuals.
2. Allocate roles for 'interviewer' and 'scribe' in advance – these roles may be alternated after each section of the interview.
3. The interviewer follows Form A and works through the questions, whilst the Scribe annotates the answers given onto Form B.
4. Scribes must write legibly in English.
5. Dress code is 'business formal' unless the host institute specifies or invites otherwise.
6. Prepare a digital voice recorder to assist the note taking.
7. There will be a briefing session prior to the interview when the team lead will address the key points about the project. This will be presented by the team lead at the start of each mission which will address the following:

a. Introduce members of the team to the hosting institute
b. Background information
c. Aim and objectives of the study
d. Methodology
e. Confidentiality
f. Funding
g. Expected outcome
h. Interview rules (as per next section)
i. Future workshop
j. facts (we are not evaluating the response but we are evaluating how did planning match the response, it is a piece of academic research which will lead to a PhD degree, etc)

The Interview

1. Interviewers must begin by addressing terms of confidentiality.
2. Role profile from will be distributed at the start of the interview.
3. Provide contact details of the interviewers.
4. Allow interviewees to clarify any doubts about the interview.
5. 'Interviewer' needs to explain the format of the interviews: four sections and how much time is dedicated to each one.
6. 'Interviewer' needs to ask one question at a time (do not combine) and provide transition between major sections.
7. When answering ask the group for one reply from the person best placed to answer the question; after he/she finishes ask other interviewees if they agree or disagree.
8. Scribes can interfere in the following situations:

a. If he/she thinks that the respondent deviates from the topic asked.
b. Clarification/checking/hearing.
c. Additional questions may not be asked until the end of the Interview.

9. Scribe is also responsible for time management throughout the interview.
10. Translation will be consecutive not continues

After the interview

1. Verify if the tape recorder worked throughout the interview.
2. Make any notes on your written notes.
3. Write down any observations made during the interview.
4. De-brief together and check both interviewers have a showed sense of:

a. how it went.
b. the main messages

Appendix F Role Profile Form

Role Profile Form

We would appreciate if you would fill in this form. It helps us describe who we interviewed for the project. However please be assured that this information will be held in confidence. No individual persons and no individual countries will be identified in the final report

1. Full Name:

2. Gender:

3. Age:

4. Job title:

5. Department:

6. Role played in pandemic planning:

7. Role played in pandemic response:

8. Work phone:

9. E-mail:

Signature

Date

Appendix G WHO Service Evaluation Letter

WORLD HEALTH ORGANIZATION
ORGANISATION MONDIALE DE LA SANTÉ
WELTGESUNDHEITSORGANISATION
ВСЕМИРНАЯ ОРГАНИЗАЦИЯ ЗДРАВООХРАНЕНИЯ

REGIONAL OFFICE FOR EUROPE
BUREAU RÉGIONAL DE L'EUROPE
REGIONALBÜRO FÜR EUROPA
ЕВРОПЕЙСКОЕ РЕГИОНАЛЬНОЕ БЮРО

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Email: contact@euro.who.int
Website: http://www.euro.who.int

Date: 27 March 2014

Prof Jonathan Van Tam Nguyen
Professor of Health Protection
University of Nottingham
Clinical Sciences Building City Hospital
Hucknall Road
Nottingham NG5 1PB
United Kingdom of Great Britain and Northern Ireland

Our reference: CBR/MHL
Notre référence:
Unser Zeichen:
См. наш номер:

Your reference:
Votre référence:
Ihr Zeichen:
На Ваш номер:

Dear Professor Van-Tam,

I am writing to confirm that the Evaluation of how Pandemic Preparedness aided the Response to the Pandemic (H1N1) 2009, undertaken in cooperation with the University of Nottingham (Dr A. Hashim, Prof J. Van-Tam, Prof I. Shaw), was a Service Evaluation project commissioned by the World Health Organization (WHO). It was undertaken in partnership with the University of Nottingham in order to increase academic rigour and methodological robustness.

Yours sincerely,

Caroline S. Brown
Programme Manager
Influenza & other Respiratory Pathogens
Division of Communicable Diseases, Health Security, and Environment