2 Setting the scene

2.1 Seasonal influenza

Influenza is an acute infectious viral illness that spreads rapidly from person to person when in close contact. It is characterised by the sudden onset of fever, chills, headache, muscle pain, severe prostration and usually cough – with or without a sore throat – or other respiratory symptoms. The acute symptoms generally last for about a week, although full recovery may take longer. In most years, seasonal influenza occurs in the UK predominantly during a six to eight week period in winter and affects some 5% to 15% of the population.

There are three broad types of influenza virus – A, B and C. Influenza A viruses cause most winter epidemics (and pandemics) and can affect a wide range of animal species as well as humans. They have a remarkable ability to adapt and change – which is what keeps them in circulation – and the resulting viruses can have widely differing impacts. Influenza B viruses only infect people. They circulate most winters but generally cause less severe illness and smaller outbreaks, particularly amongst children. Influenza C viruses are amongst the many causes of the common cold.

About half of those who become infected have no symptoms and are therefore not even aware of the infection. For the majority of the other half, 'seasonal' influenza is an unpleasant but self-limiting and not life-endangering illness. However, in some it may be more severe, or complicated by secondary bacterial infections such as bronchitis or pneumonia. The very young, older people and those with underlying diseases such as heart or chest disease are particularly at risk of serious illness. Without interventions, those in high-risk groups can suffer significant ill health, and a small percentage of those affected die. An estimated 12,000 – mainly older – people die each year from seasonal influenza in England and Wales. The cornerstone of reducing the impact of seasonal influenza is selective annual vaccination of those groups most at risk of serious illness, complications and death with an appropriately formulated vaccine.

More information on seasonal influenza is available from the Department of Health's immunisation information website at www.immunisation.nhs.uk

2.2 How influenza spreads

Influenza is one of the most difficult infectious diseases to control because the virus spreads easily from person to person via the respiratory route when an infected person talks, coughs or sneezes. It also spreads through hand-to-face contact if hands are contaminated.

Experimental studies suggest that influenza viruses may survive for some time on various surfaces, surviving longer on hard non-porous surfaces than on soft porous materials. Studies have also shown that careful hand washing,

commercially available alcohol-based hand disinfectant and domestic cleaning products can easily deactivate the virus.

The incubation period (the time from exposure to first symptoms) is in a range of one to four days, typically two to three. Without intervention – or significant immunity in the population – historical evidence suggests that one person infects about two others on average and that influenza spreads particularly rapidly in closed communities such as schools or residential homes. People are most infectious soon after they develop symptoms, though they can continue to shed virus for usually up to five days after the onset of symptoms (seven days in children).

It is sometimes stated that patients are infectious shortly before they develop symptoms; however, the evidence for this is limited. Spread from a person before they develop symptoms has rarely been recorded, though experimental studies have shown that some people start shedding low doses of virus in the 24 hours before symptoms occur. Some people can be infected without showing symptoms and, as they may shed the virus, be able to pass on the infection.

2.3 An influenza pandemic

Pandemic influenza occurs when an influenza A virus subtype emerges or re-emerges which is:

- markedly different from recently circulating strains
- able to infect people
- readily transmissible from person to person
- capable of causing illness in a high proportion of those infected
- able to spread widely because few – if any – people have natural or acquired immunity to it.

Whilst such a virus could first emerge anywhere in the world – including the UK – South East Asia, the Middle East and Africa are widely considered to be the most likely potential sources. It would initially spread to cause outbreaks and epidemics within the country of origin and its immediate neighbours before spreading globally to cause a pandemic. The conditions that allow a new virus to develop and spread continue to exist, and some features of modern society, such as air travel, could accelerate the rate of spread. Experts therefore agree that there is a high probability of a pandemic occurring, although timing and impact are impossible to predict.

More detailed information on influenza viruses, the illness they can cause and the impact of past pandemics is available at www.dh.gov.uk/pandemicflu

2.4 Avian influenza

Avian influenza ('bird flu') is an infectious disease of birds caused by influenza A viruses that spread mainly through contact with contaminated faeces (droppings) but also via respiratory secretions. Although they do not readily infect species other than birds and pigs, scientists believe that human-adapted avian viruses were the most likely origin of the last three human influenza pandemics.

The highly pathogenic A/H5N1 avian influenza virus – which is extremely contagious and rapidly fatal in domestic poultry species – has prompted particular concerns in recent years. There has been rapid spread within and from the Far East, with incursions into Europe and Africa caused by movement of infected poultry and poultry products, and possibly via migratory birds. Whilst the virus has also infected humans, such infections have only been recognised in a small proportion of those who have been exposed to infected birds. To date there has only been limited evidence of person-to-person transmission and, even where that has occurred, it has been with difficulty and has not been sustained.

A growing reservoir of infection in birds, combined with transmission to more people over time, increases the opportunities for the A/H5N1 virus either to adapt to give it greater affinity to humans or to exchange genes with a human influenza virus to produce a completely novel virus capable of spreading easily between people and causing a pandemic. However, the likelihood of and time span required for such mutations are not possible to predict.

Experts agree that A/H5N1 is not necessarily the most likely virus to develop pandemic potential. However, due to the potential severity of a pandemic originating from an H5N1 virus, this possibility cannot be discounted. For planning purposes, it is important to be aware of the many other avian viruses that are endemic in birds and have the potential to infect humans.

Further information on the human and animal health aspects of avian influenza – including contingency arrangements for responding to an avian influenza outbreak in the UK – is available from the Department for Environment, Food and Rural Affairs (Defra) at www.defra.gov.uk, the Department of Health at www.dh.gov.uk/pandemicflu, HPA at www.hpa.org.uk, WHO at www.who.int/csr/en and the OIE at www.oie.int

2.5 What an influenza pandemic might look like

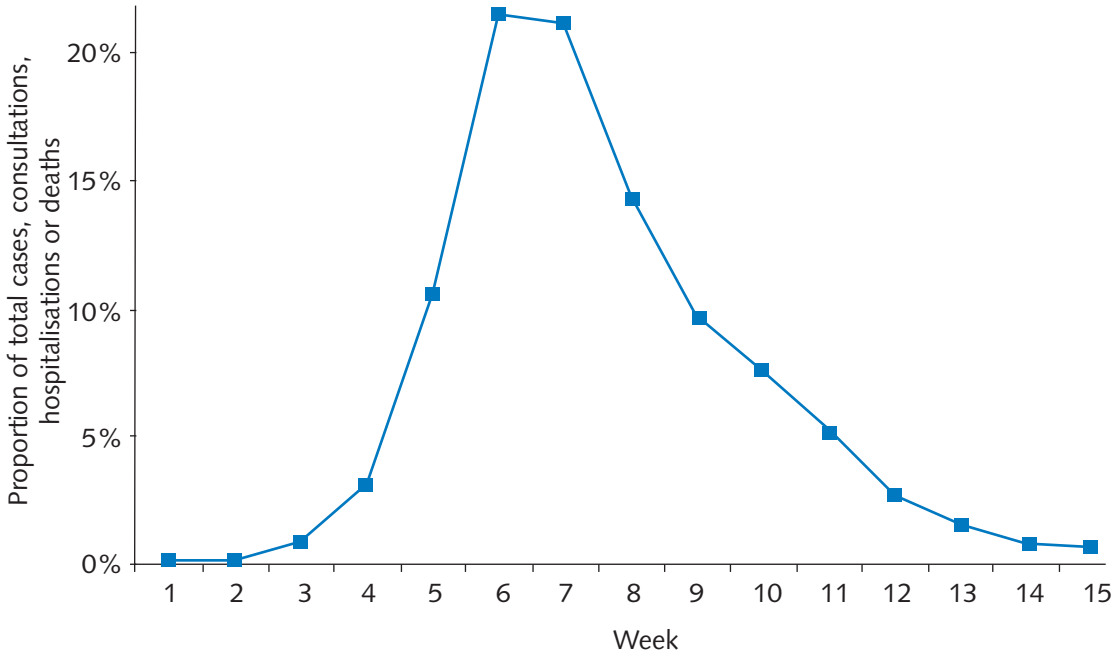
Past pandemics have varied in scale, severity and consequence, although in general their impact has been much greater than that of even the most severe winter 'epidemic'. There have also been material differences in the age groups most affected, the time of year they occurred and the speed of spread, all of

which influenced their overall impact. Although little information is available on earlier pandemics, the three that occurred in the 20th century are well documented. The worst (often referred to as 'Spanish flu') occurred in 1918/19. It caused serious illness, an estimated 20–40 million deaths worldwide (with peak mortality rates in people aged 20–45) and major disruption. Some residual health problems attributed to it lasted for many years thereafter. Whilst the pandemics in 1957 and 1968 (often referred to as 'Asian' and 'Hong Kong flu' respectively) were much less severe, they also caused significant illness levels – mainly in the young and the elderly – and an estimated 1–4 million deaths between them.

It is impossible to forecast the precise characteristics, spread and impact of a new influenza virus strain. Modelling suggests that from the time it begins in the country of origin it may take as little as two to four weeks to build from a few to around 1,000 cases and could reach the UK within another two to four weeks. Once in the UK, it is likely to spread to all major population centres within one to two weeks, with its peak possibly only 50 days from initial entry.

An influenza pandemic can occur either in one wave, or in a series of waves, weeks to months apart. To inform preparedness planning, a temporal profile based on the three pandemics that occurred in the last century and current models of disease transmission has been constructed (see Figure 1). This shows the fastest overall national progression of a pandemic from the time it becomes the dominant form of influenza-like disease, when the number of cases rises above the background of such diseases. Although there is a significant number of pandemic influenza cases in week 1 of the profile, most recorded influenza-like infections at this stage will not be pandemic influenza. By week 2 most influenza-like infections will be pandemic influenza, which will overtake the background level of similar illness. The earlier stages of the UK epidemic, before pandemic influenza becomes the dominant respiratory disease, are much harder to predict because they depend on chance events. The epidemic may take off only a couple of weeks after the first reported case or it may take significantly longer. Local epidemics might be over more quickly (six to eight weeks) with a proportionately higher peak.

Figure 1: Single wave national profile showing proportion of new clinical cases by week



Vaccination or mass treatment with antiviral medicines can be expected to modify this profile, assuming their efficacy is similar to that against seasonal influenza.

2.6 Predicting the health and wider impacts of a pandemic

It is impossible to predict the exact nature, timing or impact of any future pandemic because the root cause will be the circulation of a new strain of influenza virus and such viruses differ in their attributes and effects. For planning purposes, impact assessments are derived from a combination of current virological and clinical knowledge, expert analysis, extrapolations from previous pandemics and mathematical modelling.

Despite their variability, previous pandemics provide a valuable source of planning information and experience, but much has changed since the last in 1968. An increased proportion of older people in the population, improved healthcare opportunities and expectations, the growing emergence of antimicrobial resistance amongst the bacteria that may cause secondary infections following influenza, reduced 'surge' capacity in most healthcare systems and various pharmaceutical advances are some examples of factors that limit the reliability of data from past pandemics as predictors of future impact.

Mathematical modelling provides an adjunct to previous experience to help inform both strategic and operational planning for a future pandemic. The

models enable current circumstances and the likely impact and effectiveness of interventions to inform plans. However, models are only as good as the data fed into them and the assumptions made in their design. In the case of new influenza viruses, there are few data, and a wide range of plausible assumptions can be made. The main role of modelling in advance of a pandemic is to map out the range of possible risks and to investigate which responses are robust over the range of uncertainties. It is therefore important to emphasise that all impact predictions are estimates – not forecasts – made to manage the risks of a pandemic, and that the actual shape and impact may turn out to be very different. Impact predictions will therefore be compared against emerging data as the pandemic develops.

When influenza pandemics occur, many millions of people around the world can become ill, and a proportion will die from the disease itself or from complications such as pneumonia. Depending upon the virulence of the influenza virus, the susceptibility of the population and the effectiveness of countermeasures, up to half the population could have developed illness and between 50,000 and 750,000 additional deaths (that is deaths that would not have happened over the same period of time had a pandemic not taken place) could have occurred by the end of a pandemic in the UK.

In the absence of early or effective interventions, society is also likely to face much wider social and economic disruption, significant threats to the continuity of essential services, lower production levels, shortages and distribution difficulties. Individual organisations may also suffer from the pandemic's impact on business and services. Difficulties in maintaining business and service continuity will be exacerbated if the virus affects those of working age more than other groups, and fear of infection, illness, care-providing responsibilities, stress, bereavement and potential travel disruption are all likely to lead to higher levels of staff absence. Staffing is therefore the critical element in business and service continuity plans.

High levels of public and political concern, general scrutiny and demands for advice and information are also inevitable at all stages of an influenza pandemic. An effective communications strategy that provides timely advice and information on the situation in the UK and in other countries must form a key part of the management strategy.

Given the lack of relevant information, assessments of impact on the overall economy are necessarily simplistic and can only be illustrative. One such illustrative assessment suggests that illness-related absence from work of 25% of employees over the course of the pandemic (only half of what may be expected in a widespread pandemic) could reduce the year's gross domestic product (GDP) by between £3 billion and £7 billion. Additional premature deaths could

cause a further reduction of between £1 billion and £7 billion depending on whether case fatality rates are low or high and whether earnings or gross output are used in the calculation. Overall, therefore, an influenza pandemic might be expected to reduce current year GDP by some 0.75%. In the longer term, the impact of premature deaths could reduce future lifetime earnings by between £21 billion and £26 billion at a low case fatality rate and by between £145 billion and £172 billion at a high case fatality rate; estimating this impact depends critically on assumptions about the age ranges affected and about future economic trends.

Further information on the principles underlying the use of modelling in preparing for an influenza pandemic and some of the results thus far are available at www.dh.gov.uk/pandemicflu

Further advice on business continuity aspects is available on the UK Resilience website at www.ukresilience.info/ccact/index.shtm