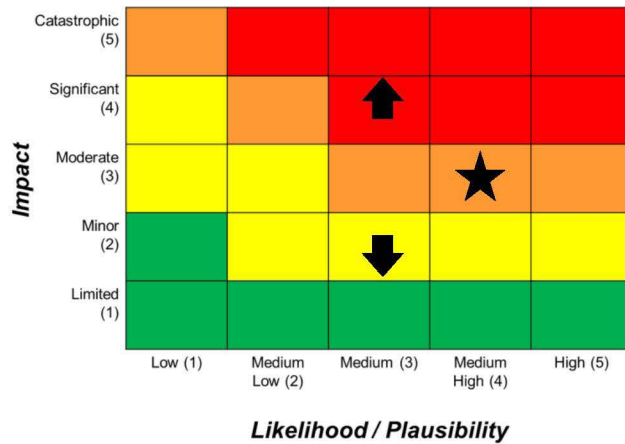


Disease –
Emerging Infectious Diseases
 H24 (DH)

Overall Assessment = High
Overall Impact Score = 3
Likelihood/Plausibility Score = 4



Key

- ★ Reasonable worst case scenario
- ↑ Upper range ↓ Lower range

Outcome Description

Over the past 30 years, more than 30 new or newly recognised diseases have been identified. Most of these have been zoonoses, i.e. diseases that are naturally transmissible, directly or indirectly, from animals to man. It is highly probable that such an infection will arise in another country and possible that it could arrive in the UK before it is identified, but also possible that one may arise in the UK. Severe Acute Respiratory Syndrome (SARS); a newly emerging severe respiratory infection, spread to infect over 8,000 people worldwide within an eight month period before it was contained in early 2004. An emerging or re-emerging infection would not necessarily be spread by the respiratory route (as are influenza and SARS/MERS). Infections can be transmitted directly between people through the gastrointestinal or blood routes, or indirectly via vectors, such as insects.

A new gastrointestinal infection could emerge; this being spread by contaminated food, water and directly between people. This was seen in 2011 when a hitherto rare type of *E.coli* was associated with severe illness and was subsequently found to have been transmitted by contaminated bean sprouts. It ultimately involved more than 4,000 persons in 16 countries.

Ebola is an example of a longer established (first identified in humans in 1976), blood-borne infection that recently spread more significantly in its country of origin, than in the past and required a global response in order to bring the outbreak under control at its source in West Africa.

The vectors that can transmit Zika virus, West Nile virus, Dengue and Chikungunya are currently spreading across Europe, becoming established and in some cases (Zika being the exception) transmitting such infections in areas in which they were unknown in recent years.

Based upon the experience of the outbreak of SARS and more recently, MERS and Ebola, the worst case likely impact of such an outbreak originating outside the UK would be cases occurring amongst returning travellers and their families and close contacts, with spread to health care workers within a hospital setting. However, it is unlikely to present a wider threat to the UK through sustained spread. It could lead to:

- Short term disruption to local hospital intensive care facilities

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- Possible disruption of several weeks to elective procedures
- Public concern about travel, within and beyond the UK and possible international travel restriction advice.

For a gastrointestinal infection, the worst case likely impact could be similar to that in Germany where *E.coli* caused around 1000 cases of severe disease.

Precise impact will depend upon the identity of the organism involved and the route of transmission. If it is a novel pathogen it is unlikely that effective antibiotics/antivirals or vaccines will be available.

Background and Specific Assumptions

New infections have emerged in the human population at regular intervals during recent decades. These have ranged from widespread and devastating infections, such as HIV, a blood-borne infection, which became known in 1981, but which may have entered the human population in the 1920s, to human enterovirus 68 (EV-D68) which was first isolated from samples obtained in California in 1962, associated initially with respiratory infections, but has more recently tentatively linked to cases of flaccid paralysis (like poliomyelitis) in the USA.

To the end of 2014 there were 36.9 million [34.3 million – 41.4 million] people globally living with HIV, 2 million [1.9 million – 2.2 million] people became newly infected with HIV and 1.2 million [980 000 – 1.6 million] people died from AIDS-related illnesses.

Middle East Respiratory Syndrome (MERS), caused by a virus related to the virus that caused SARS, emerged in the Middle East and globally, since September 2012, WHO has been notified of 1,644 laboratory-confirmed cases of infection with MERS-CoV, including at least 590 related deaths. The vast majority of these occurred in the Middle East, but this includes an outbreak that occurred in South Korea, triggered by an individual who had travelled in the Middle East. There were 186 cases including 36 deaths.

Zika virus infection, a viral disease which is transmitted to humans from infected mosquitoes including *Aedes aegypti* and *Aedes albopictus* was first identified in 1947 in Uganda. From its discovery until 2007, confirmed cases of Zika virus infection from Africa and Southeast Asia were rare. In 2007, however, a major epidemic occurred in Yap Island, Micronesia. In May 2015, local transmission of Zika virus was confirmed in some states in Brazil. In October 2015, there were reports of an unusual increase of cases of microcephaly among newborns in one of the states with a high number of cases of Zika virus. The epidemic of Zika virus continued to evolve rapidly in the Americas and has recently expanded to new countries and territories in the Caribbean and Central America. Up to 25 February 2016, a total of 52 countries and territories have reported local transmission of Zika virus. In the past, Zika virus has not been noted to cause death, nor has it been linked to intra-uterine infections and congenital CNS anomalies. 80% of those infected have no symptoms and in those that do, they are mild and short-lived. Although a causal association between Zika virus infection during pregnancy and adverse pregnancy outcomes has not been conclusively established, the evidence is compelling enough for public health authorities around the world to issue travel advice concerning the affected areas.

Other similar diseases include Chikungunya (first identified in Tanzania in early 1952 and causing periodic outbreaks of severe non-specific feverish illness in Asia and Africa since

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the 1960s, Dengue (the Americas; the first epidemics having been reported in the 1780s) and West Nile Virus (Asia, Africa, Europe and North America; first isolated in 1937).

The emergence of new infectious diseases is unpredictable but appears to have become more frequent. This may be linked to a number of factors such as climate change, the increase in world travel, the displacement of people because of war, the global transport of food, the encroachment of humans on the habitat of wild animals and enhanced detection. It is now the case that no country is immune to the effects of an isolated outbreak of an infectious disease in a seemingly remote part of the world.

For an infection spread by the respiratory route

- New infection can spread rapidly from person to person and has done so before the first case(s) is identified.
- The new infection does not originate within the UK but rapid global spread to UK via air travel.
- Infection for which there is no effective treatment other than symptomatic management.
- The possibility of spread within a hospital (or other close) setting, prior to the infection being identified in the patient.

For a vector-borne infection

- The relevant vector is established in the UK.
- The vector, if it is an insect commonly bites humans (and possibly animals).
- The pathogen can be found in the bloodstream of humans (and/or animals) before any symptoms are present and therefore puts the blood supply at risk
- There is no effective antimicrobial treatment or vaccine available

For an infection spread by the gastrointestinal route

- As it is a rare or novel pathogen, it will not be detected quickly
- It can be transmitted person to person as well as via food and/or water
- There is no antimicrobial treatment available

These assumptions, impact and likelihood estimations are based on the expert opinion of the Advisory Committee on Dangerous Pathogens that considered the evidence presented in a review by Public Health England.

Likelihood - (Hazards)

Although new zoonotic risks arise with greater frequency than 1/20 in 5 years, the ability of these infections, especially respiratory ones because of the ease of spread, to transmit between people, as SARS did, is in fact unusual. This is evidenced by H5N1 avian influenza, a serious new zoonosis. During the 12 years that sporadic human cases have been recorded, although more than 700 human infections have been reported to WHO from primarily 15 countries in Asia, Africa, the Pacific, Europe and the Near East since November

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2003, there is no evidence of rapid or easy person to person transmission. On balance, a likelihood score of 3 (<1/20 but >1/200 over 5 years) is therefore considered a reasonable assumption.

Likelihood Score = 3

Economic Impact

- **Lost Tourism**

Any outbreak of a novel disease is likely to have a major effect on tourism. The World Bank, in their calculation of the cost of pan flu, based costs on SARS and noted a peak decline of 75 percent in air travel to Hong Kong during the SARS epidemic and an average decline of 50-60 percent during the four-month period the outbreak was active. The World Bank conservatively took a figure of a 20% reduction over a twelve month period for a pandemic. The sustained impact of a lesser emerging disease would likely to be smaller so we have taken this to be in the 'moderate' range of 5-10% reduction. This leads an estimated cost of ~ £7billion.

- **Lost Working Hours**

Given 5,000 working age casualties are possible in an outbreak from respiratory and vector borne disease and illness is expected to last around 1 to 2 weeks, some 300,000 lost hours of work might be expected with an economic impact of around £3.5 million.

- **Fatalities and Casualties**
- The 1000 fatalities and 10,000 casualties for each scenario described in detail in the sequel lead to economic impacts of £2 billion and £1billion respectively.

The total economic impact of such an outbreak is likely is to be of the order of £10 billion in the reasonable worst case.

Economic Impact Score = 4/5

Fatalities

101 to 1000 (based on SARS resulting in 200 fatalities across the country, 200-300 for a vector-borne disease and 50 deaths for a gastrointestinal disease)

Fatalities Score = 3/4 (depending on the nature of the infection)

Casualties

2,000 – 10,000, based on 2,000 casualties for a SARS-like respiratory infection, 3,000 for a gastro-intestinal infection and between 5,000 and 10,000 for a vector-borne infection.

Casualties Score = 4

Social Disruption

- **Transport** - Significant restrictions on travel to and from the country of origin.
Transport services may be affected by staff absences.

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- **Environment** – If the emerging infection is carried by an insect vector there may be some environmental impact in the use of insecticides.
- **Food and water** – The supply of food and water may be affected by staff absences.
If the infection was carried by food or water there may be an impact in the form of 'panic buying' or unwarranted avoidance of certain foodstuffs.
- **Fuel/gas and electricity** – Essential services, such as power supply may be affected by staff absences.
- **Finance** – The financial sector may be affected by staff absences.
- **Communications** – The communications sector, both within telecommunications and media, is likely to be affected by staff absence.

Education - Sporadic closures of school anticipated where cases in children are confirmed.
Teaching staff are as likely to be infected as other people groups.

Access to healthcare - Prolonged regional (or even short-term national) disruption to the availability of primary care appointments (due to surge in appointments owing to concerns over symptoms).

Short term disruption to local hospital intensive care facilities.

Possible disruption of several weeks to elective procedures.

'Worried well' impact would be felt at a national level. This would be due to elevated levels of public concern, particularly due to the unknown nature of the disease. In addition, if the disease is spread by foreign travel there are a number of different entry points into the UK and so we could see cases spread across the UK relatively quickly, increasing public concern.

Evacuation and shelter - We do not consider that this risk is likely to result in any requirement for evacuation or shelter.

Judicial disruption – The judicial system may be affected by staff absences.

Social Disruption Score = 2

Psychological Impact

Public outrage

Even though the Government and other authorities can do little to prevent the emergence of natural diseases, there would be some outrage directed at the authorities associated with a perceived failure to contain the outbreak, given the numbers of fatalities and casualties. There would also be anger that diseases were not prevented from spreading to the UK. Blame would be dependent on where the disease has come from but there would be strong views that this should have been prevented.

Public perception

There is likely to be extreme, widespread and prolonged anxiety amongst the public for their own health the health of family and friends (especially children and the elderly) as well as a lack of understanding of the risks of infection as this is a new disease. Anxiety may be

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heightened by how Government and media handles the situation and informs the public about the risks and provides advice on protective measures they may take to lessen its impact.

Public Perception = 3

Public Outrage = 2

(Combined) Psychological Impact Score = 3

Longer Term Impacts

It is difficult to make any comment on the possible longer-term impacts of an emerging infectious disease, as the type, spread and particular groups of the population affected, cannot be predicted in advance.

In general, the outcome of an infectious disease, whether it is established, or emerging, is that the infected individual recovers and is subsequently immune to further infection with the same organism, or dies as a result of the infection.

Vulnerability Assessment – (Hazards)

It is likely that, in the light of increased international travel, a person or persons carrying an emerging or re-emerging infectious disease could arrive in the UK unnoticed. However, because of the high level of awareness of infectious disease events around the world and the surveillance that is carried out by Public Health England, it is likely that the NHS would be ready to deal with cases appropriately and limit the potential for an outbreak.

The significant outbreaks that have occurred recently, ie Ebola in West Africa and MERS-CoV in South Korea would not have the same impact in the UK as result of differing cultural attitudes and significantly higher levels of infection control measures in UK healthcare settings. This means that sustained spread would be unlikely.

Overall, the level of exposure to the hazard would be variable; depending on what it was, sustained spread could occur within the UK. A respiratory-transmitted pathogen, for example, could spread widely, bearing in mind the ease with which other respiratory pathogens, such as influenza, are able to spread. Exposure to vector-borne infections would be dependent on exposure to the relevant vector and that itself would depend on the range of the vector. An invasive mosquito, for example, might be confined to warmer parts of the country, but other vectors, not so dependent on the right climatic conditions, might be more widespread. A gastrointestinal infection may be transmitted from person to person or via another vehicle such as food or water. The vulnerability to this type of infection would depend on whether the transmission was simply by person-to-person spread or through other vehicles.

Risk Ranges

The Reasonable Worst Case Scenario for this risk is based on a respiratory or vector borne disease as described above.

The less impactful (lower range) alternative scenario is that of a reasonable worst case of a food borne disease as described above.

The more impactful but less likely/plausible alternative scenario (upper range) is based on the 'Black Death'.

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The disease known as the Black Death spread across Europe in the years 1346-53. As an example of the impact, in the course of just a few months, 60 per cent of Florence’s population died from the plague, and probably the same proportion in Siena.

The data are sufficiently widespread and numerous to make it likely that the Black Death killed around 60 per cent of Europe’s population. It is generally assumed that the size of Europe’s population at the time was around 80 million. This implies that that around 50 million people died in the Black Death.

This is an example of the emergence of a rare, but catastrophic, infectious disease in Europe in the last 1000 years giving a similar disease a low/medium rating.

The dotted box marks the approximate total range of different scenarios that this risk type could feasibly include. As noted above the emergence of new diseases is a common process; however the vast majority of these have very minor impacts such as variants of the ‘common cold’.

Confidence Levels

By definition a new disease will have unpredictable impact and likelihood. This assessment is simply based on the historical record of emerged diseases.

Statements	Put a X next to the statement which best represents your risk
Very High confidence in the overall assessment based on a thorough knowledge of the issue and includes evidence of a very high quality informed by consistent / relevant expert judgements.	
High confidence in the overall assessment based on a large body of knowledge of the issue and includes evidence of a high quality informed by consistent / relevant expert judgements.	
Low confidence in the overall assessment based on a relatively small body of knowledge of the issue and includes relevant evidence and somewhat consistent / relevant expert judgements.	X
Very Low confidence in the overall assessment based on small to insignificant body of knowledge of the issue and includes evidence of low quality and inconsistent / irrelevant expert judgements.	

Linked and Compound Risks

Human disease may be linked to concurrent animal disease. Environmental factors and hazards (such as flooding) may also increase both the spread of existing exotic (from a UK perspective) diseases and the probability of the emergence of new diseases. Climate change may result in conditions that may make the UK more hospitable for establishment of insect vectors of diseases currently not endemic in the country.

H19 – Natural hazard – Coastal flooding

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H21 – Natural hazard – Fluvial flooding

H22 – Natural hazard – Surface water flooding

H25 – Disease – Animals

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