

**PIPP-1122-G – ANNEX A****PLANNING SCENARIOS FOR A FUTURE PANDEMIC OR EMERGING INFECTIOUS DISEASE OUTBREAK****Background**

1. The *Review of Emergency Preparedness and Clinical Countermeasures: Epidemiology and Modelling Subgroup* was convened as a time-limited task and finish group “to advise on the characteristics of different infectious disease risks and:
  - A. “develop a set of scenarios, including Reasonable Worst Case Scenarios (RWCS), for human disease risks to inform the development of a policy package on countermeasures systems for future pandemics and infectious disease outbreaks that cause civil emergencies;
  - B. “support development of impact assessments (including economic impact assessments) to support the presentation of policy recommendations to Seniors and Ministers in all four UK nations; and
  - C. “advise on gaps within current epidemiological forecasting and modelling where the health Departments of the four UK nations may wish to commission further research to support continued developments in preparedness for human disease outbreaks.”<sup>1</sup>
2. The main outputs of the Subgroup have been Reasonable Worst Case Scenarios (RWCS) for both a future pandemic and future outbreak of an emerging infectious disease. These outputs have been leveraged to inform the new 2020 National Security Risk Assessment (NSRA) that will be cascaded to the resilience community by Cabinet Office to support emergency planning across many sectors of society.

**Pandemic RWCS**

3. The new RWCS for a pandemic is pathogen agnostic and supposes an outbreak of a novel respiratory pandemic in the UK. The numerical assumptions of the RWCS are based on influenza, but the advice recognises that the impacts could be caused by a range of novel respiratory pathogens to which the population has little or no immunity, not just influenza.
4. The central pathogen agnostic scenario for a respiratory pandemic assumes no mitigation, i.e. the impact of the successful deployment of countermeasures (e.g. clinical countermeasures or non-pharmaceutical interventions) has not been reflected in the estimates because:
  - there may be no available countermeasure; and/or,
  - one or more countermeasures deployed in response to the pandemic may fail.
5. Central assumptions of the RWCS (as included in the 2020 NSRA) are that:
  - 85% of the population become infected during the pandemic;

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<sup>1</sup> Review of emergency Preparedness Countermeasures: Epidemiology and Modelling Subgroup, Terms of Reference, [Epi and Modelling SubGrp- ToR Revised May2021.docx](#) (DHSC users only internal SharePoint)

- 50% of the population become infected and experience symptoms;
- 4% of cases (symptomatic infections) require hospital care
- 25% of cases requiring hospital care require the highest levels of critical care;
- the pathogen has a Case Fatality Rate ratio of 2.5%, resulting in 840,000 deaths;
- peak illness rates of around 10-12% (measured in terms of new cases (symptomatic infections) as a proportion of the population) are expected in each of the weeks during the peak fortnight of a pandemic wave; and
- average workplace absence rates due to illness of 20% during the peak weeks. Some small organisations (5 to 15 staff) or small teams within larger organisations where staff work in close proximity may experience higher absence rates of 30-35% on any given day.

6. Regards timing and progression of the RWCS pandemic, it is assumed that:

- from start to finish, the “emergency stage” of the pandemic in the UK will last at least 9 months and potentially significantly longer and may come in a single wave or multiple waves;
- The number of waves will depend on the characteristics of the disease, public behaviour, and whether the government intervenes to reduce transmission, and the period of highest prevalence could be considerable shorter than the pandemic as a whole; and
- the timing, size and shape of the pandemic is expected to vary in different parts of the UK. Local epidemics could peak more quickly or slowly and at a higher or lower level than the national epidemic.

**Variations to the pandemic RWCS**

7. Each pandemic is different and the characteristics of the pathogen, its transmission route, where and the time of year it emerges, and its impact on society cannot be known in advance. To reflect this uncertainty, and to support consideration of specific risks by expert subgroups advising on Personal Protective Equipment and Medicines, a number of variations were developed.

8. These variations do not represent an exhaustive list of ways a human disease pandemic could impact the UK but are significant risks that do not meet the bar to be the central RWCS.

9. Identified variations include<sup>2</sup>:

	Variation	Notes	At risk population(s)	Assumptions	In NSRA?
1	Novel enterovirus pandemic	Enteroviruses are a group of single-stranded RNA viruses. Their rapidly evolving genomes and presence in animals	Outbreaks typically affect young children (under 10 years of age), possibly due to their higher contact rates, poor hygiene	<ul style="list-style-type: none"> <li>• High rates of asymptomatic transmission.</li> <li>• Short serial intervals (time between the onset of symptoms)</li> </ul>	Yes

<sup>2</sup> Full outputs of the Epidemiology and Modelling Subgroup, as approved, are filed here: [Policy - Final AB Papers - All Documents \(sharepoint.com\)](#) (for DHSC users). This include additional variations by time of year and strain severity.

	Variation	Notes	At risk population(s)	Assumptions	In NSRA?
		means there is potential for a novel virus to emerge and spread quickly in humans. Enteroviruses are often spread during close contact with an infected person, either via the faecal-oral route, contact with contaminated objects or respiratory transmission.	practices, and the higher levels of immunity in older individuals after exposure to similar viruses	<p>in the primary and secondary case).</p> <ul style="list-style-type: none"> <li>• 85% of the population are infected.</li> <li>• 25% of the population experience symptoms.</li> <li>• Rates of infection and severe disease are higher in young children.</li> <li>• 16% of symptomatic cases require hospital care.</li> <li>• 1.5% of symptomatic cases result in death.</li> </ul>	
2	Novel coronavirus pandemic	This variation is based on the emergence of a novel coronavirus with transmissibility equivalent to the Delta variant of Covid-19 at the point of emergence and a range of potential severities based on the three coronaviruses that have emerged in the 21st century (SARS; SARS-CoV2; and, MERS)	Risk of severe disease increases with age in the presence of comorbidities. Other demographic factors that contribute to an individual's risk will be similar to those that currently impact other health outcomes, and may include age; sex; geography; deprivation; ethnicity; and occupation.	<ul style="list-style-type: none"> <li>• The virus spreads extremely rapidly through the population.</li> <li>• Over 90% of the population are infected during the pandemic.</li> <li>• Only 60% of the population experience symptoms.</li> <li>• 4% (COVID-19) to 50% (MERS) would require hospital care.</li> <li>• 3% (COVID-19) to (35% MERS) of cases would result in death.</li> </ul>	Yes
3	Novel sexually transmitted infection (STI) pandemic	The next pandemic could be caused by a STI. Hundreds of thousands of people in the UK are diagnosed with an STI every year. The only non-respiratory pandemic to affect the UK since 1900 was human immunodeficiency virus (HIV).	Individuals who engage in risky sexual behaviours, such as condomless sex with casual partners, or have multiple sexual partners will be at higher risk of becoming infected.	<ul style="list-style-type: none"> <li>• Could spread quickly through a dense network of sexual contacts but would progress much more slowly at a population level compared to a respiratory virus.</li> </ul>	Yes, but not produced by Subgroup. Included here for completeness

### RWCS for an outbreak of an Emerging Infectious Disease

10. The new RWCS for an Emerging Infectious disease (EID) is pathogen agnostic.
11. The RWCS, unlike the unmitigated pandemic scenario, implicitly assumes an effective public health response is undertaken and the outbreak is ultimately contained. Failure to contain an outbreak of an EID within the UK would result in a large outbreak or 'pandemic' situation. If this were to be the case the planning assumptions in the pandemic RWCS would apply.

12. The RWCS is based on a novel respiratory-transmitted virus that emerges zoonotically in another country and causes a regional epidemic in that country, with cases subsequently being imported into the UK. It is possible that a novel infection could arise in the UK first, but this is seen as less likely.

13. Central assumptions of the RWCS (as included in the 2020 NSRA) are that:

- there are up to 10 incursions (no-notice imported cases) into the UK before border measures are applied;
- the pathogen imported is previously unknown and/or not normally found within the UK;
- the incursions result in an outbreak of between 200 and 2,000 cases;
- all cases will require admission to hospital for specialist care;
- the novel pathogen has a case fatality rate of 25%, lead to between 50 to 500 deaths; and
- between 20,000 and 200,000 contacts need to be traced (assuming 100 contacts per case) and either isolated or monitored depending on their exposure.

14. Wider assumptions, including those relating to public health measures limiting the outbreak<sup>3</sup> are:

- a combination of NPIs, rapid isolation of cases and contact tracing activities following the initial border measures, combined with limited transmissibility of the virus bring the outbreak under control;
- infected individuals are non-cryptic (i.e. they show visible and identifiable symptoms at the same time as, or preceding, the risk of transmission);
- the most clinically affected population subgroups will not be known until the first few hundred cases have been identified and followed-up. It will be particularly challenging to manage if the infection leads to severe outcomes in those with specific comorbidities or specific age groups;
- incoming traveller quarantine is robust and isolation measures prevent further incursions (after initial no-notice cases);
- there are easily identifiable symptoms that individuals in quarantine and isolation can use to identify and communicate to a control officer;
- all superspreading events are correctly and swiftly identified and all individuals are quarantined or isolated appropriately; and
- there is substantial disruption to the NHS as it adapts to screen new patients and implement effective infection prevention and control measures.

15. Based on these assumptions, the RWCS assumes that any outbreak would last between two and six months, possibly longer depending on the pathogen involved. Response measures (e.g. NPIs; requirements for self-isolation and quarantine; and/or

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<sup>3</sup> NOTE: These assumptions are also set out clearly in the NSRA.

control measures at the border) may remain in place longer depending on the risk to the UK.

16. For the EID RWCS, there is an assumption that, although there will be national impacts, the spread of casualties and fatalities will be more contained within a region. Although this cannot be guaranteed, the most likely people to be infected are close contacts of the initial case and health care workers and patients within the health care setting where they are treated. Cases among healthcare workers would lead to disproportionate impact on health and care services. This assumption would depend on transmissibility and the effectiveness of infection control procedures.

### Variations to the Emerging Infectious Disease RWCS

17. The characteristics of the EID; its transmission route; where and the time of year it emerges; and its severity cannot be known in advance. To reflect this uncertainty, a number of variations to the central RWCS were prepared. These explore a range of different transmission routes and disease severities. This is not an exhaustive list of the all the different ways an infectious disease outbreak could impact the UK.

	Variation	Notes	At risk population(s)	Assumptions	In NSRA?
1	Viral haemorrhagic fever (VHF) outbreak	<p>VHFs are initially transmitted through contact with the blood or tissue of an infected animal; subsequent human to human transmission is via direct contact with the blood or body fluids of an infected person.</p> <p>Case fatality rates in documented VHF outbreaks vary significantly depending on the specific disease (e.g. Ebola has an average case fatality rate of 50% (range of 25-90% reported). In contrast, the majority of Lassa cases are mild and case fatality for all infections are approximately 1%)</p> <p>Supportive care would be the mainstay of treatment, delivered in a HCID unit.</p>	<p>Mortality rates appear higher in older adults and young children.</p> <p>Transmission is more likely to take place among household contacts and in close contact settings. Healthcare workers treating infected patients, individuals handling objects contaminated with body fluids and those with direct contact with the bodies of deceased patients are likely to be at particularly high risk of infection.</p>	<ul style="list-style-type: none"> <li>• An incubation period of 2 to 21 days;</li> <li>• Less than 10 no-notice casualties (symptomatic cases resulting from the initial importation);</li> <li>• 1,000 infections symptomatic cases</li> <li>• All infections considered likely to be symptomatic;</li> <li>• 100% of cases isolated/treated in a hospital setting;</li> <li>• A 6-month outbreak duration;</li> <li>• Up to a 50% Case fatality Rate (CFR) with mortality rates appearing to be higher in older adults and young children.</li> </ul>	Yes (but not generic numerical assumptions)
2	Vector borne disease (VBD) outbreak	This variation relates to the establishment of	At-risk populations would depend on the pathogen and	No specific numerical assumptions.	Yes (but no numerical assumptions)

	Variation	Notes	At risk population(s)	Assumptions	In NSRA?
		<p>an infection in a vector population in the UK, whether a currently established one (e.g. midges) or an invasive species (e.g. the establishment of Aedes mosquitoes), that can transmit to humans.</p> <p>Infection might be imported by a vector or an infected human.</p> <p>Some VBD can also spread directly between infected humans.</p>	prevalence of the vector in the UK.	<p>Identified as an area where further research into vectors was required.</p> <p>Human cases would require the capabilities in line with those required to respond to the RWCS, e.g. contact tracing; self-isolation for contacts; and, sufficient healthcare and laboratory capacity for human cases.</p>	available at the time of drafting)
3	Zoonotic infection	<p>An emerging respiratory infection arises from an animal reservoir. In this scenario the infection may be introduced to one or more animal species in the UK from another country. The domestic UK animal species will then become a reservoir for infection, when there is frequent close contact between humans and the animal species or their related products.</p>	At risk populations would depend on the animal reservoir. Default to central RWCS for planning	<p>The disease itself follows the same assumptions as those for the main scenario (see above). However, due to the common occurrence of human exposures to the animal reservoir in the UK, even limited transmissibility of an infection from that reservoir (or related products) to humans would lead to multiple sporadic human infections (no-notice cases).</p>	Yes (but no numerical assumptions due to uncertainty)
4	Foodborne pathogen outbreak <sup>4</sup>	<p>A major contamination incident involving a microbiological pathogen in the food chain causing illness, hospitalisation and possible fatalities in a moderate to large number of people over a period of a few</p>	<p>Events such as these can potentially also cause chronic health effects and demands on health care for many months or years following the incident.</p> <p>The impact of infection in vulnerable groups such as young</p>	<ul style="list-style-type: none"> <li>• A high likelihood of the RWCS occurring.</li> <li>• Type of contamination not detected immediately.</li> <li>• Source of the contamination not identified immediately</li> </ul>	Yes (new scenario produced by FSA)

<sup>4</sup> NOTE: The central RWCS for “food supply contamination” (R64) is owned by the Food Standards Agency and has been revised since the conclusion of the work of the Epidemiology and Modelling Subgroup. This entry has therefore been updated to reflect the new RWCS agreed with FSA experts and Ministers and has been cascaded to planners in the 2022 NSRA.

	Variation	Notes	At risk population(s)	Assumptions	In NSRA?
		days to weeks to identify the contaminant and months for the response.	children, the elderly and the immunocompromised may be more severe.	<ul style="list-style-type: none"> <li>• Traceability of the contaminated product could be complex and time consuming.</li> <li>• The type of food is a widely consumed product or an ingredient in a range of different products</li> <li>• 3,900 cases requiring a clinical assessment and/or treatment.</li> <li>• Case numbers probably higher as not all cases are expected to be reported.</li> <li>• 50 deaths.</li> <li>• Containment and response could take months.</li> </ul>	
5	Respiratory/Bacterial pathogen	<i>Yersinia pestis</i> was identified as a potential risk by the Epidemiology and Modelling Subgroup, however this pathogen was outside the remit of the subgroup and no RWCS variation was developed.			N/A
6	Prion disease	Identified as an area where further work to develop a scenario was required. A scenario with an extended time lag between infection and impact was identified as being potentially beneficial.			N/A

**Research recommendations**

18. A number of gaps in knowledge required to more fully develop a suite of planning scenarios were identified by the Epidemiology and Modelling subgroup. These are set out alongside other recommendations from the Review of emergency Preparedness Countermeasures in **PIPP-1122-G Annex B**.