

# COVID-19: Scientific and Medical Background Briefing Paper 31<sup>st</sup> March 2020

## Introduction

We are still in the relatively early stages of the COVID-19 pandemic. Much of the scientific information in the public domain is based on research from the initial outbreak in China or on its transmission to mainland Europe, especially to Italy and Spain.

We have to be cautious when interpreting this research for a UK setting: population demographics, healthcare systems, speed and nature of social interventions, testing methodologies and data collection all differ from country to country.

Scientific studies in the public domain vary in their reliability, many are not peer-reviewed and can present an inconsistent and even in some cases, a contradictory picture.

The Chief Medical Officer, the Government's Chief Scientific Adviser and their teams will also have access to studies not yet in the public domain and will be analysing these carefully before advising the Government on how best to tackle this pandemic in the context of the UK.

## Current numbers of Cases

### The Global picture

Coronavirus, which was first reported in China in December 2019, has been spreading rapidly across the world, affecting more than 177 countries and claiming more than 40,000 lives. There are more than 820,000 confirmed cases worldwide, with the US recording more than any other country, including China. Europe has also seen a surge in cases.

As countries vary in the ways in which they record cases *these figures are indicative only*. They do not reflect the number of asymptomatic or mild cases, so the true number of people infected will be higher, but no one can say by how much.

An image of how epidemics happen is that of an earthquake. There is an 'epicentre' where transmission is intense and extensive. Like an earthquake, the 'shockwaves' of an epidemic become less and less as the distance from the epicentre increases. So globally, the 'epicentres' of the epidemic thus far have been in Wuhan in China, in Northern Italy in Europe and in New York in the USA. In the United Kingdom, the epicentre of infection is London which has seen most of our country's cases. Regions further from London have seen much less infection and illness. Thus experiences of an epidemic differ markedly in different parts of the world and within countries.

### The UK Picture

In the UK, there have been 25,150 confirmed cases and 1,829 COVID-19-related deaths (31<sup>st</sup> March 2020). The number of cases recorded comes overwhelmingly from hospital admissions. No data is available about the prevalence of infection within the general population. This means that the number of people who have been infected with COVID-19 is likely to be much, much higher.

Figures in the UK began to increase markedly at the beginning of March. Numbers are now increasing rapidly and Tuesday 31<sup>st</sup> March saw daily confirmed cases jump by more than 3,000, compared with the previous day. Deaths rose by 393 since Monday 30<sup>th</sup> March, the highest daily increase in numbers (even with 40 deaths in the community from previous weeks being incorporated into the total).

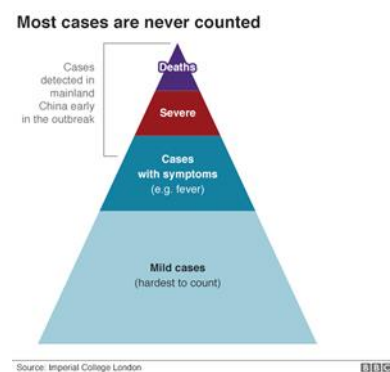
Over the past week, the rate of infection and number of deaths have roughly doubled every three days. This rate of increase is expected to continue for the next 2-3 weeks before the impact of the current social restrictions are seen. So far, London has seen a third of the deaths.

We do need to be careful however, with fatality data. The deaths quoted are the number of people dying with the virus, not necessarily because of the virus. Some of these people will have had serious underlying health conditions which means they would have been expected to die soon, although the virus may have hastened their deaths.

The primary current challenge with COVID-19 is that people who require hospital treatment are presenting over a short period of time and are creating additional pressures on ‘normal’ winter/early spring numbers, putting the NHS under severe strain.

### **The Tip of The Iceberg**

Most cases of most viruses go uncounted because people have mild symptoms. Initial estimates have suggested that 6% of people with COVID-19 become critically ill (lung failure, septic shock, organ failure and risk of death), 14% develop severe symptoms (difficulty breathing and shortness of breath) and 80% develop mild symptoms (fever and cough and some may have pneumonia). *However, these estimates should be received with great caution given that, as has already been mentioned, we do not as yet have any real understanding of the prevalence of infection within the general population.*



### **The Future Pattern – Modelling**

National policies during the COVID-19 pandemic have been guided by the outputs from mathematical models that seek to estimate, as accurately as possible, the extent and impact of the outbreak. Such models are based on a number of factors including available data (including number of cases, numbers of deaths etc), assumptions about people’s behaviour (such as compliance with social distancing guidance) and knowledge of the transmission of infections similar to COVID-19 such as influenza. Models are only as good as the data available to be fed

into them and assumptions included in models may be more or less accurate. As a result models produce a range of scenarios, for example giving upper and lower ranges of deaths expected to result from infection. As an outbreak progresses, more and more data becomes available, assumptions become better tested and the outputs of modelling become more accurate.

In the case of COVID-19 the earliest models, based largely on data from China, estimated that deaths resulting from the infection in the United Kingdom could be as high as 500,000 resulting in the National Health Service being overwhelmed by demands for care, if no social interventions took place. Unsurprisingly, this figure led government to impose the drastic measures that have been implemented during recent weeks. More recent models have suggested that the impact of COVID-19 may now be much less severe resulting in lower estimates of deaths being between 6000 – 20000 and thus much more in line with the kind of mortality expected from seasonal influenza. However, it is simply not possible at this time to place any great confidence in any of the estimates given, largely because the numbers of known cases remain relatively few and because accurate data about the extent of the infection across the country in different contexts is not yet available.

The probability is that deaths from COVID-19 will increase markedly in London and the South East of England during the next two to three weeks. Also, antibody tests will become available showing who has been infected by COVID-19 over time (as opposed to the current antigen test which shows only who is infected right now). Together, the data that becomes available from these developments will increase significantly our understanding of the likely future path of the epidemic. We will have a better idea of what kind of mortality might be expected, the likely impact of the epidemic on the National Health Service, whether and what kind of control measures will need to be maintained for shorter or longer periods etc. In the meantime, the Government must act on the basis of the information that it has received.

The British statistician George Box said,: ‘All models are wrong, but some are useful.’ In two to three weeks’ time, the results of modelling of this epidemic will be considerably more useful than those we have now.

### **The disease symptoms**

Our current understanding is that it takes five days on average since infection, for individuals to start showing symptoms of COVID-19, but some people will get symptoms much later than this with the incubation period lasting up to 14 days (hence this being the time length for self-isolation after possible contact with a case.)

Coronavirus can infect the lungs. The symptoms start with a fever followed by a dry cough, which can lead to breathing problems. There have been reports of anosmia or loss of smell. Other symptoms have also been reported, but there is not enough data to know if these are related to the virus.

## Testing

There are two types of testing for COVID-19: Antigen testing, which diagnoses whether someone currently has the disease; and Antibody testing which tells whether someone has had the disease and has developed some immunity.

The antigen test is the one currently in use. It has been prioritised initially to those in hospital with COVID-19 like symptoms; and is now being rolled out to front line staff who are self-isolating either with symptoms or because they have been in contact with someone with symptoms. There is not the capacity for widespread community testing.

The antibody test will be available shortly, and 3.5m kits have been bought.

In addition there are 100 GP ‘spotter’ practices that are performing diagnostic tests on their patients with or without symptoms, to see how widespread the disease is in the general community.

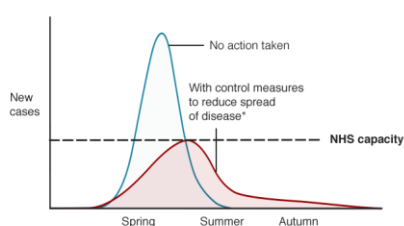
All this information will enable us to know how many new cases there are, how widespread the disease is, and what proportion of the population have immunity to the disease.

## Control measures

Coronavirus spreads when an infected person coughs small droplets with the virus into the air. These can be breathed in, or cause an infection if someone touches a contaminated surface and then touches their eyes, nose or mouth before washing their hands thoroughly. Control measures aimed at reducing the spread and protecting the individual, include washing hands, not touching one’s face, hygiene around coughs and sneezes and physical distancing. It is hoped that by slowing the rate of transmission and pushing much of the epidemic curve into the summer, that the virus will subside of itself, as flu does. *However, we do not know if the virus is susceptible to summer conditions.*

Different approaches to the severity of control measures, particularly physical distancing, have been seen around the world. It may be that stringent physical distancing measures are most effective though recent research has begun to suggest that a ‘threshold’ of control measures may be sufficient to hold back infections. At this point, no certainty exists and more information is being accrued every day. Unanswered questions centre on how long such measures should be applied and what happens when those measures are lifted. *At present, we just don’t know the answer to this.*

How control measures may reduce spread of virus in UK



\*Control measures: Self-isolating if ill, social distancing for vulnerable and whole household isolation if one member is ill

Source: Department of Health



## When will this end?

We will have a better idea of how successful control measures have been in 2-3 weeks' time. This will determine the next steps in terms of control measures and the shape of the epidemic curve. Current thinking is that strict control measures will impact sufficiently to be lifted in 3 months but that there will need to be some form of control measure in place for another 3 months to prevent an immediate return of the virus. *This time-frame is provisional.* A number of factors may lead this thinking to change, including what actually happens with respect to the course of the epidemic in the coming weeks, greater understanding of the true prevalence of COVID-19 within the population, increased treatment capacity within the NHS as the supply of ventilators expands and the ability to trace and isolate cases of COVID-19 as access to testing increases.

Early models have suggested that we are looking at a cycle of control measures to suppress the virus, a lifting of those with a re-emergence of the virus, though hopefully not to the same levels, a re-introduction of control measures etc until such a time as the virus is fully suppressed, a vaccine is developed, or we have enough immunity in the population.

- a) **Vaccination:** If we immunise an estimated 60% of the population, the virus will be suppressed (herd immunity), but a vaccine is 12-18 months away from being available for mass use.
- b) **Immunity through infection:** If 60% of the population becomes infected and gets immunity then the virus will not be able to spread and will be suppressed. However, we still do not know if being infected confers immunity, and at what level, and how long that immunity lasts. Other coronaviruses, such as the ones causing the common cold, give only weak immunity, with people being able to catch the same strain of virus multiple times over a lifetime. In addition, the problem with relying on obtaining immunity 'naturally' is that there is a significant risk of significant numbers of people getting very sick and some dying; hence the need for a vaccine.

## Other issues

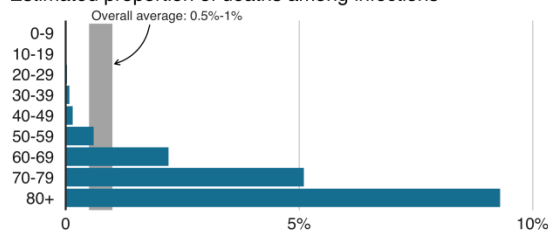
There are other issues for which we do not as yet have answers.

- **Will the virus mutate?** It may well mutate as viruses tend to do, but we don't know if it will mutate to a less virulent form as also often happens with viruses.
- **The role of children:** There are relatively few confirmed cases of children with COVID-19 and where these have occurred, severe illness is rare. However, we do not know if children play an increased role in spreading the virus, as is the case in flu where they are known to be "super-spreaders." This is in part due to their personal hygiene: what child can wash their hands for 2 minutes; and the way children mix, both amongst peer groups and amongst the most vulnerable such as grandparents.
- **Why is the severity different in some people?** People with normal immune systems do have some capacity in their bodies to protect themselves. Also, our immune systems can learn during an infection to clear the virus from our bodies. This is essentially the

mainstay of current treatment where COVID-19 patients are supported in the hospital while their own bodies fight the virus. However, those with compromised immune systems, or with underlying health conditions that make their organs more susceptible to the effects of the virus, develop more severe forms of the disease. *According to one study of 45,000 confirmed cases in China* fewer than 1.0% of healthy people who contracted the COVID-19 virus died from the disease, but that percentage was around 6.0% for people with cancer, hypertension or chronic respiratory disease, 7.3% for those with diabetes and 10.5% for those with cardiovascular disease. Death rates vary by age with the death rate being 10 times higher than average for those over 80, and much lower for those under 40.

### Death rates depend on age group

Estimated proportion of deaths among infections

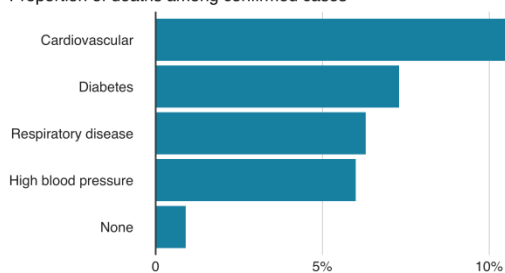


Source: Imperial College London, 16 March, SAGE



### Death rates depend on underlying health

Proportion of deaths among confirmed cases



Source: Chinese Centre for Disease Control and Prevention, Feb 18



This is population-based data and will not give an indication of individual risk. For example, we still don't understand why some apparently healthy people die from the virus.

- **Why do death rates vary between countries?** A number of factors will have an impact on this. Firstly, if there is a high level of case finding through testing, then the death rate is more likely to be lower, as the total number of cases will be higher, and will include those with mild symptoms. Secondly, the success level of measures to protect those most at risk and who will have the highest death rates. Thirdly, the quality and capacity of the healthcare system to treat severe cases.

## Conclusion

There remain a number of unknowns about this virus and its likely trajectory. The next 2-3 weeks will be critical in seeing whether the current control measures are having an impact, and how significant this is, on the epidemic curve. It is primarily for this reason that the Government has said that it will review its current strategy at the end of that period.

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