

## Summary of the effectiveness and harms of different non-pharmaceutical interventions

21<sup>st</sup> Sept 2020

### Key points

- Cases are increasing across the country in all age groups. The effect of opening of schools, colleges and universities has only just begun to affect this increase. Even so, the latest data suggests that the doubling time might be as low as 7-8 days. COVID-19 related hospitalisations and intensive care bed usage have started to increase.
- As over 90% of the population remain susceptible not acting now to reduce cases will result in a very large epidemic with catastrophic consequences in terms of direct COVID related deaths and the ability of the health service to meet needs. As in the first wave, the burden of a large second wave would fall disproportionately on the frailest in our society, but also those on lower incomes and BAME communities.
- A package of interventions will need to be adopted to prevent this exponential rise in cases. Single interventions are unlikely to be able to reduce incidence. If schools are to remain open, then a wide range of other measures will be required. The short-list of non-pharmaceutical interventions that should be considered for immediate introduction include:
  - A circuit-breaker (short period of lockdown) to return incidence to low levels.
  - Advice to work from home for all those that can.
  - Banning all contact within the home with members of other households (except members of a support bubble)
  - Closure of all bars, restaurants, cafes, indoor gyms, and personal services (e.g. hairdressers)
  - All university and college teaching to be online unless absolutely essential.
- Although beyond the scope of this paper, the rapid rise in cases means that **a raft of complementary measures is required to reduce transmission in care homes, hospitals and other enclosed settings**, such as prisons and hostels for the homeless.
- All these interventions listed above have associated costs in terms of health and wellbeing and many interventions will affect the poorest members of society to a greater extent. Measures will be needed urgently to mitigate these effects and to achieve equity and social justice.
- The more rapidly these interventions are put in place the greater the reduction in COVID-related deaths and the quicker they can be eased. However, some restrictions will be necessary for a considerable time.
- Clear, consistent communications will be essential, and a consistent package of measures should be adopted that does not appear to promote contradictory goals.

### Background

A variety of different non-pharmaceutical interventions (NPIs) have been adopted in the UK since the start of the COVID-19 epidemic. In common with many other countries, the UK implemented a mass “stay-at-home” order (or “lockdown”) on March 23<sup>rd</sup> in response to the worsening epidemic situation. The four nations of the UK implemented similar measures, and have each undertaken a gradual easement of restrictions since May 2020.

The strategy has been to use the Test, Trace and Isolate system and “COVID security” to reduce incidence, and to impose local restrictions where necessary.

The current epidemiological situation, which is set out below, indicates, however, that the (re-)imposition of a package of measures is required urgently. The aim of this paper is to identify a list of measures that would have the largest epidemiological impact, while minimising social and health harms, and which could be imposed at a regional or national level.

This document takes a population-level perspective. The benefits and harms experienced by any one individual resulting from a course of action may be very different to that averaged over the population as a whole. That is, policies may be beneficial to the population, but cause costs and harms to some in society. We have attempted to highlight those areas where harms may fall on certain sectors of society and point out that measures are urgently needed to help mitigate these effects for individuals. Often the poorest members of the community are more likely to experience the negative consequences of some of these interventions. However, not taking action is also likely to adversely affect these same individuals, as the patterns of deaths in the spring wave by deprivation indices and ethnic groups clearly demonstrates<sup>1 2</sup>.

This document should be reviewed regularly as the epidemiological picture changes and the evidence base for the effectiveness and harms associated with these interventions is improved.

### **Current epidemiological situation**

Infections are now increasing in each of the four nations of the UK. Transmission is changing from localised hotspots to a more generalised epidemic. New cases are predominantly in young adults, but cases are rising in all age groups. Hospitalisation rates are now increasing as is intensive care use.

The latest SPI-M consensus statement suggests that  $R$  is between 1.1 and 1.4 nationally and most local authorities have  $R > 1$ .  $R$  is a lagging indicator and describes the epidemic situation over recent weeks. It is likely to keep rising in the short term as changes in contacts over recent weeks result in increased cases that are picked up by our surveillance systems.

The epidemic has been growing at a rate of between 2% and 7% per day. This implies that it doubles every 10-20 days, but the latest data suggest that this may be as little as 7-8 days with even quicker doubling times in some areas.

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<sup>1</sup><https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/articles/corona-viruscovid19relateddeathsbyethnicgroupenglandandwales/2march2020to15may2020>

<sup>2</sup><https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/bulletins/deathsinvolvingcovid19bylocalareasanddeprivation/deathsoccurringbetween1marchand31july2020>

This suggests that there could be around 3000 hospital admissions per day by the end of October (which was the peak at the start of April) unless rapid action is taken to reduce transmission.

Given that admissions and deaths will increase for 2-3 weeks after R is brought below 1, cessation of the current growth is required by the start of October to prevent a repeat of the first months of the epidemic. The 3000 admissions per day at the end of October is largely driven by the infections that occur by the first week of October. It is possible that improvements in treatment and prevention of transmission in health and social care settings will reduce deaths associated with infections but will not generally prevent admissions. To reduce R from 1.6 to 0.8 would require interventions to reduce transmission by 50% - a substantial amount.

The rate of increase in infections is expected to accelerate in the near future as the impact of school, college and university openings, and policy changes with respect to return to workplaces, and entertainment and leisure venues, filter through. For example, ONS data show that rates of working from home are continuing to decline, from around 40% who "worked from home only" at the start of June, to 20% at the start of September.

Household transmission remains the most widely recorded setting of transmission. PHE reports secondary attack rates of around 40-50% within households, confirming the key role the household plays in transmission. Outside the household, preliminary analysis of a recent case-control study by PHE suggests that working in health and social care remains a risk factor, as is working in close personal services and hospitality. Activities associated with increased risk amongst cases include frequenting entertainment venues e.g. bars and restaurants. Outbreaks associated with restaurants and bars have also been recorded, both in the UK and elsewhere. Outbreaks in educational settings are leading to widespread disruption. It is still not clear to what extent (if any) schools magnify transmission in communities rather than reflect the prevalence within the community.

### **Starting point**

This document addresses the (re-)imposition of further measures to curb the spread of COVID-19. We assume that no further easements to remaining restrictions will occur over the period that these additional measures will apply. Imposing restrictions while simultaneously easing them would be counter-productive and pose considerable communication challenges.

There are undoubted social, psychological and health harms associated with many of the interventions listed here. However, there are also very large harms inherent in not acting quickly to curb the current exponential rise in cases and hospitalisations.

### **Beyond the immediate**

In the longer-term, gaining control of COVID requires reduction in prevalence. Prevalence drives the absolute increase in numbers of infections; R drives the rate of increase. If the strategy is to retain control of the pandemic until a vaccine can be deployed at scale, then maintaining a low prevalence will be essential until this time. Government will continue to have to juggle social freedom, economic activity and transmission for many months. It is

imperative, therefore, that a consistent series of measures is adopted over the next 6-9 months.

### **Evidence for measures**

Reduction in prevalence is achieved by reducing the connectedness of the population. Transmission within households is efficient, so reducing the connectedness requires reducing interactions between households that occur via contacts made in education, work and social/leisure activities. The effectiveness of the individual interventions listed below should be measured in terms of their impact on connectedness between households.

Evidence for the effectiveness and harms related to individual interventions is difficult to ascertain as packages of interventions are usually implemented together and the level of adherence may be heterogeneous and poorly quantified. Lower levels of adherence to interventions will erode their effectiveness. Past levels are not necessarily an accurate guide to the levels of adherence to measures that we might expect now and into the future. Furthermore, there will be delays between the imposition of an intervention and any effect it may have on cases or other key indicators. Finally, the counterfactual – how many outcomes might have occurred without that package of interventions – is difficult to ascertain. There is a lack of randomised evidence for these packages of interventions, so the data is often observational and routinely collected in nature, supplemented with modelled estimates. Estimating the harms from these interventions is even more difficult, given the breadth of possible impact on physical and mental health, education, society and the economy. Overall, the evidence base on which to judge the effectiveness and harms associated with different interventions is weak and so there is considerable uncertainty around the estimates presented here.

### **Impact of national “lockdown” and scale of individual measures**

The lockdown imposed in late March (and the changes in behaviour that preceded this) had a high level of uptake and resulted in a rapid reduction in the reproduction number ( $R$ ), from about 2.5-3.0 to about 0.5-0.7. That is a reduction in  $R$  of about 2, or a reduction in transmission of 75%. The national lockdown can be thought of as a combination of many different measures – from closing schools and universities, to closing pubs, restaurants, gyms and close-contact services, restricting all contact with other households and mandating that all but essential workers work from home. All of these measures came in simultaneously, and the sum of each of their effects reduced the reproduction number by about 2. Hence, each measure alone is likely to have a relatively small effect. That is, a large number of these individual measures is necessary to be in place to keep  $R$  to below 1.

A “circuit-breaker”, in which a package of stringent non-pharmaceutical interventions is reintroduced for 2-3 weeks should act to reduce  $R$  below 1. Over a fortnight’s “break”, two weeks of growth could be exchanged for two weeks of decay in transmission, assuming good adherence to measures, and no additional increase in contacts before or after the break. If this were as strict and well-adhered to as the restrictions in late May, this could put the epidemic back by approximately 28 days or more. The amount of “time gained” is highly dependent on how quickly the epidemic is growing – the faster the growth or stricter the measures introduced, the more time gained.

If regulations and behaviour then returned to pre-circuit break levels, there would be a return to exponential growth, but from a significantly lower level than would have been the case without the break. The deleterious impact would be maximised if they coincided with school holidays. Multiple circuit-breaks might be necessary to maintain low levels of incidence.

### **Measures considered out of scope**

The implementation of **tightened infection control measures in all hospitals, care homes, and other enclosed settings including regular testing of staff should be seen as a priority if infections continue to grow**. Such measures are likely to have a major impact on deaths and hospitalisations for COVID-19. SAGE has also previously noted the risks associated with discharging people from hospitals into the community without testing to ascertain whether they may be infectious. However, these issues are beyond the scope of this paper.

The effectiveness of all of the measures in this document requires good communication with the public, businesses and other stakeholders. However, good risk communication is also an intervention in its own right – helping individuals assess and reduce their own risks appropriately. This is out of scope of this document, but the importance of engagement, communication and feedback cannot be overemphasised.

An effective test, trace and isolate (TTI) system is important to reduce the incidence of infections in the community. Estimates of the effectiveness of this system on R are difficult to ascertain. The relatively low levels of engagement with the system (comparing ONS incidence estimates with NHS Test and Trace numbers) coupled with testing delays and likely poor rates of adherence with self-isolation suggests that this system is having a marginal impact on transmission at the moment. Unless the system grows at the same rate as the epidemic, and support is given to people to enable them to adhere to self-isolation, it is likely that the impact of Test, Trace and Isolate will further decline in the future. Addressing these issues is beyond the scope of this document.

Individuals and organisations have adopted a range of measures to reduce the risk of transmission. These are collectively called “COVID secure” measures and include the use of face coverings and increased hand hygiene for individuals, and the use of screens, social distancing, cleaning of surfaces and improved ventilation. It is likely that these measures are having an effect at slowing the rate of transmission. Maintaining or improving “COVID security” will be important over the coming months, but the details of how to achieve this are beyond the scope of this work. International travel / border screening has no direct effect on onward transmission within the country (as opposed to seeding) and is not considered here.

The economic impact of these measures will be addressed elsewhere. This document should be seen in the context of that accompanying analysis.

## **Findings**

The tables in Annex 1 summarise the potential impact of the different interventions, on transmission, severe disease and deaths from COVID-19 the potential social and health harms from the measure and potential implementation issues.

The measures below are (i) selected based on the balance between epidemiological benefits and health and social harms, (ii) likely each to make a non-negligible impact on R. The higher R rises, the more of them will be needed to restore R to below 1. From a purely epidemiological position, implementing measures as soon as possible would have the largest effect and likelihood of bringing R back below one.

Before enacting these measures, consideration needs to be given to how long they will need to be in place. To regain control of transmission R has to be reduced, ideally to below 1. Releasing the measures is likely to result in R returning above 1, so the longer they are in place (and the lower the prevalence falls), the longer before they will have to be reimposed.

- Working at home for anyone who can, to be recommended immediately. In place indefinitely.
- Implement a planned “circuit-breaker” (2 or 3 weeks in duration), with general stay-at-home measures (similar to restrictions in place in late May).
- Banning of all contacts between households within the home, except for support-bubble members. This should be implemented immediately and remain in place until prevalence has fallen.
- Closure of restaurants, bars, cafes etc. In place until prevalence has fallen.
- Closure of personal services (beauty etc). In place until prevalence has fallen.
- Closure of gyms and other similar indoor exercise activities. In place until prevalence has fallen.
- Higher education tuition to move to on-line / distance learning for term 1. In place until prevalence has fallen.

## **Discussion**

### **Broad impact**

The “circuit breaker” can be thought of a way to reduce R to below 1 and reset the incidence of disease to a lower level. The other measures will be necessary to maintain the reproduction number around 1 for the coming months. Careful monitoring will be necessary to ascertain whether further changes may be necessary. It is important to emphasise that a low incidence of disease will not only reduce the direct harms associated with COVID-19 (e.g. deaths and hospitalisations), but also allow a safer return to more normal behaviour and allow the health service to deliver its full range of functions as safely as possible. That is, a low incidence will also help reduce indirect health and social harms.

### **Getting the implementation right**

In terms of implementation, there is a danger in viewing each measure in isolation. When considering how to implement a package of measures, HMG should take into account:

- **Consistency.** If policies appear to promote contradictory goals, this will at best confuse the public and at worst degrade trust and adherence. For example, preventing people from meeting a relative at home, while encouraging them to go to pubs or workplaces appears inconsistent. Or allowing paid childcare / nannies, but not support between households.
- **Positive framing.** Measures need to be presented and supported as positively as possible, as a collective effort to protect our ability to be able to sustain valued activities, such as schools, jobs and outdoor activities. If restrictions are seen as a punitive response to failure to comply by some members of the public or are insensitively enforced this will cause resentment, conflict and lower adherence.
- **Equity.** Each measure will affect some groups and individuals more than others. Planning should start now to refine measures to minimise the harms and mitigate impact on vulnerable groups, to achieve equity and social justice.
- **Co-production.** Implementing policies without engaging early and actively with the people they will affect increases the chances of mistakes being made, avoidable harm occurring and unworkable guidance leading to criticism and loss of trust. Developing and checking policies with those who will be affected will pay dividends and will improve trust and buy-in. Given the disproportionate impact of the pandemic on low income and BAME communities, specific consideration is needed here.
- **Support.** For many of the measures, people will need support to adhere. If measures result in those with the lowest incomes losing money, having less access to shops, having fewer social or educational interactions, or being without vital social support networks, they will need financial and other support. Without this, health, adherence and trust could all be harmed.
- **Feedback.** Monitoring the impact of changes and providing frequent, clear and honest feedback to the public will encourage adherence and support for any further change if needed. Seeking ongoing feedback from the public on where policies are misunderstood, hard to adhere to or going wrong, with suggestions for improvement, will allow rapid improvement and prevent loss of trust.

### **Population vs individual-level impacts**

Some of the interventions here can have a significant impact on the individuals who are affected, but a relatively minor effect at the population level as they are comparatively rare. Whilst we have tried to maintain a population-level approach (e.g. evidenced through our use of the population indicator R) the weaker, anecdotal or theoretical arguments on the evidence for harms is often at the individual-level. Adding up these individual potential harms is more difficult. The model provided by ONS does attempt to do this, though as with all models there are limitations to its scope and accuracy.

### **Beneficial impacts of NPIs**

Many of the NPIs will result in modest beneficial impacts on health. The most obvious impact being the reduction in circulation of influenza and other respiratory pathogens.

Evidence from the Southern Hemisphere has demonstrated an almost complete absence of a flu season in those countries that have adopted stringent NPIs over their winters. Other pathogens spread through close contact, such as norovirus and rotavirus, might also be expected to be suppressed as a result of social distancing. There are also other benefits that may occur from, for instance, improved air quality as a result of reduced traffic congestion.

### **The effects of multiple interventions**

There may well be synergistic (or even antagonistic) effects resulting from adopting multiple interventions. The estimated impact of the different interventions on R shown in the table are very rough approximations and should not be added together to estimate the impact of combinations of options. As stated elsewhere in this document it is imperative to look at combinations of interventions in terms of the consistency of messages to the public.

### **Knowledge gaps and proposed short, and medium-term research activities**

The evidence base into the effectiveness and harms of these interventions is generally weak. However, the urgency of the situation is such that we cannot wait for better quality evidence before making decisions. Nevertheless, NPIs will need to be in place for a considerable period of time and it is important, therefore, that studies are undertaken to evaluate the risks in different settings and the impact of different control policies. Such work will need to be kept continually under review as evidence emerges and the dominant modes of transmission alter. Suggested data analyses and studies include:

- Collection and analysis of contact-tracing data, particularly from backward contact tracing. This requires improved record-linkages, so that routes of transmission can be routinely investigated. At present this is only available for a small minority of cases, so the power of these data to inform decisions is not being maximised. In addition, care needs to be taken when analysing these data as they lack a control group.
- More detailed data collection on the environments and occupations where people are interacting linked to the T&T system.
- Regular (perhaps every 1 or 2 weeks) case control studies should be undertaken in which a large random sample of cases are matched with community controls and their risk factors are examined. Any such study would need to be large enough to examine regional differences, should they emerge (or be able to oversample to look at regional differences) or differences by socio-economic and demographic groups. PHE have recently undertaken a case-control study that meets most of these requirements.
- An alternative would be to follow a large cohort of individuals with regular reporting of risk factors as well as disease status (ideally linked to national T&T system).
- Studies on the impact of harms of interventions.
- Studies on the effectiveness of interventions in different settings.
- Studies on the effectiveness of “COVID-security” measures on viral transmission.
- Detailed pilot studies on the safe opening of indoor and outdoor entertainment venues should be considered so that cultural and sporting events can be opened up as rapidly as possible as restrictions are eased once more.