

Post-lockdown Epidemiological Scenarios

10th April 2020

Draft 1

At SAGE working group discussions on the Science of Exit Strategies on Friday 10th April, we focussed on two epidemiological scenarios for the coming months and years. These are:

- a **low incidence (or hospitals empty) scenario, (LI)**, where incidence is driven down to low levels by a continuation of the current lockdown in the coming months and then maintained at that low level until vaccines or drugs are available; and
- a **higher incidence (or hospitals full) scenario, (HI)**, in which incidence is maintained at a level similar to that observed at the moment, but not worse.

Benefits and disbenefits of the two strategies are:

LI benefits: COVID-19 illness and deaths as low as possible, NHS resources available for other tasks, lower intensity of social distancing required if case-based (testing, contact tracing) measures are effective

LI disbenefits: undefined timeline until the release of most SD measures, always at risk of explosive exponential growth in hotspots, no guarantee there will ever be an effective vaccine

HI benefits: definable timeline to a target date when most SD benefits could be released for everyone (~12 months), as the population acquires immunity the risk of explosive exponential growth recedes, population protection through acquired immunity is at least as likely as an effective vaccine

HI disbenefits: much more COVID-19 illness and death, NHS runs hot for at least a year, more indirect deaths due to NHS pressures, higher levels of social distancing needed if contact tracing not feasible at high case incidence levels

In either scenario any technology available (e.g. mass contact tracing and testing) might replace some social distance measures. However, such technologies are more feasible when incidence is low.

A number of general points need to be borne in mind for both scenarios:

- This epidemic will ultimately be brought under control when a sufficient level of population immunity is reached. This can be achieved via mass vaccination (though vaccines are likely at least 12 months away) or via the build-up of naturally acquired immunity. Elimination from the UK and global eradication are impossible without vaccines and, even if possible, would take years or decades.
- It is likely that COVID-19 will circulate in the human population long-term, causing periodic epidemics (albeit on a much smaller scale than this year) like other

respiratory viruses. Hence, vaccines, therapeutics and effective measures to treat and isolate cases will continue to be needed in the long term.

- Social distance measures will be in place for a considerable length of time in both scenarios. The time frames are difficult to accurately predict, but social distance measures will almost certainly be necessary for the remainder of 2020.
- Mass-testing and contact-tracing measures might be able to substitute for the most intensive aspects of social distancing and lockdown measures while still suppressing transmission (keeping $R < 1$). However, testing and contact tracing (even if automated via technology) are highly resource intensive, particularly so when case numbers are high, and therefore more feasible if cases are first driven to low levels through intense social distancing.
- The effectiveness of measures such as social distancing and mass testing and contact tracing is uncertain over the long run. Adjustments to responses will be inevitable and major changes to strategy cannot be ruled out. For instance, if therapeutics or clinical interventions are developed which greatly reduce the CFR, the direct deaths from COVID-19 would fall and switching to a Higher Incidence (HI) scenario might then be strongly favoured.
- The scenarios outlined here, represent two ends of a spectrum bracketed by the current level of incidence (HI) and much lower levels (LI). The incidence could be intermediate between these extremes and is likely to vary in different population groups. Hence a mixture of these broad approaches might be implemented.
- This note concentrates on measures to control the epidemic of COVID-19 in the wider community. However, at present there are also many outbreaks occurring in hospitals, nursing homes and other institutional settings, such as prisons. Continuing outbreaks in these settings will lead to large numbers of deaths, undermining the effect of controls in the community. There is an urgent requirement for additional measures to be put in place in these settings. These measures will be required for both scenarios outlined below and will need to be applied over the long term.

The table below outlines the key epidemiological features of the two scenarios.

	Low Incidence	Higher incidence
Duration of extension of current lockdown	Uncertain until rate of decline of cases under current lockdown can be estimated, but perhaps 6-8 weeks to achieve substantially lower incidence.	Limited relaxation of current measures might be possible within 3 weeks, subject to requirement to keep R close to 1. However, any infection control strategy is more likely to be successful if it starts from a low incidence.
Transmission reduction required	Keep R substantially below 1 until very low daily case numbers achieved, then sustain R	Keep R just below 1 on average. That average might be through time (on-off tactics) or across population

	at below 1 throughout the population.	sub-groups (e.g. least vulnerable released first)
Requirement for further lockdowns	Local lockdowns may be necessary at times to prevent local outbreaks spreading more widely.	National lockdowns may be required to cool the epidemic if forecasts suggest that the NHS is likely to be overstretched. If some subgroups of the population have been released from social distancing, those who have not will need to have very high compliance to ensure overall $R \sim 1$
School closure	Schools could re-open once effectiveness of testing/contact tracing established, but occurrence of new cases would require closure of individual classes or schools, hence disruption would continue.	If children and younger adults were part of the “released sub-group” schools could re-open soon, though this would be at the risk of pushing R above 1. School opening in September would be more feasible, as population immunity levels would be higher by then.
Shielding of vulnerable groups	Some shielding still advisable until and unless case numbers driven to very low levels in the UK population	Highly effective shielding essential until population immunity reached given ongoing transmission.
Duration of interventions	Until an effective vaccine is available in sufficient numbers of doses to immunise the entire population. Likely at least a year, though could be longer if vaccine development is unsuccessful or delayed.	Until an effective vaccine is available, or the epidemic is brought under control through natural immunity. Probably about 1 year.
Impact on NHS over next 12 months (excluding nosocomial transmission)	Relatively few COVID-19 patients in hospitals. ICU requirement well below current capacity. Normal NHS activities resume subject to adequate infection control.	Large numbers of COVID-19 patients in hospitals. ICUs running close to capacity. Normal NHS activities will be more difficult

Additional systems required	Mass contact tracing and testing required. Will require infrastructure and technologies that are not yet in place and have not been tested. Isolation of mild cases outside the household (in designated facilities) could further improve control but would require investment and public acceptance. Improved surveillance to monitor transmission in the community	Improved surveillance to monitor transmission in the community. “Immunity passports” could help individuals return to work more quickly, if they can be shown to be effective.
Direct deaths from COVID-19 over next 12 months (rough approximations)	Low (tens of thousands)	Moderate to high
Indirect deaths over next 12 months	Low to moderate, given lower levels of NHS demand and less reliance on intense social distancing	Moderate to high, given high NHS demand and reliance on at least episodic intense social distancing
Measures at UK border	Measures may be desirable, e.g. quarantine of visitors to the UK.	No measures necessary.
Vaccine doses required to control first wave of epidemic	Sufficient to vaccinate the entire population (66 million individuals).	None, if population-level immunity has been reached, though vaccination of the elderly and vulnerable (~20 million individuals) would still be highly advisable. If vaccines are available before herd immunity is reached, then they should be used to bring the epidemic under control
Health equity aspects	Lower incidence focusses on individuals and smaller sub-groups so raises risks of stigma and, potentially, low adherence.	If social distance restrictions are more rapidly lifted in some sub-groups (e.g. the young), then there will be inequalities in risk.