

COVID-19: Summary of external research

April 2nd 2020

This newsletter series presents a digest of external research that the Greater London Authority is making available for the benefit of external stakeholders in tackling the COVID-19 crisis. These summaries have been prepared under challenging circumstances and to short timescales. They are not intended to be comprehensive and exhaustive and do not represent the full body of evidence on which Mayoral Policies are or will be based.

Introduction and summary

This is the first in a series of briefings highlighting key statistics and external research and recommendations relevant to the GLA's response to the COVID-19 pandemic. Each briefing will offer short summaries and a deep-dive into one topic.

In the first briefing the City Intelligence Unit's demographic modelling team have provided an **overview of recent academic publications and media commentary of epidemiological modelling of COVID-19**. Key points include:

- The government's tightening of restrictions on March 16th was informed by modelling from Imperial College, which suggested that available ICU capacity would be overwhelmed without adopting far stricter measures than those introduced earlier in the month.
- The Imperial work raised the possibility that it may be impossible to completely remove restrictions until an effective COVID-19 vaccine becomes widely available.
- A paper from Oxford University demonstrating that the observed deaths in the UK and Italy were consistent with a wide range of possible scenarios – suggesting that the proportion of the population that had been infected with COVID-19 may be significantly higher than previously assumed.
- Media reporting of the Oxford paper initially focussed on the (extreme) possibility that over 50% of the UK population may already have been infected. Subsequent reporting and expert commentary urged caution in interpreting the results.
- Initial modelling by both Imperial College and the London School of Hygiene and Tropical Medicine suggests that the introduction of strict physical distancing measures on March 23rd have reduced the transmission rate of the infection – most likely to a level at which the number of cases should be expected to fall over time.

External data

This section highlights important data releases that illustrate the impact of COVID-19 on the economy and society, or provide key context.

Economic forecasts for London (31/03/2020)

- On March 31st, Oxford Economics (OE) updated their regional economic forecast to incorporate the Covid-19 outbreak impact. There have been no more updates of London economic forecasters so far.
- London's real GVA is now expected by OE to fall by 1.2% in 2020 when compared to real GVA produced in 2019. In 2021, the real GVA annual growth rate is estimated at 4.0%.
- Looking at the breakdown by sectors, Accommodation & Food services would be the most hit industry in London in 2020, with an estimated -15.6% of output growth rate in annual terms. This is followed by the Art, Entertainment & Recreation industry (-14.7%) and by the Transport & Storage industry (-7.2%). The two main London industries in terms of output - Real Estate Activities and Financial & Insurance - would also experience annual output contractions in 2020 by -1.6%, -0.3%, respectively. Conversely, Human health & Social work would work by 3.3% in output terms in 2020 on 2019.
- In terms of London employment, this is estimated to decrease by 0.6% in 2020 compared to 2019, although the employment annual growth rate in 2021 is forecasted at 1.8%. In 2020, employment is expected to especially fall in annual terms in the following London industries: Accommodation & Food services (-5.1%); Art, Entertainment & Recreation industry (-4.0%); and Transport & Storage industry (-2.7%). Oxford Economics forecast.

Poverty data referring to 2018/19 (26/03/2020)

- Overall poverty levels have stayed the same in London and nationally
- Child poverty has risen in London, both in terms of number and rates and now stands at 39 per cent of all the capital's children. This represents 800,000 children living in poverty – more than at any time since the data series began in 1994/5

Universal Credit data referring to 2020 (01/04/2020)

- There has been an increase in UC claims, with nearly a million applications in the last fortnight – massively surpassing the departments normal expectation of 100,000 claims in a two week period.
- This data is representative of the whole of the UK.

COVID-19 external research

This section highlights external research into the economic and social impact of COVID-19.

[**London business school: The economics of a pandemic: the case of COVID-19 \(23/03/2020\)**](#)

Wide-ranging academic presentation on the economics of COVID-19:

- Even if mortality of Covid-19 proves to be limited, a global major recession seems unavoidable.
- All sectors will be impacted up to some extent, although the most affected ones are likely to be (sorted by degree of impact): Tourism and hospitality, Aviation/airlines, Oil and gas, Automotive, and Consumer products (especially durable goods).
- Global supply chains have already been hit, although the full effect of the shock is to be seen.
- Demand shock might be even larger than supply shock in the medium-term, driven by uncertainty, panics, and long-lasting lock-down policies.
- High-skilled workers/high-earners are more likely to work from home during the lock-down period, thus creating a larger divergence with the rest of the labour supply.
- This crisis will be a good opportunity for the digitalisation and restructuring of some industries though.
- The investment of many firms (especially SMEs) and spending of many households (especially renters and mortgagors) depend largely on cash flows and this crisis is already showing liquidity issues in some markets.
- Whatever mix is chosen, policies need to: 1) Be now and of the same order of magnitude of the output loss; 2) Start from health expenditure; 3) Be about cash disbursements to households and businesses; 4) Use coordinated fiscal and monetary interventions; 5) Be global.

[**Institute for Fiscal Studies: The impact of COVID-19 on share prices in the UK \(30/03/2020\)**](#)

- Uses share price data by sector to analyse the impact of COVID-19 on the economy.
- The industries that have been hardest hit include tourism and leisure (which includes air travel), fossil fuels production and distribution, insurance, retailers (excluding food and drug retailers) and some large manufacturing industries.
- At the other end of the spectrum some industries have outperformed the market, including food and drug manufacturers and retailers, utilities, high tech manufacturing and tobacco. Unsurprisingly, firms in medical and biotech research have also outperformed the market.
- The Job Retention Scheme is more effectively targeted at some industries than others. For example, retail, for which labour is a relatively high share of output, has a comparatively high share of output covered by the JRS. Insurance, airlines, automotive and building and materials on the other hand have relatively small shares covered by JRS.

[**Resolution Foundation: Doing what it takes: Protecting firms and families from the economic impact of coronavirus \(17/03/2020\)**](#)

- UK firms will go bust and unemployment will rise. The majority of this economic damage will be driven not by the direct impact of coronavirus itself, but by the necessary measures – such as social distancing – that we put in place to respond to it.
- Lower earners are likely to be hit most swiftly, in stark contrast to the 2008 financial crisis. Sectors already heavily affected have typical weekly pay of £320, compared to £455 for the economy as a whole. These include retail (excluding food), hotels and restaurants, airlines, travel operators, cleaning, arts and entertainment, and personal services like hairdressing, comprising 5 million employees and 1.2 million self-employed people.
- 2 million of the lowest earners also lack entitlement to sick pay.

- Less than one-in-ten of those in the bottom half of earners say they can work from home, making it much harder for them to protect their incomes in the face of social distancing measures.
- Those in the most at-risk sectors and occupations also have less to fall back on, being around 25% more likely than average to live in families with no savings at all.
- They propose a broad and radical approach in three areas: relatively simple extensions of sick pay itself, much bolder moves to aid the retention of workers by struggling firms, and a stronger social security safety net.

International Labour Organization: Covid-19 and the world of work: Impacts and responses (18/03/2020)

- Initial ILO estimates point to a significant rise in global unemployment and underemployment in the wake of the virus. The “mid” scenario suggests an increase of 13 million (7.4 million in high-income countries).
- Underemployment is also expected to increase on a large scale.
- The decline in economic activity and constraints on people’s movements is impacting both manufacturing and services.
- Labour supply is declining because of quarantine measures and a fall in economic activity. Employment impacts imply large income losses for workers.
- Working poverty is also likely to increase significantly globally (20.1 million and 35.0 million more people in working poverty than before the pre-COVID-19 estimate for 2020).
- Epidemics and economic crises can have a disproportionate impact on certain segments of the population, which can trigger worsening inequality.
- Vulnerable groups: those with underlying health conditions and older people, young persons already facing higher rates of unemployment and underemployment, women who are over-represented in more affected sectors, unprotected workers, and migrants).

Institute for Fiscal Studies: Income protection for the self-employed and employees during the coronavirus crisis (02/04/2020)

- The self-employed will get even more protection, but with a delay in the timing of payments.
- The wait until June for the grant to arrive means it is important to ensure the quick delivery of other mechanisms for the self-employed to access cash in the short term, such as the Coronavirus Business Interruption Loan Scheme and universal credit.
- Many self-employed workers will be better off financially than if the crisis had never happened.
- There are large differences in the types of protection offered to different groups.

COVID-19 external policy recommendations

This section highlights external publications that have made policy recommendations.

New Economics Foundation: Building a minimum income guarantee for the UK (29/03/2020)

- Proposes a minimum income floor to ensure everyone who has missed out on the job retention and self-employed income support schemes has access to a Minimum Income Standard
- Every adult who is not covered by either the job retention scheme or the self-employed income support scheme will be entitled to a weekly payment worth £221 per week
- Initial entitlement to the MIG will be extended to anyone who wishes to apply via the advanced payment system in UC. Anyone whose income rises above £2,500 per month as a result of receiving the payment will have to pay back the difference through 2020/21 tax

IPPR Children of the Pandemic (31/03/2020)

Provides a number of recommendations to strengthen our social safety net for families with children and allow children access to essentials like outdoor space and digital access:

- The government should ensure those with full-time caring responsibilities, including parents, can access paid leave through the Coronavirus Job Retention Scheme. It should also introduce a statutory 'right to request' for the 80 per cent wage subsidy up to £2500 a month. This should be accompanied by a clear 'right to return', ensuring they can return to their job without the risk of employer discrimination.
- Welfare: increase the child-related element of UC by £10/week, remove the two-child limit and the benefit cap
- Emergency one-off payment of £30 through child benefit and an ongoing increase of £5 per week for the duration of the crisis
- Broadband installed and devices loaned or donated to children without internet access
- LAs to encourage owners of private green spaces to offer open access for the duration of the crisis.

Policy Exchange: Limiting the Economic Impact of the Covid-19 Virus (26/03/2020)

- They recommend that employee wages should be covered in full, but to limit costs not all company employees need to be eligible for furlough since some will still be working, and to stick to the existing cap per worker.
- The new aid scheme for self-employed will not be accessible for some time yet. To cover this gap, an option could be the use of the existing Universal Credit administration infrastructure to institute a temporary and targeted Coronavirus Bridging Payment (CBP) on top of the UC entitlement, to which any self-employed person of a specific but easily identifiable definition (for example anyone who filed a self-assessment and is not on the PAYE system) would be entitled to.
- Since the UC administration system is already overwhelmed, its capacity will need to be greatly increased quickly, but a different way to reduce the need for administrative capacity is to strip back conditions and checks associated with disbursing the payments.
- The Government is deferring VAT and self-assessed income tax payments – an important aid to cashflow – and has declared a tax holiday for business rates for firms in the retail, hospitality and leisure sectors. Coverage should be extended to all directly affected sectors.

Review of COVID-19 modelling papers and commentary

Summary

This note provides a brief overview of recent academic publications and media commentary of epidemiological modelling of COVID-19. Several papers released since mid-March that have had a significant impact on government policy and public perception of the pandemic. The dramatic shift in government policy on March 16th was a result of research published by Imperial College which indicated that continuing the existing response would lead to hospitals being rapidly overwhelmed.

A subsequent paper by Oxford University published a week later questioned some of the assumptions underpinning the Imperial work and was widely covered in the media in a way that was potentially misleading – the most extreme interpretation of their findings, that more than half of the UK population could already be infected with coronavirus, becoming the basis for the headlines.

More recent work from both Imperial College and the London School of Hygiene and Tropical Medicine has attempted to quantify the impact of policies implemented to reduce the spread of the virus. Both pieces of research suggest that the lockdown introduced on March 23rd has likely been successful in reducing the transmission of the disease.

At the time of writing, there remains a great deal that is poorly understood about the spread of the infection and the fraction of the population that experience no/mild/severe symptoms. As such, even the best modelling available is subject to a great deal of uncertainty in the outcomes predicted. A consensus exists for the urgent need to undertake widespread antibody testing of the population to improve our understanding of the disease and the accuracy with which its progression can be modelled.

Key points

- The government's tightening of restrictions on March 16th was informed by modelling from Imperial College, which suggested that available ICU capacity would be overwhelmed without adopting far stricter measures than those introduced earlier in the month.
- The Imperial work raised the possibility that it may be impossible to completely remove restrictions until an effective COVID-19 vaccine becomes widely available.
- A paper from Oxford University demonstrating that the observed deaths in the UK and Italy were consistent with a wide range of possible scenarios – suggesting that the proportion of the population that had been infected with COVID-19 may be significantly higher than previously assumed.
- Media reporting of the Oxford paper initially focussed on the (extreme) possibility that over 50% of the UK population may already have been infected. Subsequent reporting and expert commentary urged caution in interpreting the results.
- Initial modelling by both Imperial College and the London School of Hygiene and Tropical Medicine suggests that the introduction of strict physical distancing measures on March 23rd have reduced the transmission rate of the infection – most likely to a level at which the number of cases should be expected to fall over time.

Imperial College paper and the tightening of restrictions

The government's decision to impose tighter restrictions was reportedly based in large part on the results of a paper from Imperial College published March 16th¹.

This paper presents analysis of two potential strategies for dealing with COVID-19:

- Mitigation – slowing, but not stopping the spread of the disease, to reduce peak healthcare demand and mortality
- Suppression – employing tighter restrictions to reduce the number of cases of the virus to low levels.

The Imperial team's modelling showed anticipated critical care bed occupation under three scenarios:

- Do nothing
- Moderate measures – case isolation, household quarantine, and general social distancing
- Stricter measures – as above, but including school and university closures

The results of this modelling showed that under the 'do nothing' scenario, existing ICU capacity would be overwhelmed – with the need for beds peaking in mid-May at a level 35 times greater than (surge) capacity.

This contrasts with the projected results under the strictest scenario in which demand for beds peaked in mid-April at a level within the notional capacity estimate. Under moderate restrictions, the modelling suggested that demand would reach capacity by late-April and almost double it by mid-June.

These stark findings suggested no responsible alternative existed to an immediate tightening of restrictions. However, they also made clear that this strategy presents long-term challenges due to the likely resurgence of cases that would follow any lifting of restrictions. Assuming that behaviour returned to 'normal' following a lifting of restrictions in late August, cases would again begin to rise exponentially and the 'do nothing' scenario would play out again, with the period of tighter restrictions having served only to delay the peak.

This illustrates an issue with suppression strategies, which is that more successful they are in the short term, the larger the likely peak of an epidemic would be following a lifting of restrictions, due to the limited build-up of herd immunity. A suppression strategy would therefore require substantial restrictions to be applied until such time as an effective vaccine is developed and available in mass quantities – something the authors suggest could be more than 18 months away.

The paper goes on to examine one possible approach to this problem, which would be to adaptively adjust policies to maintain a manageable load on ICU facilities while allowing periods in which restrictions are somewhat reduced. An illustrative scenario is presented in which social distancing, plus school and university closures are in place for two-thirds of the time, while the less restrictive policies of home isolation of symptomatic cases and household quarantine are continued throughout.

Oxford paper and modelling uncertainty

On March 24th, a team from Oxford University published a paper² that considered the range of possible assumptions relating to the coronavirus that would be consistent with the observed numbers of deaths in Italy and the UK.

¹ [Impact of non-pharmaceutical interventions \(NPIs\) to reduce COVID19 mortality and healthcare demand](#)

² [Fundamental principles of epidemic spread highlight the immediate need for large-scale serological surveys to assess the stage of the SARS-CoV-2 epidemic](#)

The authors used a standard epidemiological model and looked for combinations of parameters that gave outcomes that fitted with the available timeseries of deaths data. The parameters that were adjusted were:

- The contagiousness of the disease
- Mean time between infection and death
- The number of days in which an individual is infectious
- The proportion of the population at risk of severe disease
- The probability of dying with severe disease

The team found that the death trajectories could be reproduced by models using a wide range of different parameter combinations. For example, models in which the infection spread rapidly could yield similar numbers of deaths to models with a lower rate of contagion if the proportion of the population that developed severe disease was assumed to be lower.

Importantly, though these models all matched the observed deaths up to the last data incorporated (March 19th), they varied greatly in the proportion of the population that had already been infected. In scenarios in which 10% of those infected developed severe disease, less than 10% of the population were infected, whereas in scenarios where just 0.1% of those infected go on to develop severe disease, as much as 68% of the population were infected.

The significance of these findings is that the alternative model scenarios have very different implications for both how the pandemic can be expected to unfold as well as future policy responses.

In scenarios where a relatively small number of people had already been infected there was a higher potential for future deaths as a large proportion of the population remained susceptible to the infection and those that contracted it had a relatively high risk of experiencing severe disease. Such scenarios present the kind of significant long-term challenges discussed in the Imperial College paper, likely requiring significant restrictions to remain in place until a vaccine is developed.

These contrast with scenarios where higher proportions of the population have been infected. In these scenarios, though the short-term impacts would likely be challenging, the population would already be a significant part of the way to having achieved herd-immunity and making it more likely that restrictions could be lifted or loosened over the coming months.

That such a wide range of scenarios are consistent with observation is a consequence of the model's sensitivity to, and the uncertainty of, the fraction of the population vulnerable to severe disease. The authors highlight the urgent need for antibody testing to determine how many people have already been infected so as to allow this factor to be better quantified.

Media reporting of the Oxford paper

The Oxford paper was widely reported on³ with headlines focussing on the 'possibility' that more than half of the UK population may already have been infected with COVID-19.

While it is true that the Oxford paper did conclude that such a high proportion of the population *could* be infected, scenarios where this was the case appear to be at the outer limits of their sensitivity analysis – i.e. possible, but unlikely. Nonetheless, the authors did consider it likely that the actual level of infection among the population was

³ Financial Times - [Coronavirus may have infected half of UK population — Oxford study](#)
 Evening Standard - [Coronavirus may have infected half of UK population, experts believe](#)
 New York Post - [Coronavirus may have already infected half of UK, study says](#)

significantly higher than assumed by others. The FT article quotes the leader of the study, Sunetra Gupta, as saying, “I am surprised that there has been such unqualified acceptance of the Imperial model”.

Following the immediate media response to the Oxford study, two articles were published urging caution in accepting the apparent findings indicated by the headlines.

Writing in the Guardian⁴ on March 26th, epidemiologist Adam Kucharski stresses the point that the media had picked up on the most extreme possible scenarios. In addition, he pointed out a limitation of the Oxford study, which was that it only considered deaths in determining consistent scenarios when, in fact, additional data is available. He cites:

- testing on the Diamond Princess cruise ship
- testing of passengers on evacuation flights
- the age pattern of Covid-19 cases
- and infections detected among contacts of cases

He suggests that studies of these sources indicate that 20-80% of those infected could show symptoms. He also provides an estimate that one in 15 people with symptoms are being reported [the basis for this is unclear from the article]. Together these estimates suggest ‘hundreds of thousands’ of people in the UK have probably been infected, rather than the tens of millions suggested by the outlier Oxford results and media headlines.

In an article⁵ for the Financial Times, economist Tim Harford makes many similar points, citing data from Wuhan and Italy that indicate the rate of asymptomatic infections is much lower than that implied by many of the Oxford scenarios. In addition, Harford raises the concern that the Oxford study could provoke a ‘reckless response’ from individuals of policy makers and notes that neutral experts⁶ have responded with caution to the report.

Both authors conclude that more and better data is needed (particularly antibody testing) in order to inform our understanding, and that for the present we should continue to plan for less optimistic scenarios.

A week after the Oxford paper was published, a Bloomberg opinion piece⁷ by Therese Raphael provided further commentary on the Imperial and Oxford work, as well as discussion of the inherent challenges of communicating complex modelling to effectively guide policy.

Estimating the impact of interventions

In recent days, both Imperial College⁸ and the London School of Hygiene and Tropical Medicine (LSHTM)⁹ have published papers on work to estimate the impact of recent restrictions on the transmission of coronavirus – each based on very different approaches.

LSHTM’s estimates are informed by responses from UK adults to a questionnaire about their contacts with other people subsequent to the March 23rd ‘lockdown’. This data was compared with that from comparable studies carried out prior to the pandemic to estimate how patterns of contact between individuals has changed, with the study finding an overall reduction of 73% in average daily contacts (from 10.8 to 2.9).

⁴ Guardian – [Can we trust the Oxford study on Covid-19 infections?](#)

⁵ Financial Times – [Why it’s too tempting to believe the Oxford study on coronavirus](#)

⁶ Science Media Centre – [expert reaction to unpublished paper modelling what percentage of the UK population may have been exposed to COVID-19](#)

⁷ Bloomberg – [Science Isn’t A Clear-Cut Pandemic Guide](#)

⁸ [Estimating the number of infections and the impact of nonpharmaceutical interventions on COVID-19 in 11 European countries](#)

⁹ [Impact of physical distance measures on transmission in the UK](#)

These patterns were then used to model the expected change in transmission rates that resulted from the introduction of physical distancing measures. Based on an estimated initial reproduction number (R_0) of 2.6 prior to the lockdown, the authors estimate that this measure subsequently fell to 0.62 (0.37 - 0.89) – indicating that the number of infections would begin to fall as a result.

Imperial's work is based on a complex epidemiological model that combines data from 11 European cities on reported numbers of cases, deaths, and the interventions. The model works backwards from observed deaths, attempting to account for the lag between infection and death, to estimate infection numbers and effective reproduction numbers for each country over time. Changes in the estimated reproduction number are assumed to be the direct result of interventions and the effects of similar interventions are assumed to be the same across all countries.

The authors estimated that 2.7% [1.2% to 5.4%] of the UK population was likely to have been infected with the coronavirus and that, following the lockdown on March 23rd, the effective reproduction number for COVID-19 fell to 1.3 [0.3 to 2.3] from 2.6 immediately prior to these measures being introduced.

On March 30th the Imperial team released a version of their model, reimplemented in R and available for download, which can be used to reproduce the results of this paper.

The published results were based on the available data up to March 28th. Rerunning this same model with data updated to April 1st gives results¹⁰ with a lower estimated value of the reproduction number and narrower confidence intervals: 0.9 [0.4 to 1.7]. These indicative results suggest both that the initial estimates by Imperial *may* prove to be overly pessimistic, and that estimates will continue to change in light as new data becomes available.

Key resources

London School of Hygiene and Tropical Medicine [CMMID Repository](#)

John Hopkins [Coronavirus Resource Centre](#)

UK Government [COVID-19: track coronavirus cases](#)

Imperial College [Department of Infectious Disease](#)

Imperial College [COVID-19 model repository](#)

¹⁰ The publicly available Imperial model is provided with the following disclaimer, "As with any mathematical model, it is easy to misconfigure inputs and therefore get meaningless outputs. The development team only endorses outputs it has itself generated"