COVID-19 in England: Analysis of the first two waves

23 December 2020, by Dr Sabine L. Van Elsland

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The latest report from the Imperial College London COVID-19 Response Team presents an overview of SARS-CoV-2 transmission during the first two waves.

The report presents a comprehensive overview of SARS-CoV-2 transmission, severity, hospitalization and intervention impact in the first two epidemic waves across all regions of England between March and December 2020.

The key findings are below:

- At the start of the first wave across all regions in England except London, 1.3% (95% CrI 1.2%-1.3%) of people infected died and 3.5% (95% CrI 3.3%-3.7%) of people infected needed hospitalization
- Infection fatality ratio (IFR) reduced to 0.8% (95% Cri: 0.7-0.8%) at the end of the first wave due to improvements in clinical management
- IFR was lower throughout in London at 0.9% (95% CrI 0.8%-1.0%), even when adjusting for demographics

- IFR was higher in elderly residing in care homes, 35.9% (95% CrI 29.1%-43.4%) than those residing in the community, 10.4% (95% CrI 9.1%-11.5%)
- Only national lockdown brought the reproduction number below 1 consistently in the first wave
- Introducing national lockdown one week earlier would have reduced the first wave death toll from 36,700 to 15,700 (95% CrI 8,900-26,800)

The team developed a mathematical (stochastic) model for the transmission of SARS-CoV-2, the virus that causes COVID-19. The age structured model is unique in representing care homes, in addition to hospital clinical pathways and the wider community. It uses data from daily recorded deaths, PCR testing, hospital admissions, hospital bed occupancy, individual patient outcomes, contact surveys, and serological surveys.

Transmission

The results presented in this report suggest that the intense transmission seen within the care home network, makes reducing infection levels in this key population group challenging.

Although the reproduction number Rt in the community was well below 1 in all regions during lockdown, high level of transmission was still ongoing in care homes during that period.

The researchers estimate a cumulative attack rate ranging between 4.8% (95% CrI 4.4%-5.1%) and 15.4% (95% CrI 14.9%-15.9%) depending on region, suggesting that the current level of population-level immunity from natural infection in England is still low.

Severity

COVID-19 manifests a broad spectrum of severity,

from asymptomatic infection to life-threatening illness requiring intensive care. Severity, in this report calculated as the proportion of hospitalisations (infection hospitalization ratio, IHR) and deaths (infection fatality ratio, IFR) among all infections, was estimated by region and by age.

At the start of the first wave, the report found that 3.5% (95% CrI: 3.3%-3.7-%) of people infected in England needed hospitalization (IHR) and 1.3% (95% CrI: 1.2%-1.3%) of people infected in England died (IFR).

The IFR was significantly lower throughout in London at 0.9% (95% CrI 0.8%-1.0%), even when adjusting for demographics. At the end of the first wave, the national IFR was 0.8% (95% Cri: 0.7-0.8%) due to improvements in clinical management and alleviation of capacity constraints.

A key feature of the first wave epidemic in England, in common with other European countries, was the death toll within care homes, which accounted for 23.3% laboratory-confirmed COVID-19 deaths in England.

The IFR was higher in the elderly (all ages) residing in care homes at 35.9% (95% CrI 29.1%-43.4%) than those aged over 80 years residing in the community at 10.4% (95% CrI 9.1%-11.5%). Deaths in care homes peaked on average 13 days later than deaths in the wider community.

Intervention impact

Although timing of non-pharmaceutical interventions (NPIs) and demographic differences caused regional variation in case numbers, the effect of the lockdown announcement on transmission was remarkably consistent across the country the report finds. Irrespective of initial differences, the level of transmission during lockdown was similar across all geographic regions.

The study shows how only national lockdown brought the reproduction number below 1 consistently in the first wave, and if it had been introduced one week earlier, it would have reduced

the first wave death toll from 36,700 to 15,700 (95% CrI 8,900-26,800).

The researchers estimate (with significant uncertainty) that reducing contact between the general population and care home residents by 50% could have reduced care home deaths by 44%.

The epidemic in London began an estimated 15 days before the rest of the country. This means that its lockdown occurred at a later stage of its epidemic. This explains the difference in mortality during the first wave between London compared to the national average 88.5 (95% CrI: 79.9–95.3) per 100,000 versus 70.7 (95% CrI: 64.6–77.1) per 100,000.

The local approach to control the epidemic during the summer was unable to contain the increase in transmission seen following the relaxation of lockdown measures. The increases in R during that period were substantially greater than those which followed the re-opening of schools and universities.

The work is presented in the latest report from the WHO Collaborating Centre for Infectious Disease Modeling within the MRC Centre for Global Infectious Disease Analysis, Jameel Institute (J-IDEA), Imperial College London.

Since the emergence of the new [coronavirus](#) (COVID-19) in December 2019, the Imperial College COVID-19 Response Team has adopted a policy of immediately sharing research findings on the developing pandemic.

Prof Neil Ferguson, author of the report from Imperial College London said: "The modeling presented here has informed SPI-M and SAGE discussions throughout the pandemic. Real-time modeling has a key role to play in enhancing situational awareness, by integrating data from multiple surveillance systems to give a coherent overview of ongoing patterns of transmission and likely future trends."

Dr. Marc Baguelin, author of the report from Imperial College London said: "This work highlights the importance of an early intervention in order to

reduce the number of cumulative deaths. This model also quantifies for the first time the dynamics of SARS-Cov-2 in the UK between care homes and the wider community and shows how difficult it is to mitigate the impact on the most fragile. On a more positive note it points out that a substantial reduction in the infection fatality ratio has been achieved from one wave to the other thanks to better treatment and improved care protocols."

Dr. Lilith Whittles, author of the report from Imperial College London said: "Our work pulls together the many different perspectives we have on the COVID-19 epidemic in England to form a complete picture of the first two waves of the epidemic. Above all our findings emphasize the vital importance of acting fast to save lives."

Dr. Edward Knock, author of the report from Imperial College London said: "By fitting our model to multiple data streams we are able to paint a broad picture of the epidemic. Control measures were able to reduce infections under lockdown in Spring, but after relaxations by the end of Summer, control measures were insufficient to prevent increasing spread again. However, since the peak in the first wave, there has been a reduction in the infection fatality ratio due to successful breakthroughs and improvements in treatment of hospitalized cases."

Provided by Imperial College London

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