YOUR QUESTION

What has been the impact of mitigation and restriction measures in curtailing the spread of COVID 19?

What is the best evidence currently?

The evidence base is still very limited in answering this question. However, there are a few key messages which have emerged from the research literature:

- No single measure is successful in isolation. Only a package of measures including contract tracing, social distancing, quarantine and isolation as appropriate are effective when used in conjunction
- The timing and duration of these initiatives is hugely important
- Success or relative success of these initiatives is driven by a high level [over 80%] of personal compliance from the population

Imperial College [London] COVID-19 Response Team. Estimating the number of infections and the impact of nonpharmaceutical interventions on COVID-19 in 11 European countries[1]

Modelling estimates are becoming more accurate as the pandemic progresses. A recent study from the Imperial College COVID-19 Response Team indicates that mitigation and restriction methods have saved in the region of 59,000 lives globally.

Contact Tracing

Contact tracing has been shown to be valuable in the early stages of the COVID-19 pandemic. However, it requires a significant investment of resources.

Fong et al. (2020). Nonpharmaceutical Measures for Pandemic Influenza in Nonhealthcare Settings: Social Distancing Measures[2]

Fong et al. reviewed 4 simulation studies, all of which found contact tracing to be effective when used in combination with other interventions, including isolation, quarantine, and prophylactic treatment with antiviral drugs. However, Wu et al.[3] estimated that the addition of contact tracing to an

existing combination of quarantine, isolation, and antiviral prophylaxis measures would only provide modest benefit, while increasing considerably the proportion of population in quarantine and the consequent costs. Contact tracing requires substantial resources to sustain after the early phases of a pandemic because the number of case-patients and contacts grows exponentially within a short generation time. Therefore, there is no obvious rationale for the routine use of contact tracing in the general population for control of pandemic influenza. However, contact tracing might be implemented for other purposes, such as identification of case-patients in high-risk groups to enable early treatment. There are some specific circumstances in which contact tracing might be more feasible and justified, such as to enable short delay of widespread transmission in small, isolated communities, or within aircraft settings to prevent importation of cases.

Keeling at al. Efficacy of Contact Tracing for the Containment of the 2019 Novel Coronavirus (COVID-19)[4]

Contact tracing is a central public health response to infectious disease outbreaks, especially in the early stages of an outbreak when specific treatments are limited. Using detailed survey information on social encounters coupled to predictive models, we investigate the efficacy of the current UK definition of a close contact – within 2 meters for 15 minutes or more – and the distribution of secondary cases that may go untraced. Taking recent estimates for COVID-19 transmission, we show that less than 1 in 5 cases will generate any subsequent untraced cases, although this comes at a high logistical burden with an average of 36.1 individuals (95th percentiles 0-182) traced per case. Changes to the definition of a close contact can reduce this burden, but with increased risk of untraced cases; we estimate that any definition where close contact requires more than 4 hours of contact is probable to lead to uncontrolled spread.

Oxford University Big Data Institute (31 March 2020). Controlling coronavirus transmission using a mobile app to trace close proximity contacts

Several international partners are assessing the feasibility of developing mobile apps for contact tracing in record time. If rapidly and widely developed, these mobile apps could help to significantly slow the rate of transmission, and support countries to emerge from lockdowns safely, as restrictions are gradually eased.

Professor Christophe Fraser, Oxford University Big Data Institute, explains: "We need a mobile contact tracing app to urgently support health services to control coronavirus transmission, target interventions and keep people safe. Our analysis suggests that about half of transmissions occur in the early phase of the infection, before you show any symptoms of infection. Our mathematical models also highlight that traditional public health contact tracing approaches provide incomplete data and cannot keep up with the pace of this pandemic."

Dr David Bonsall, Oxford University Nuffield Department of Medicine, explains: "The mobile app concept we've mathematically modelled is simple and doesn't need to track your location; it uses a low-energy version of Bluetooth to log a memory of all the app users with whom you have come into close proximity over the last few days. If you then become infected, these people are alerted instantly and anonymously, and advised to go home and self-isolate."

The authors argue that a mobile app can reduce transmission at any stage of the epidemic, in countries or regions where the epidemic is just emerging, at the peak of the epidemic, or to support a safe transition out of restricted movement or lockdown. It could also help to reduce the serious social, psychological and economic impacts caused by widespread lockdowns.

Critically, the researchers suggest a mobile app can help slow the spread of infection until vaccines and antiviral treatments become widely available.

Professor Fraser explains: "A contact tracing app can foster good citizenship by alerting people at risk, it can also help ease us out of confinement If we know we've not been in contact with anyone infected we can leave home safely, whilst still protecting our loved ones and avoiding a broader resurgence of coronavirus in our community."

The Oxford team highlight that the mobile contact tracing app should still be combined with isolation of cases, tracing and quarantine of contacts, physical distancing, scaled-up diagnostic testing, decontamination and

hygiene measures; and point to the importance of rigorous ethical standards underpinning the successful and appropriate use of mobile phone technology in addressing the coronavirus pandemic, including a number of ethical requirements needed to foster well-founded public trust and confidence.

Social Distancing

European Centre for Disease Prevention and Control. Considerations Relating to Social Distancing Measures in Response to the COVID-19 Epidemic[5]

Social distancing measures comprise one category of non-pharmaceutical countermeasures aimed at reducing disease transmission and thereby also reducing pressure on health services.
Social distancing aims through a variety of means to minimise contact between individuals and thereby to reduce the possibility for new infections. Decisions on when and how to implement social distancing measures should always be informed by evidence, but they will very rarely be purely evidence-based. Social and political considerations will also need to be taken into account. The detection of COVID-19 cases and deaths outside of known chains of transmission is a strong signal that social distancing measures should be considered. The early, decisive, rapid, coordinated and comprehensive implementation of closures and quarantines is more effective in slowing the spread of the virus than a delayed implementation.

Shenjie et al. Effect of Non-Pharmaceutical Interventions for Containing the COVID-19 Outbreak: An Observational and Modelling Study[6]

Without non-pharmaceutical interventions (NPIs) the number of COVID-19 cases would have shown a 67-fold increase with the effectiveness of different interventions varying. The early detection and isolation of cases was estimated to prevent more infections than travel restrictions and contact reductions, but integrated NPIs would achieve the strongest and most rapid effect. If NPIs could have been conducted one week, two weeks or three weeks earlier in China, cases could have been reduced by 66%, 86% and 95% respectively, together with significantly reducing the number of affected areas. However, if NPIs were conducted one week, two weeks or three weeks later, the number of cases could have shown a 3-fold, 7-fold and 18-fold increase across China, respectively. Results also suggest that the

social distancing intervention should be continued for the next few months in China to prevent case numbers increasing again after travel restrictions were lifted on February 17, 2020. Conclusion: The NPIs deployed in China appear to be effectively containing the COVID-19 outbreak, but the efficacy of the different interventions varied, with the early case detection and contact reduction being the most effective. Moreover, deploying the NPIs early is also important to prevent further spread. Early and integrated NPI strategies should be prepared, adopted and adjusted to minimize health, social and economic impacts in affected regions around the World.

Quarantine and Isolation

A recent paper by Wilder-Smith notes that in the absence of any one effective measure to mitigate COVID 19, governments have had to revert to tried and tested public health measures such as quarantine and isolation.

Wilder-Smith et al. Isolation, quarantine, social distancing and community containment: pivotal role for old-style public health measures in the novel coronavirus (2019-nCoV) outbreak[7]
Public health measures were decisive in controlling the SARS epidemic in 2003. Isolation is the separation of ill persons from non-infected persons. Quarantine is movement restriction, often with fever surveillance, of contacts when it is not evident whether they have been infected but are not yet symptomatic or have not been infected. Community containment includes measures that range from increasing social distancing to community-wide quarantine. Whether these measures will be sufficient to control 2019-nCoV depends on addressing some unanswered questions.

Oxford University Centre for Evidence Based Medicine. What is the evidence for social distancing [and quarantine] during pandemics?[8]
Although the evidence for home quarantine was moderate, there was a large enough signal to suggest that it may be effective in slowing transmission, particularly with high adherence [>70%]. Rashid (2015)[9] included a modelling study where quarantining 50% of all case contacts over a period of 4 weeks before the epidemic peak, reduced the peak case-load and attack rate by 25% and 1.5% respectively and delayed the peak by around 1 week.
Fong et al. highlighted the need to consider the economic and social costs of these interventions. For example, the benefits of quarantine would need to

be taken in the context of the risk to other household members, a risk that might increase the longer the period of quarantine continues.
Similarly, Rashid highlighted the risk of cross house contamination.

Quarantine however is a shock tactic that can only be employed for a relatively short period of time. As Brooks notes, increasingly we are beginning to see evidence of the psychological impacts from prolonged periods of quarantine.

Brooks et al. The psychological impact of quarantine and how to reduce it: rapid review of the evidence[10]

Most reviewed studies reported negative psychological effects including post-traumatic stress symptoms, confusion and anger. Stressors included longer quarantine duration, infection fears, frustration, boredom, inadequate supplies, inadequate information, financial loss and stigma. Some researchers have suggested long-lasting effects. In situations where quarantine is deemed necessary, officials should quarantine individuals for no longer than required, provide clear rationale for quarantine and information about protocols, and ensure sufficient supplies are provided. Appeals to altruism by reminding the public about the benefits of quarantine to wider society can be favourable.

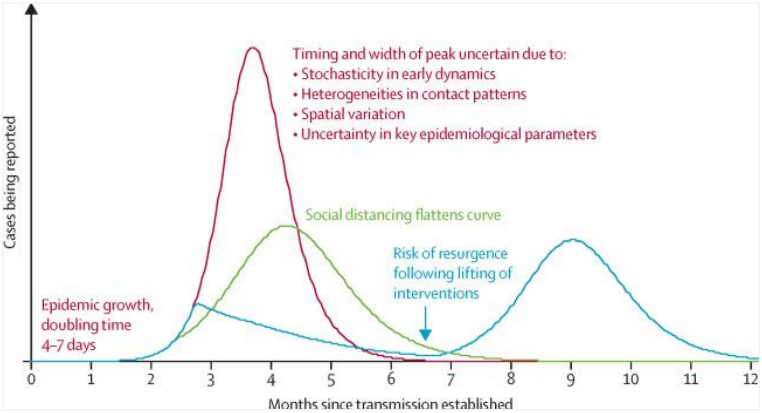
Hellewell et al. Feasibility of controlling COVID-19 outbreaks by isolation of cases and contacts[11]

In most scenarios, highly effective contact tracing and case isolation is enough to control a new outbreak of COVID-19 within 3 months. The probability of control decreases with long delays from symptom onset to isolation, fewer cases ascertained by contact tracing, and increasing transmission before symptoms. This model can be modified to reflect updated transmission characteristics and more specific definitions of outbreak control to assess the potential success of local response efforts.

Anderson et al. How will country-based mitigation measures influence the course of the COVID-19 pandemic?[12]

Model-based predictions can help policy makers make the right decisions in a timely way, even with the uncertainties about COVID-19. Indicating what

level of transmission reduction is required for social distancing interventions to mitigate the epidemic is a key activity.

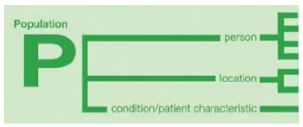
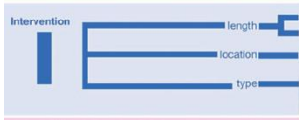
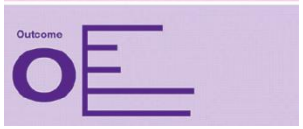


However, it is easy to suggest a 60% reduction in transmission will do it or quarantining within 1 day from symptom onset will control transmission, but it is unclear what communication strategies or social distancing actions individuals and governments must put in place to achieve these desired outcomes. A degree of pragmatism will be needed for the implementation of social distancing and quarantine measures. Ongoing data collection and epidemiological analysis are therefore essential parts of assessing the impacts of mitigation strategies, alongside clinical research on how to best manage seriously ill patients with COVID-19.
There are difficult decisions ahead for governments. How individuals respond to advice on how best to prevent transmission will be as important as government actions, if not more important. Government communication strategies to keep the public informed of how best to avoid infection are vital, as is extra support to manage the economic downturn.

At present the limited evidence means that it is not possible to pinpoint a single measure as being the most effective in reducing the spread of COVID 19. What the evidence does show is that at present only an aggressive lockdown strategy, supplemented with contact tracing and social distancing has slowed or flattened the curve of the spread of the infection. These measures rely on a high degree of continued public co-operation.

Produced by the members of the National Health Library and Knowledge Service Evidence Team.† Current as at 06 April 2020. This evidence summary collates the best available evidence at the time of writing. Emerging literature or subsequent developments in respect of COVID-19 may require amendment to the information or sources listed in the document. Although all reasonable care has been taken in the compilation of content, the National Health Library and Knowledge Service Evidence Team makes no representations or warranties expressed or implied as to the accuracy or suitability of the information or sources listed in the document. This evidence summary is the property of the National Health Library and Knowledge Service and subsequent re-use or distribution in whole or in part should include acknowledgement of the service.

The following PICO(T) was used as a basis for the evidence summary:

	COVID 19 PATIENT
	
	
	MITIGATION RESTRICTION CONTAINMENT MEASURES

The following search strategy was used:

ABBREVIATED] ((coronavirus OR COVID-19 OR (Wuhan ADJ3 virus) OR 2019-nCoV OR SARS-COV-2) AND (nebuliz$ OR nebulis$ OR "Aero Comfort" OR "Aero Mist" OR atomiz$ OR atomis$ OR eRapid OR nembuliz$ OR nembulis$))

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[1] Imperial College [London] COVID-19 Response Team (2020). Estimating the number of infections and the impact of nonpharmaceutical interventions on COVID-19 in 11 European countries. https://www.imperial.ac.uk/media/imperial-college/medicine/mrc-gida/2020-03-30-COVID19-Report-13.pdf. [Accessed 8 April 2020].
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