Should Everyone Stay Home for a Month?

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Abstract

We propose a thought experiment in which regions not yet experiencing large-scale COVID-19 spread implement a preventive quarantine procedure, in which all individuals remain within their place of residence for a minimum period of 30 days. Our analysis shows that such a plan could conceivably be run, and is likely the strategy which would save the most lives.

We expect this thought experiment to raise important questions stemming from the prompt, "Why would this not work?" If we cannot get the core pillars of an idealized scenario to work out, what approximation do we choose to make — and how many corners can be cut, before the plan falls apart? For much the same reason that the pure sciences establish fundamental bounds and impossibility theorems — to know what is theoretically possible — we wish to do the same with the COVID-19 outbreak. What is the best possible outcome, given limited resources, from our current state? Then, with the limited resources we have, what is the best we could theoretically reach?

We raise questions of economic ability for individuals to stay home from work, how many workers we can afford to supply with anti-viral PPE, how many negative-pressure containment rooms we can generate, and how many ICU beds are available for new patients. From these constraints, we back up our mental calculation, to ask how early-on a full-force, mass quarantine would need to be put in place, to have a chance of containing the current outbreak — or whether this opportunity has already passed.

While not the only way to prevent the disease from spreading, the strategy here would be the swiftest and save the most lives. We propose that policy-makers use this strategy as a base-line in their planning. We present a top-down vision for what would guarantee containment, with opportunity to relax certain constraints as needed. This stands in contrast to a starting assumption of un-restricted movement, with layer upon layer of new policies added to gradually slow the spread of disease. We propose that the top-down approach, starting from a known airtight solution, can help policymakers make more systematic arguments about how they plan to stop the spread. thus convincing their colleagues and constituents of the validity of their plan.

I. Introduction

The recent outbreak of the SARS-CoV-2 virus, and the disease it causes, COVID-19, has caused many organizations to postpone mass gatherings, across schools and universities, sporting events, religious gatherings and more. There have been many calls for wider-spread lock-down.* In this brief, we propose that governments, community institutions and families prepare plans to implement mass quarantines as soon as possible. We examine the opportunities and trade-offs of implementing such a quarantine. We argue that enacting such plans before an outbreak occurs, rather than after, are essential for preventing mass spread.

Up until this point, wide-spread lock-downs have only been enacted in countries with the most severe outbreaks: namely, China and Italy. We propose a global lock-down, including locations having few or no COVID-19 cases currently. While the lock-down in China has lasted more than [] days, we claim that a 30-day lockdown would be sufficient for eradicating the disease in nearly all countries that have not had severe, pervasive outbreaks. Here, we detail the policies that such a lock-down would need to have. We then discuss the impacts such policies would have, both on the transmission of SARS-CoV-2 itself, as well as downstream economic and lifestyle conditions during and after the lock-down. We advocate for self-quarantine by ***all*** countries, on the basis that doing so preventatively can bring the necessary benefit much faster than waiting for outbreaks to spread further. Most countries, provinces, cities and neighborhoods around the world face the threat of an eventual COVID-19 outbreak, which, left unchecked, will require mass quarantine one way or the other. It is not a matter of *if*, but *when*, and the only choice is to act preventatively or reactively. Do it now, or do it later.

The preventative path offers the prospect of a swifter, more effective quarantine. It also offers governments, communities and families the opportunity to prepare for such a scenario in various respects — a luxury those in the existing quarantines did not have. The countries currently under quarantine have been forced to enact such policies swiftly due to the emergency nature of their outbreaks, with little time for preparation. The magnitude of life-style change within a matter of days, combined with confusion amidst rapidly changing, un-clear policies, and an overall "element of surprise", caused a large degree of fear, resentment and unrest. For the rest of the world, however, quarantine is likely inevitable, and becoming more imminent every day. Time still remains for many countries to implement quarantine preventatively — before emergency rooms fill up, rather than after.

Doing so preventively offers the chance for better preparation and a smoother transition into quarantine. Communities can make plans to enter the quarantine on their own terms and their own time-line, with adequate time taken to prepare clear and concise policies, including provisions for how those policies may change over time. This preparation can ensure safety, comfort, willing cooperation and a positive mind-set throughout the duration. There sufficient time now to do this calmly — but it must be done.

If performed preventatively, in regions with minimal to mild current outbreak levels, we reason that a a 30-day quarantine period could completely contain all cases of COVID-19, stopping all community transmission. This parameter requires empirical analysis, which we call upon the community to help investigate. 30 days of halted activity seems a small price to pay for the hopeful outcome. Yet, implementing such a plan requires considerable preparation in order to run effectively.

In this note, we propose a rough outline for how governments, communities and families can draft their own plan.

II. Lock-Down Plan

Our current knowledge about the SARS-CoV-2 incubation period in humans, and the duration for which the virus remains

*For example, https://twitter.com/sriramchs/status/1237040636114743298

intact on solid surfaces, indicates that 30 days is enough time to eradicate community transmission in communities that have few or no severe cases. Below we present a plan for how to operate in that 30-day period, how to prepare for such a period to go smoothly, and how to transition back to normal operation post-quarantine.

A. Preparations

Before undergoing a 30-day quarantine period, individuals and families will need to make adequate preparations to live safely, healthfully and comfortably. Given the not-yet-emergency situation in most locales, there is likely time for a substantial preparation period, to ensure individuals are prepared for and comfortable in their new lifestyle. We propose preparations cover the following categories, with significant government assistance:

- **Delivery of supplies to homes:**
  - Food
  - Toiletries
  - Medications
  - Trash, recycling and compost bags
  - Air filtration, soap, rubbing alcohol, and other preventative supplies for preventing disease spread

  Individuals will still have the opportunity to acquire any other supplies they desire, while being advised to begin minimizing trips outside. Delivering the bulk of essential items will greatly ease the burden on individuals and families, eliminating the need for bulk shopping, which otherwise would involve a large up-front expense and heavy physical labor.
- **Delivery of supplies to hospitals:**
  - Personal Protective Equipment (PPE) for health care workers (HCW), including anti-viral, copper-infused clothing which de-activates viral particles upon contact.
  - SARS-CoV-2 testing kits
  - Any other diagnostic or treatment materials required for essential health care.
- Any patients who are known or suspected to have SARS-CoV-2, can be **transported to hospitals preventatively**, to begin monitoring for disease progression.
- **Doctors, nurses and other HCWs transported to take residence within the hospitals where they work**, to the extent that such space is available, so that they may continue working during the quarantine period while minimizing the number of doctors who need to commute. Eliminating as many commutes as possible reduces the potential for spreading virus particles.
- **Discharge patients receiving non-essential treatment.** This makes space available both for potential incoming patients, who may need urgent medical attention once the quarantine period begins, and for HCWs who will be taking residence in the hospital in order to avoid commuting.
- **Hospitals shall prepare separate spaces** for those patients who (potentially) have the SARS-CoV-2 virus, and those who do not. **Airborne Infection Isolation Rooms (AIIRs)** should be prepared for any patients being treated or tested for COVID-19. Separate hospitals could even be allocated for such patients, if space allows, for the purpose of containment, with other patients being relocated to non-COVID-19 hospitals.

B. Quarantine Period

With preparations in place, the quarantine period would commence, with rules following this general framework:

- Nobody allowed outside their place of residence, aside from exceptions listed below.
- Everyone whose job can be performed remotely, works from home.
- People whose jobs cannot be done remotely (or whose jobs have been eliminated due to quarantine policies), will be funded for any time due to missed work. (Indeed, this has been happening organically in large technology companies, with hourly, on-site employees being paid for time when their job had been suspended. However, others may be less fortunate, and would require government assistance for time away from work. Independently of the rest of this plan, it is essential that economic roadblocks be removed for individuals who want to stay home from work.)
- Exceptions to stay-at-home policy:
  - **Individuals who contract COVID-19** may be transported to a hospital via an emergency vehicle.
  - **Patients who recover may be sent home**, also in designated health-care transit vehicles.
  - **A skeleton crew of HCWs and hospital maintenance workers**, including Emergency Medical Technicians (EMTs) on call to transport patients. Any such employees who were unable to be housed on hospital premises, may commute to the hospital to perform their duties, and subsequently return home.
  - **Police officers enforcing quarantine measures** will stay within their patrol cars, monitoring streets and highways, only exiting if necessary to stop a vehicle or pedestrian who is in transit against policy. As much of this surveilance as possible should be performed remotely with digital tools such as traffic cameras or satellite image monitoring, with a minimal deployment of police officers necessary to enforce the quarantine.
- **Extensive personal protective equipment (PPE)** shall be provided to all individuals who will leave their house at any point. This should include:
  - Masks to filter out virus particles
  - Anti-viral clothing, which prevents the virus from clinging to one's clothes or body, and prevents someone from becoming a passive vessel for the virus to travel on.
  - All staff members who are bound to be leaving their home regularly, shall have such clothing provided in advance.
  - Any infected patients who are transported from their home, shall be given anti-viral clothing to wear prior to leaving their home (delivered by an emergency medical technician [EMT] who is also wearing anti-viral clothing).

  There will be a small enough number of individuals traveling outside, that we believe it will be cost-effective to provide anti-viral clothing for this small number of

people. (This remains a calculation which we, or the community, should determine empirically.)

C. Return to Normal Life

Viral particles in any public spaces will become inactivated within 9 days of the start of the quarantine (this is the length of time that previous coronaviruses have been known to remain active on surfaces [1]). This is guaranteed because all individuals traveling will have been wearing anti-viral clothing, and therefore would not have deposited any new viral particles into public spaces, even if they were infected or had otherwise come in contact with the virus.

As soon as a household has gone 30 days with none of its members showing symptoms of infection, that household comes out of quarantine. It takes the virus 9 days to become inactivated on any surfaces. It usually takes 2 - 14 days [**?**], with some estimates claiming as long as 20 days [**?**] for the virus to incubate in an infected individual, before that individual shows any symptoms. Therefore, if 29 days pass in which no individual in a home shows any symptoms, then all the individuals in that home are healthy, and all stray virus particles that they might transfer out of their home, have become de-activated.

Any household with an individual showing symptoms, must send that individual to a hospital for testing. If the test comes back negative, and the household has been in quarantine for the full 30 days required, then that house is released from quarantine. **If the test comes back positive**, that individual must remain in the hospital, and that household's "quarantine clock" must be reset. From the day that the infected individual was transported out of the home, that household must remain in quarantine for another 30 days, to ensure the virus is fully eliminated from the home, with that household becoming eligible for a new shipment of food and other supplies.

III. Analysis of Impacts

In short, everyone staying home for 30 days would guarantee removal of the virus from all spaces, public and private.

At the current levels of infection in most parts of the world, the number of cases resulting in hospital visits is quite low, and would remain so if a quarantine measure like this were taken. Hence, we can avoid hospitals become overrun with patients, and ICUs running out of bed space (as has happened in the areas most critically affected). Hence, we foresee it as feasible to bring all infected patients to a hospital immediately, as presented in Section II-B, while simultaneously housing all necessary HCWs on-premise to eliminate their commute.

The number of daily new infections would necessarily approach zero, as the available routes of transmission are reduced. The possible paths to infection would be limited to:

1) healthy individuals becoming infected in their own homes, from viral particles present on surfaces
2) infected individuals spreading the virus to:
   a) others within their home
   b) health care workers (HCW) workers who transport them to the hospital
   c) HCWs who treat them during their stay
   d) other patients in the hospital
3) The limited staff of HCWs, hospital maintenance workers, and law enforcement who need to commute regularly, spreading viral particles among each other back into their homes.

Items (1) and (2)(a) would be unavoidable, and are the reason for the 30-day quarantine to determine which homes have viral particles present, with a "quarantine reset" any time an infected individual is discovered. The rest of the transmission routes would be mitigated by personal protective equipment (PPE) and Airborne Infection Isolation Rooms (AIIRs). Our proposal is that there would be a sufficiently small number of people needing to commute outside, and a sufficiently small number of patients in the hospital, that it would be cheap enough to provide that limited number of individuals with extremely effective PPE and a separate Airborne Infection Isolation Room (AIIR) for each patient.

IV. Contributions and Future Work

In this work, we propose a thought experiment for a highly aggressive preventation strategy for systematically stopping the spread of COVID-19. We have shown what we believe to be the most sure-fire containment strategy possible, arguing that such measures would be sufficient for bringing the outbreak under control, and avoiding large death tolls along the way. While such measures are not the only way to slow the spread — and certainly not the cheapest — we simply argue that this would resolve the issue as swiftly as biologically possible, would save the most lives, and would potentially cause the least total unrest over the full duration of this outbreak.

We invite comment and analysis on the feasibility of various aspects of this plan, especially regarding financial cost. More importantly, we expect this thought experiment to raise important questions stemming from the prompt, "Why would this not work?"

If not implemented in full, we envision useful insights and questions being spawned from this thought experiment.

References

[1] Günter Kampf, Daniel Todt, Stephanie Pfaender, and Eike Steinmann. Persistence of coronaviruses on inanimate surfaces and its inactivation with biocidal agents. *Journal of Hospital Infection*, 2020.