



A Simple Decision Analysis of a Mandatory Lockdown Response to the COVID-19 Pandemic

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On 29 March 2020, it was noted that globally, two camps are emerging in the policy debate around how governments should respond to the COVID-19 pandemic [1]. The ‘lockdowners’ argue for tighter restrictions, succinctly summarised by New Zealand’s Prime Minister Jacinda Ardern’s instructions to “act like you have COVID-19” [2] or more formally defined as mandatory mass quarantine. The lockdowners’ argument is that reducing the duration of the crisis period will reduce the number of COVID-19 cases and decrease the period of disruption to the economy.

The ‘gradual steppers’ argue against an immediate lockdown, opting instead for a policy response based on the provision of advice and awareness raising, with the option of penalties for contraventions of selected instructions. The basis for the gradual approach is that keeping as many people in work for as long as possible is more likely to result in a functioning economy once the crisis is over. As Australian Prime Minister Scott Morrison has highlighted, it is also important to consider the potential adverse effects of lockdown on the well-being of the population, which may include psychological effects and physical effects, e.g. from reduced access to health care and increased domestic violence—the isolation effects [3].

There is no easy way to determine which camp is right or wrong—this “is a legitimate debate” [1].

Decision analysis could be used to shed some light on the debate [4]. Decision analysis supports the explicit and transparent use of available information to inform decision making, often using ‘decision trees’ to structure problems. To illustrate the use of decision analysis, we use a decision tree to compare an immediate lockdown policy option with the maintenance of a gradual steps approach.

Figure 1 presents a decision tree that describes the pathways and outcomes associated with maintaining a gradual steps approach relative to the immediate implementation of a mandatory lockdown policy. The tree represents the possibilities that a mandatory lockdown will or will not be required at a later stage of the crisis, followed by an assessment of three outcomes:

- the number of COVID-19 cases;
- the effects on the economy;
- the effects of isolation on the well-being of the population.

The ‘later lockdown required’ scenario reflects the possibility that the number of COVID-19 cases will rise to a point at which a lockdown is the only feasible policy. The later mandatory lockdown scenario is assumed to result in a lockdown of at least the same duration as an immediate lockdown, so the lesser economic and isolation effects incurred in the period prior to a lockdown are added to the effects incurred during the lockdown. Additional COVID-19 cases will also be experienced in the period prior to a lockdown. The ‘later lockdown required’ scenario is assumed to be worse than the immediate lockdown option for all three options.

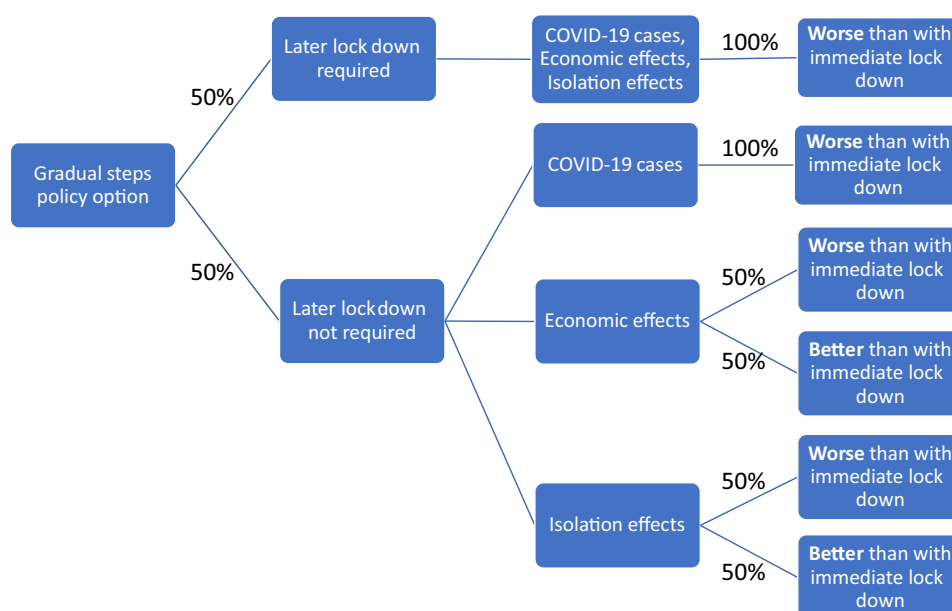
The ‘later lockdown not required’ scenario is also likely to result in larger numbers of COVID-19 cases compared with an immediate lockdown. The economic and isolation effects are likely to last for a longer period, but the intensity of the effects would likely be lower than for the immediate lockdown option. The overall economic and isolation effects could be better or worse than for the immediate lockdown option, as represented in the decision tree.

The figures in the tree represent hypothetical likelihoods of the represented events occurring, that there is a one in two (50%) chance that a later lockdown will be required (and hence also a one in two chance that a later lockdown will not be required). The figures also represent assumptions that

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Fig. 1 Gradual steps (the gradual steps policy option involves the combination of advice and awareness raising, and penalties for contraventions of selected instructions) policy response to the COVID-19 pandemic decision tree



there is a one in two chance that the economic and isolation effects will be better if a later lockdown is not required than for immediate lockdown.

The decision tree can then be analysed to estimate the probabilities that maintaining a gradual steps policy will result in better or worse outcomes than an immediate lockdown policy. The probability that the economic effects will be better is estimated as the probability of the 'later lockdown not required' scenario multiplied by the probability that the economic effects will be better if a lockdown is avoided, which is $0.5 \times 0.5 = 0.25$, a one in four chance.

Therefore, for the probabilities represented in Fig. 1, there is a one in four chance that the economic and isolation effects of maintaining a gradual steps policy will be better than for an immediate lockdown policy, and a zero chance that there will be fewer COVID-19 cases. In this case, an immediate lockdown policy would likely be preferred.

The probabilities used in the decision tree can be varied to see what assumptions regarding the likelihood of the different scenarios and outcomes would be required to change the policy decision; for example, if there is a four in five chance of 'later lockdown not required' and a four in five chance of better economic and isolation effects if no lockdown is required, the overall probabilities of better economic and isolation effects would be $0.8 \times 0.8 = 0.64$, a 64 in 100 chance of better economic and isolation effects. This increased likelihood of better economic and isolation effects would still need to outweigh the health effects (and costs) of increased numbers of COVID-19 cases.

In interpreting the expected effects of the alternative policy options, government may also consider the issue of equity. Individuals already unemployed as a result of the pandemic are suffering the economic effects of the crisis

now and their suffering will likely continue until the crisis is over. The immediate lockdown policy option may result in more people experiencing adverse economic effects, but for a shorter period, which may be preferred from an equity perspective.

The decision analysis presented in this editorial provides an explicit and transparent framework for assessing the expected effects of maintaining a gradual steps approach to handling the COVID-19 pandemic, compared with the 'ultimate' policy option of a mandatory lockdown. The simple analysis presented in this editorial could be extended to represent differences in the expected magnitudes of the economic and isolation effects in different scenarios, but the implied policy option of the presented decision analysis seems quite clear. The scenarios tested suggest that a decision to maintain a gradual steps approach implies governments are willing to trade-off increased numbers of COVID-19 cases and deaths for reduced economic and isolation effects. More importantly, it implies governments are highly confident that a mandatory lockdown will not be required at a later date AND that a longer but less intense period of social distancing is highly likely to reduce the economic and isolation effects of the crisis AND that a more equitable distribution of the effects of the crisis is not a significant policy objective.

Many countries have now implemented mandatory mass quarantine policies. The use of decision analysis as illustrated in this editorial may have informed the earlier implementation of mandatory lockdown policies in these countries. The potential for decision analysis to inform the remaining 'gradual steppers' on whether to implement a lockdown remains. Using this framework, governments can explain their rationale for maintaining a gradual steps

approach with reference to their assumptions regarding the likelihood of a mandatory lockdown being required at a later date, as well as their expectations regarding the economic and isolation effects of avoiding a lockdown relative to experiencing a mandatory lockdown.

Compliance with Ethical Standards

Conflict of interest Jonathan Karnon has no known conflicts of interest to report.

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