Royal Society DELVE Report on Test, Trace, Isolate and Support

Summary

Implemented at scale, Test, Trace, Isolate (TTI) can contribute to controlling the UK COVID-19 epidemic when effectively implemented at scale, but only as part of a wider package of public health interventions, including physical and social distancing, control of infection procedures, outbreak investigation and control. TTI is most effective in breaking chains of transmission, and reducing the effective reproductive number, when there is maximum: (i) **speed**, i.e., quick turn-around of both index case testing and contact tracing (and testing); (ii) **compliance**, i.e., a high proportion of people in each chain are willing and able to follow guidance; and (iii) **coverage**, i.e., identification of most chains through integration of consistent case data and real-time, high-precision population surveillance. Each of these three aspects of TTI needs careful attention, as do the trade-offs implicit in choices of how precisely to implement TTI in terms of who to test, trace and isolate, and when to do so.

Based on our modelling work, we find that adding TTI to a broader package of interventions can generate a reduction of 5-15% in the number of new infections. The upper end of this range represents scenarios where the overall test and trace period for contacts has been reduced from five days to three days. Furthermore, the level of compliance with TTI guidance strongly affects its usefulness, as there are many steps in the TTI system at which cases and contacts can be lost. Phone-based apps may be able to increase TTI speed and compliance but is likely to be an adjunct to a manual TTI system. Surveillance and TTI are mutually beneficial, since TTI can capture important data on index cases and contacts, while surveillance can provide indications of who/where to target for testing, even when they are not part of an identified transmission chain. Incentives to participate in TTI and comply with isolation measures are also likely to be needed. Finally, TTI will require substantial coordination across a wide range of organizations, including central and local government departments, PHE, the NHS and business groups. In particular, local integration of systems is likely to maximize ability to conduct the agile, locally differentiated outbreak management that may be needed as the epidemic progresses.

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7. Effective TTI within a broader epidemic response

The effectiveness of contact tracing is highest when the information picture of contact chains (through surveillance and reporting) is robust, when TTI capacity can contain almost all known contact chains, and speed, efficiency and compliance is high. With a growing epidemic, as the capacity to infection ratio declines, so do the benefits of TTI. In the midst of a large outbreak with substantial community spread, TTI is likely to be resource-intensive, while providing a relatively small benefit due to slow turnaround times. Nevertheless, under the expectation that the UK is likely in the short- to medium-term to focus on containing the COVID-19 epidemic and driving down case numbers, TTI can play an important role. The exact nature of this role will depend on the resources available to it, and the policy decisions made regarding how it fits within the wider epidemic response. We have outlined some of the possible TTI activity choices and explored their likely impacts.

Several of these decisions relate to a careful balance of the health and economic impacts of the epidemic. Central to such a balancing act are careful decisions about when to adjust NPIs. TTI provides a policy tool that may allow somewhat greater relaxation of NPIs than would otherwise be possible, thus the resources required to conduct TTI may provide benefits in terms of reduced NPI stringency and thus greater economic productivity. However, TTI's benefits will depend on how it is implemented. As highlighted above, TTI is most effective when it is able to be comprehensive and efficient, rapidly reaching and ending most infection chains. It is likely to be particularly important when considering relaxing NPIs, e.g., when the number of new cases (in a given area/sector) is declining. Deciding when to adjust NPIs will be best informed by surveillance as well as the capacity of TTI itself.

Importantly, contact tracing approaches alone are unlikely to be efficient in settings with very high force of infection (e.g., care homes, hospitals) since tracing is most useful when some people are at substantially greater acquisition risk than the general population - although TTI for families and other close contacts of healthcare staff will still be important. In high-risk settings, outbreak investigation and infection control approaches are needed, to identify both who has been infected (likely widely dispersed across the institution) and where infection control has failed allowing the initial and secondary infections to arise.

Based on all of the above, we believe that TTI will require a joined-up epidemic response, both to maximize its internal efficiency and its effectiveness in support of other work. Effective TTI will benefit social distancing and other contact-reducing interventions by reducing the number of potentially infectious contacts through increasing infected individuals' status awareness and their willingness to isolate. Effective TTI can also bolster the effectiveness of antiviral treatments (once available), by getting infected individuals onto treatment early in their infection, rapidly controlling their viral load.

Nevertheless, effective TTI will require substantial coordination across a wide range of organizations. This will include public health bodies such as Public Health England, healthcare bodies such as the NHS and private healthcare (as well as NHSx), central government

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