Towards Optimal Tracing Strategy in Pandemics with Applications to Covid-19

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The sudden onset of the Covid-19 pandemic disrupted the modern multi-national interconnected society and led the countries and societies to enforce unprecedented restrictions on movement. Among myriad containment measures, the policy of trace and quarantine found universal adoption among countries; the swift adoption of the policy was soon met with widespread criticism and opposition activists who questioned the utility and the risk associated with such a large scale collection of data and infringement on the movement of individuals. Consequently, one often tends to be either pro- or anti-trace and quarantine; the ensuing polarizing and politicized left little room for nuance. In this work, we undertake a methodology study to understand the nuances of the impact of different implementations of trace and quarantine. To this end, we design a user-friendly and intuitive tool that can be employed by experts to model the disease dynamics and societal structure. We focus on the study of the cost of policy with respect to quarantine degree, which captures the distance between the person required to quarantine after a person is detected to be infected. Our study results in a surprising conclusion: the cost is not necessarily monotone with respect to the degree of quarantine. Our analysis indicates that governments must curb the urge to adopt simplistic policy and the optimal policy of trace and quarantine for a country strongly depends on its societal structure and disease dynamics.

∗The research of S. C. is supported in part by the NSF grant DMS 1812148.