



Mathematical Statistics
Stockholm University
Research Report **2022:10**,
<http://www.math.su.se>

Epidemic models with digital and manual contact tracing

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November 2022

Abstract

We consider the Markovian SIR epidemic model but where individuals either recover naturally or are diagnosed, the latter implying isolation and subject to being contact traced. More specifically, this paper is concerned with two types of contact tracing: the classical manual contact tracing and the more recent digital contact tracing based on individuals using a tracing app, and investigates the preventive effect of each, as well as their combined preventive effect. The initial phase of an outbreak is approximated by a (two-type) branching process relying on a large community and under the simplifying assumption that contact tracing happens without delay. The "types" in the branching process are not individuals but rather "to-be-traced components". It is shown that the fraction π of app-users for the digital contact tracing needs to be bigger than the fraction p of successfully contact traced individuals in the manual contact tracing for the same preventive effect. Further, the preventive effect of combining the two contact tracing methods is shown to be bigger than the product of each of the two preventive effects.