# The Optimal Control of Infectious Diseases via Prevention and Treatment*

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Abstract. This paper fully characterizes the optimal control of a recurrent infectious disease through the use of prevention and treatment. We find that under centralized decision making, treatment induces positive destabilizing feedback effects, while prevention induces negative stabilizing feedback effects. Under decentralized decision making, these effects create elements of strategic complementarities and substitutabilities, respectively. While optimal treatment pushes prevalence towards the extremes, optimal prevention pushes it towards interior solutions. As a result, the dynamic system may admit multiple steady states and the optimal policy may be path dependent. We find that steady state prevalence levels in decentralized equilibrium must be equal to or higher than the socially optimal levels. While steady state treatment levels under decentralization are typically socially optimal, steady state prevention (if used) is socially suboptimal. Last, we derive a Pigouvian subsidy scheme that decentralizes the socially optimal outcome.
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## 1. Introduction

Despite significant achievements in the battle against infectious diseases, effective infection control remains a formidable challenge.[1] Infectious diseases remain one of the major causes of morbidity and mortality in both developing and developed countries and are a major strain on public budgets. In parallel with rapid advancements in the biomedical field, there is an ongoing effort to develop strategies to better deploy existing tools and resources. In particular, it is a priority to determine how different interventions work at different stages of an epidemic (separately and in conjunction) and to determine optimal policy.

An old adage holds that *an ounce of prevention is worth a pound of cure.* In the case of infectious diseases, the relationship between prevention and treatment is complicated by the presence of externalities. It turns out that determining the right mix of prevention and treatment is a delicate matter and significantly more complicated than folk wisdom might suggest.

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[1]See Piot et al. (2008).