PRSE
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ABSTRACT:

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Sanitation, Externalities and the Urban Mortality Transition

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During the late 19th and early 20th centuries, the roll-out of tap water and sewerage infrastructure contributed to a dramatic mortality decline in Western cities. However, recent studies show that substantial health benefits only materialized after both systems were in joint operation, whereas the isolated introduction of tap water infrastructure offered little benefit and could even increase mortality before the advent of sanitary sewers. This paper offers an explanation based on a negative externality arising from spatio-temporal disparity in the roll-out of tap water and sewerage networks within a city. Access to a cheap, reliable and pressurized fresh water source allows individuals to clean up their local environment by flushing away liquid and solid waste. While this results in direct health benefits, the emission of pathogens to streets, gutters, ground water acquirers and open water bodies imposes indirect costs on neighbors located along the spatial trajectory of the resulting waste flows. As a result, city-level mortality does not necessarily decrease monotonously in the roll-out of tap water infrastructure. Sanitary sewers neutralize the externality, thus yielding social benefits on top of any direct gains for connecting households. I test this mechanism using a newly constructed dataset of all roughly 14,300 buildings in Berlin, observed in 1875 and 1880 – a crucial five-year period during which the city's mortality rate dropped by almost 20 %, while the share of buildings connected to the tap water and sewerage networks increased from 59 to 84 % and 0 to 55 %, respectively. Based on a digital terrain model and its implied flow direction matrix, I trace the spatial trajectory of waste flows, thus directly measuring the impact of the health externality. In a difference- in-differences PPML specification, I find that a building's crude death rate (CDR) drops by .085 and .168 percentage points after obtaining tap water and

sewerage, respectively – accounting for 13 and 26 % of the total CDR decline between 1875 and 1880. On top of these direct benefits, a one-standard-deviation drop in waste flow exposure decreases the CDR by .067 percentage points or 11 % of the total CDR decline. I show that the implied aggregate net effects are consistent with recent city-level studies. Exploiting sharp cut-offs in the roll-out of sewerage across Berlin's main water bodies, I report consistent results from a complimentary regression discontinuity design.