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Developing a Mathematical Modeling Approach to Public Health Assessment: HIV in China as a Case Study

The HIV infection can have a long incubation period before symptoms appear. The current HIV pandemic has produced a large population of HIV positive people who are not diagnosed or unaware of their HIV status, while capable of transmitting the infection. It was estimated that close to a quarter of the 70,000 people living with HIV in Canada at the end of 2011 were undiagnosed. Estimation of the size of undiagnosed HIV positive population is an annual/bi-annual exercise for public health agencies in all developed countries and the WHO, simply because this population is an obstacle to HIV control and prevention. From the viewpoint of public health assessment, the presence of an undiagnosed population makes it difficult to estimate the true incidence, prevalence, and mortality of the HIV epidemic, and to assess the effectiveness of control and preventive measures. Estimation of undiagnosed population using HIV surveillance data has been done using a statistical methodology called (modified) back-calculation. In this talk, I will present our work on developing a rigorous mathematical modeling approach to this problem, and our collaboration with China CDC on the assessment of the HIV epidemic in China. I will show how statistical methodologies are integrated with differential equation models, and point out several important modeling issues that tend to be overlooked. Our objective is to develop mathematical modeling, integrated with statistical methodologies and health data, as an effective tool for public health assessment.