Facing widespread, single combination anti-retroviral treatment, will HIV vanish?

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Résumé

To date, the best way of combating HIV is with highly active anti-retroviral therapy (HAART), a combination of drugs which tamper with the viral life cycle, sending the concentration of viruses in the blood to near zero. By 2015, the WHO hopes to have 15 million people on HAART, mainly in Sub-Saharan Africa, where HIV prevalence is at its highest. Epidemiological studies that predict treatment success ignore drug resistant viruses, resistance seems to incur a strong fitness cost, limiting the transmission of drug resistance (TDR). These costs have mostly been observed where patients are closely monitored and where second-line treatments are available. This is unlikely in resource-limited countries where all infections will be treated with the same drug, regardless of whether their infection is resistant. We hypothesise that the epidemiological role of drug resistance could be non negligible in this setting. Our model predicts that very high patient adherence to the treatment is required to successfully eliminate the virus. Second, the evolution of drug resistance can maintain the epidemic despite treatment, even if the cost of resistance is high. Finally, the virus may also evolve a higher viral load after treatment, bringing with it higher virulence: following an eradication failure we might face not only drug-resistant, but also more virulent strains. Models including more realistic details (contact network, within-host dynamics) are surely needed but our first approach clearly confirms that one should be careful about resistance evolution when giving millions of people the same combination of drugs.

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