

Novel mathematical model predicts new wave of drug-resistant HIV infections in San Francisco

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A mathematical model shows that a new wave of drug-resistant HIV is rising among among men in San Francisco who have sex with men and that this trend will continue over the next few years, according to a new study from the UCLA AIDS Institute.

At the same time, the evolution of drug-resistant HIV may have actually reduced the severity of the city's epidemic, saving many men from becoming infected.

The model and its results were unveiled today by UCLA biomathematics professor Sally Blower, director of the Biomedical Modeling Center at the David Geffen School of Medicine at UCLA, during a session on drug-resistant diseases at the annual American Association for the Advancement of Science conference in Boston.

"Our amplification cascade model has been validated by our reconstructions and can now be used to design novel and effective health policies for controlling single-, dual- and triple-class resistant strains of HIV in both resource-rich and resource-constrained countries," said Blower, who is also a member of the UCLA AIDS Institute.

The model enabled the researchers to reconstruct the epidemic's past and predict its future by calculating the evolution of several classes of drugresistant HIV strains in San Francisco.



The research relied on a novel multi-strain mathematical model called the Amplification Cascade Model to examine the rise between 1987 and 2007 of HIV strains resistant to the three major classes of drugs -nucleosides (NRTIs), nonnucleosides (NNRTIs) and protease inhibitors (PIs).

The model took into account three interacting processes -- transmitted, acquired and amplified resistance -- the last of which refers to amplification of drug-resistant strains in HIV-positive people due to the repeated use of multiple-treatment drug regimens.

The study tracked uninfected individuals; newly infected people in the primary stage of infection; chronically infected individuals who were not yet eligible for treatment; chronically infected people who remained untreated, though eligible for it; and patients under treatment.

Researchers found complex waves of rising and falling single-, dual- and triple-class drug-resistant HIV strains over 20 years, with more complex patterns continuing to evolve.

The model predicts that resistance to NRTIs will decline substantially and PI resistance will fall slightly through 2012, and that resistance to NNRTIs will rise over the next five years and then begin falling.

Although strains with dual- and triple-class resistance will be transmitted, they will be far less potent than wild-type HIV strains -- those strains that have not developed drug-resistant mutations and remain sensitive to all classes of drugs.

Most surprising of all, the evolution of drug-resistant HIV strains has substantially reduced the severity of the San Francisco AIDS epidemic because the strains that have emerged have become less infectious than the wild-type strains.



Source: University of California - Los Angeles

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