

# A novel linear approach for predicting HIV/aids prognosis and individualizing management

## Short communication

Presently, the world of HIV/AIDS involves the careful calibration of therapy through a physician, clinician, and even a nutritionist's efforts to assimilate the relevant impact of the viral load count and CD<sub>4</sub> count into a patient's antiretroviral regimen and practicing lifestyle. Diagnosticians already factor in CD<sub>4</sub> count and initial viral load to assay treatment options but a simple algebraic tool could use the same dataset to effectively predict treatment options on a case by case basis.

A plausible scenario that pertains to this model could be a patient who presents with a CD<sub>4</sub> count at approximately 200 where the most likely infection is pneumocystis pneumonia<sup>1,2</sup> and Bactrim® (Co-trimoxazole) prophylactic therapy can be initiated.<sup>3,4</sup> If the CD<sub>4</sub> count is lower than 50, then the diagnosis would be a mycobacterium avium complex (MAC) infection and the preferred primary prophylaxis therapy would be azithromycin.<sup>5-7</sup>

If a model was created to predict the levels of CD<sub>4</sub> count after a certain amount of time after diagnosis of HIV/AIDS, management of the disease state could improve dramatically. Applying the basic  $y=mx+b$  formula, clinicians could predict CD<sub>4</sub> counts at different times in the patient's therapy.

$$CD4_{\Delta} = VL_0 \times t$$

Through the use of logistic regression and the above formula, we are able to propose a prognostic and even a potential diagnostic tool for those triaging HIV/AIDS afflicted populations. The model above uses past calculated averages for CD<sub>4</sub> counts associated with initial viral load (VL) per unit of time. Compiling data sets over the years will allow healthcare professionals to predict the time expected to reach a certain change in CD<sub>4</sub> count given the viral load of patients and should also allow them to predict CD<sub>4</sub> levels based on initial viral load and the given time interval.<sup>5</sup>

## Limitations

The most efficient predictive model for HIV/AIDS prognosis would also involve factors that could prove confounding when simply assessing only the CD<sub>4</sub> count and initial viral load. Such limitations include patient's demographics. Patients with comorbidities, varying diet and nutrition, and polymorphisms in height and weight will react differently to the pathogenic process as well as the corresponding treatment as the disease state progresses. In addition, men having sex with men generally have different risk profile than heterosexual men.<sup>5</sup> Adherence also plays a role since non-compliance is associated with a higher viral load and lower CD<sub>4</sub> counts which will affect the prediction of CD<sub>4</sub> counts given initial viral loads.<sup>8</sup> Any future utilization of this model will have to be evaluated in the context of the above demographics and any other contributing auxiliary variables.

## Discussion

By using this principle to predict CD<sub>4</sub> counts, it is possible to

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**Derrick Wong, Rohan Ramnarain**

St. John's University College of Pharmacy and Health Sciences, USA

**Correspondence:** Rohan Ramnarain, St. John's University College of Pharmacy and Health Sciences, USA, Tel 9548260403, Email rohan.ramnarain@gmail.com

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be able to be more prepared for disease states that may approach in the near future. We may be able to initiate prophylaxis treatment for serious infections before the CD counts deplete. If we predict in a newly diagnosed AIDS that the CD<sub>4</sub> counts will reach 200 in 10days, then on day 10 co-trimoxazole can be initiated as prophylaxis treatment for a PCP infection.<sup>2,3,6</sup> Perhaps future studies can use our formula to show a specific HIV treatment is more efficacious at boosting or preserving CD<sub>4</sub> counts in any given time period with a goal of a progression free survival. Newer HIV medications being approved by the FDA can utilize the model as a benchmark for evaluating efficiency; researchers will now look at patients with the same viral load and observe their respective CD<sub>4</sub> counts over a period of time in order determine how fast the CD<sub>4</sub> counts are rising on the medication. A hypothetical patient on Kaletra® and a patient not on the therapy with a similar initial viral load will both have CD<sub>4</sub> count responses over a 3month period. Synthesizing counts and other data from patients such as these quantifies each medication's efficiency in terms of real world evidence. The same idea can be applied to the most recently approved combination HIV medications including Odefsey® (emtricitabine, rilpivirine, and tenofovir alafenamide). Health care professionals can look at a subset of patients who took the components of Odefsey® separately and evaluate the CD<sub>4</sub> counts over a period of time to figure out the most efficient HIV therapy. With enough collaborative support, this tool may prove to be the gateway to standardized AIDS prevention.

## Acknowledgements

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## Conflict of interest

Author declares that there is no conflict of interest.

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