Abstract 3908

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ESTIMATING INCIDENCE AT A REGIONAL LEVEL WITH THE CD4 DEPLETION MODEL

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Background

The Ending the HIV Epidemic (EHE) initiative targets a 75% decline in HIV incidence in 5 years and a 90% decline in 10 years. Currently HIV incidence in the U.S is derived from the Center for Disease Control's CD4 depletion model. The EHE initiative requires an understanding of HIV incidence at a regional and local level to evaluate the impact of prevention interventions.

Objective

To determine the accuracy of the CD4 depletion model for measuring incidence in sub-epidemics

Methods

- We used the San Diego Primary Infection Resource Consortium (PIRC) multi-assay estimated algorithm to derive an estimated date of infection (EDI) as a gold standard. This model estimates recency using the limiting-antigen (LAg) avidity assay in combination with HIV viral load which together has an estimated false recency rate of 1%.
- Comparing the CD4 Depletion Model to the PIRC gold standard, we found that the sensitivity of the CD4 model was 51% (95% CI 47%-55%) and specificity was 63% (95% CI 57%-68%) for determining which infections were incident. (see abstract 1291/poster 0903).
- We then used these results to determine predictive values and estimated incidence using the CD4 model in epidemic scenarios varying the proportion of incident infections and the size of the newly diagnosed population.

References

1. Fauci AS, Redfield RR, Sigounas G, et al. Ending the HIV Epidemic: A Plan for the United States. JAMA 2019.
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4. Kouyos RD, von Wyl V, Yerly S, et al. Ambiguous nucleotide calls from population-based sequencing of HIV-1 are a marker for viral diversity and the age of infection. Clin Infect Dis. 2011;52(4):532–539.
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Comparison of CD4 Depletion Model to PIRC-EDI

Figure 1. Positive Predictive Value of CD4 Model for Determining Incidence is Poor

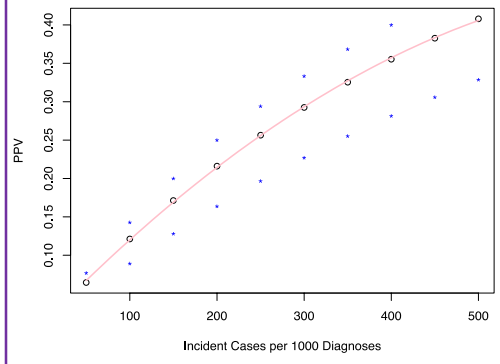


Figure 2. Negative Predictive Value of CD4 Model for Determining Incidence Worsens with Increasing Incidence

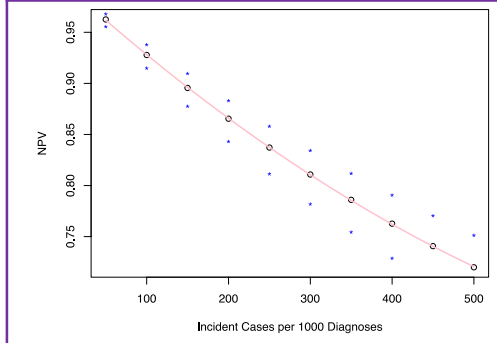


Figure 3. True Positive and False Positive Results Using the CD4 Model for Determining Incidence Progressively Skew with Increasing Size of Epidemic

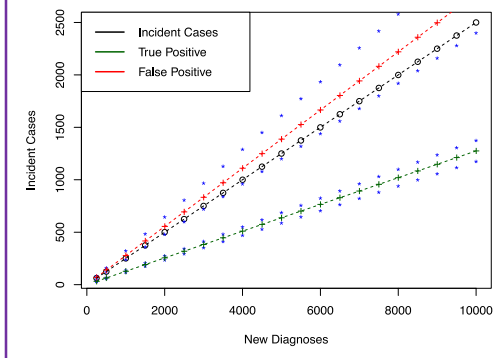
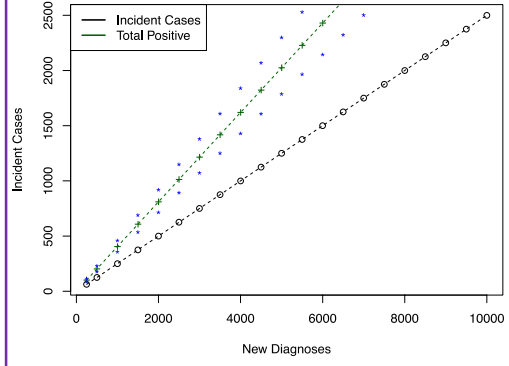


Figure 4. Total Incident Diagnoses Determined Using CD4 Model Increasingly Overestimates Incidence as Size of Epidemic Grows



Results

- Comparing the CD4 Depletion Model to the PIRC recency algorithm (see Poster 0903) varying incidence rates and total diagnoses we found:
- On an individual level, the PPV of the CD4 model is poor (Figure 1), and NPV worsens with increasing incidence (Figure 2).
- This combination of poor PPV and NPV lead to an increasingly skewed estimate of incidence that appears to overestimate the number of incident cases (Figures 3 and 4).
- In regional epidemics, with 25% of new diagnoses incident, the CD4 model will overestimate incidence by 62% (43%-84%).
- Based on this comparison to the PIRC-EDI, assuming that 25% of new diagnoses are incident, a CD4 depletion model estimate of 40,000 incident cases in the US could overestimate annual incidence by greater than 15,000 cases.

Conclusions

- **Although the CD4 model is not designed to predict if an infection is incident at an individual test level, the uncertainty in this test also impacts population scale estimates.**
- **As interventions to prevent HIV transmission are scaled up as part of the EHE effort, more accurate estimates of incidence are needed so that we will be able to measure the impact of interventions deployed on a regional level.**

Acknowledgments

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