

Yield Optimization Data Algorithm

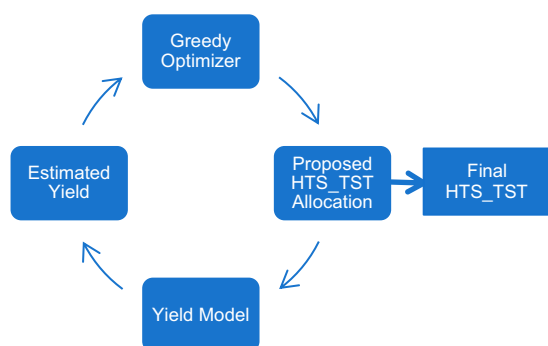
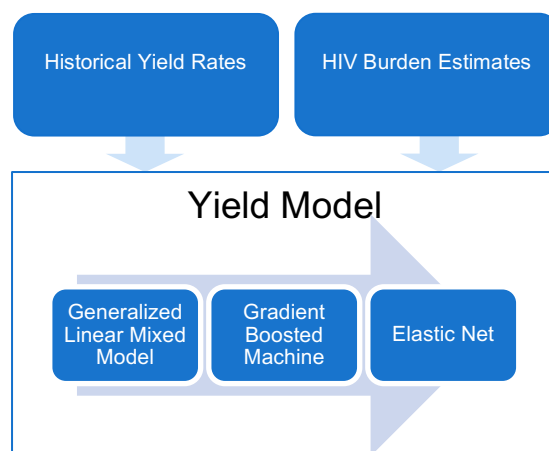


Increase HIV Yield Via Focused Testing

YODA is an objective, data-based methodology designed to optimize the allocation of HIV tests at a very granular level within countries. Using existing HTS_TST targets, the algorithm recommends quarterly HIV test counts for every partner / site / modality / age / sex combination. These recommendations are designed to maximize testing yield using cutting edge machine learning techniques. YODA supports a wide range of options, allowing for on-the-ground constraints to be incorporated into the optimization.

YODA's Yield Model: In order to optimize testing, it is first necessary to understand what drives yield and how changes in the number of tests performed at a site (or sex, age, modality combination within that site) relate to testing yield. YODA's yield model is a three stage boosted machine learning model composed of a sophisticated Generalized Linear Mixed Model (GLMM), a Gradient Boosted Machine (GBM), and an Elastic Net (EN) model. The model is trained using disaggregated historical yields, estimates of HIV burden from Spectrum, and the following predictors:

Time	Sex	Age	Site Type
Site	Partner	# Tested	SNU Priority
Modality	PSNU	PLHIV	# Treated
Population Size			



Optimizing Test Allocation: The yield model feeds into a custom greedy optimization algorithm that finds the best allocation of HIV tests across all sites and the optimal allocation of HIV tests within each site for each partner/age/sex/modality combination. It does this by observing the effects of hypothetical changes to test allocation on yield as estimated by YODA's yield model. Given the total number of tests desired for the country, it then finds the HTS_TST allocation that maximizes yield, respecting constraints imposed by on the ground considerations. The constraint system is flexible, allowing for the algorithm to limit the % change in number of tests, the total number of tests within a sub category (e.g. PSNU), or limit the optimization to ignore inelastic modalities.

Site Effectiveness: There are a number of external factors that can play a role in the yield rate observed at a particular site. The population served may have a low burden, the modalities offered may have naturally lower yield, or the age/sex distribution served by the site may tend to have lower HIV rates. This can make it difficult to make apples-to-apples comparisons as to whether a site is being effective in their HIV testing program. The YODA Site Effectiveness Score removes the effects of these external factors to provide an apples-to-apples measure of how a site compares to an "average" site with the same external considerations.

2.1X
Better Yield than
Expected

1.3X
Worse Yield than
Expected