Baseline Scenarios

In order to evaluate whether Multiple-Firstline-Therapy (MFT) will generate more double-, or triple-drug-resistance cases, compared to Single-Firstline-Therapy (SFT) and Cycling strategies, we need to first define some Outcome Measures. Then we have a standard metrics to compare between different drug deployment strategies.

The first Outcome Measure we defined is *Total Number of Multi-Drug-Resistant (MDR) cases*, where we count total cases with 2-or-more-drug resistance, *excluding Lumefantrine*.

The second measure would be Waiting Time until a Milestone event. This includes the *Time until* $k\%$ *of all genotype is multiple-resistant*, where $k = 1, 2, 3...$, and *Time until double-resistance emerges (in DHA-PPQ & ASAQ)*.

The third measure *Total Number of Mutation Occurrences from Single- to Multiple-Drug-Resistant*.

I. Baseline with 1-ACT (SFT) Strategy

To compare MFT with SFT strategy, we first need to establish a baseline scenario, where only one ACT is deployed throughout the whole time of simulation. The simulation was set up with $40\% \ \text{treatment coverage}$ - i.e. 60% of the population don't get any drug. The initial population is set to $50,000$, and the simulation runs for $40 \ years$ (1990/1/1 - 2030/1/1), with the first $10 \ years$ being the burn-in period (nobody in the population gets any drug) to find the equilibrium.

1. MDR Case Count

We first count the *Total Number of Multi-Drug-Resistant (MDR) cases* in SFT scenarios, with different drug.

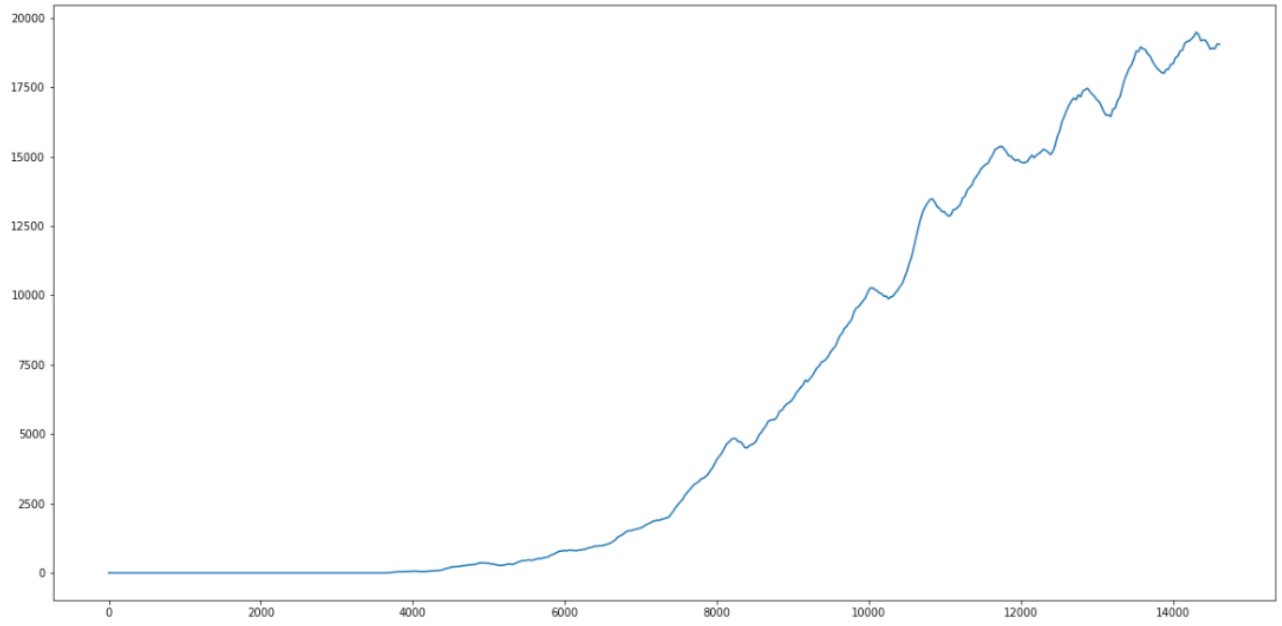
1.1. Just Using AL

Reported by the simulation output data and python function [1], if only AL is deployed, by the end of 30th year, around 12.85% of the whole population is infected with Double-Drug-Resistant parasite.

```
MDR_case_count('al.txt', '^(TYF|TNY|TNF|KYY|KYF|KNY|KNF)..Y..$')
```

```
[19044, 148249, 12.845955116054746]
```

```
MDR_plot_geno_freq('al.txt', '^(TYF|TNY|TNF|KYY|KYF|KNY|KNF)..Y..$')
```



1.2 Just Using AS-AQ

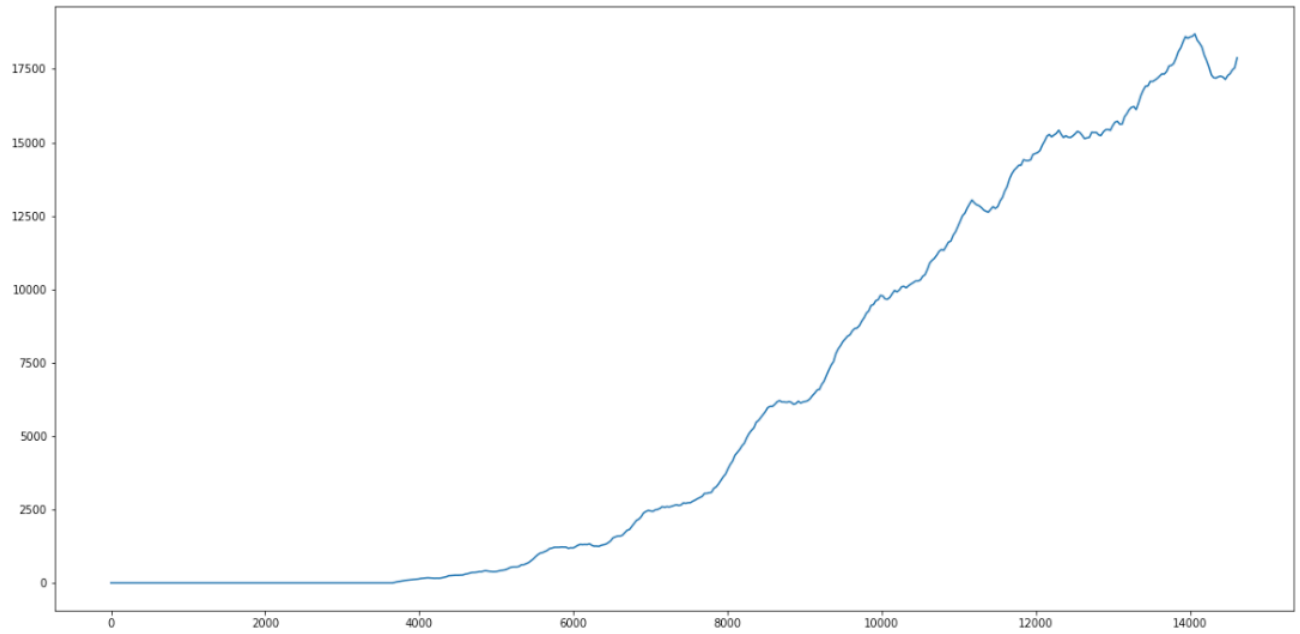
Similarly, if only AS-AQ is deployed, by the end of 30th year, around 11.99% [2] of the whole population is infected with Double-Drug-Resistant parasite.

AS-AQ

```
MDR_case_count('asaq.txt', '^(TYF|TNY|TNF|KYY|KYF|KNY|TYY)..Y..$')
```

```
[17880, 149123, 11.990102130456066]
```

```
MDR_plot_geno_freq('asaq.txt', '^(TYF|TNY|TNF|KYY|KYF|KNY|TYY)..Y..$')
```



1.3 Just Using DHA-PPQ

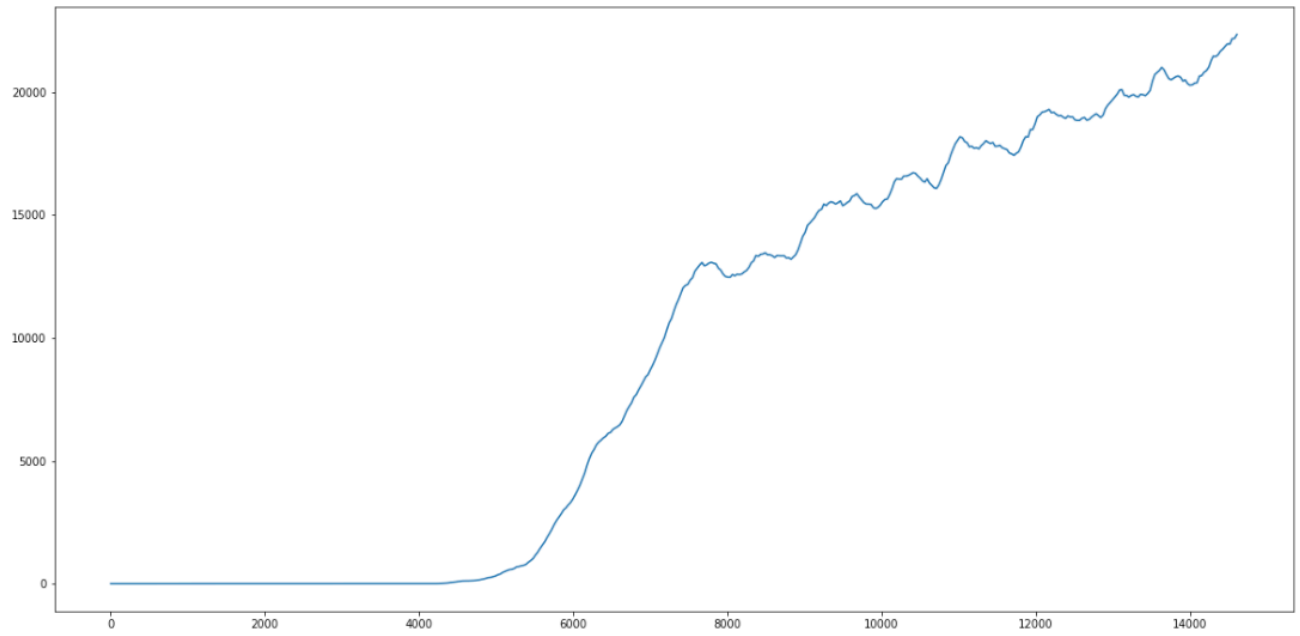
Similarly, if only DHA-PPQ is deployed, by the end of 30th year, around 14.94% [3] of the whole population is infected with Double-Drug-Resistant parasite.

DHA-PPQ

```
MDR_case_count('dhappq.txt', '^.....Y2.$')
```

```
[22344, 149582, 14.93762618496878]
```

```
MDR_plot_geno_freq('dhappq.txt', '^.....Y2.$')
```



1. Source Code, output 6. ↩
2. Source Code, output 8. ↩
3. Source Code, output 10. ↩