

Assessing Ending the HIV Epidemic (EHE) Goals for San Diego (SD) County



CALIFORNIA
HIV/AIDS POLICY
RESEARCH CENTERS

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Agenda

- Overview of the Microsimulation Model for San Diego
- EHE Goals
- Scenarios
- Results
- Questions

Why use models?

- **Capture complex disease dynamics**
 - Population growth and deaths
 - Differences across demographic groups
 - Linkage, retention, and adherence to ART treatment
 - Partnership and transmission patterns
 - Uptake, discontinuation, and adherence to PrEP
 - Disease prevalence and incidence
 - New diagnoses
 - Disease progression
- **Able to test hypothetical interventions**
 - Can test different policies to understand outcomes and compare

Approach to modeling

Model: A simplified representation of reality

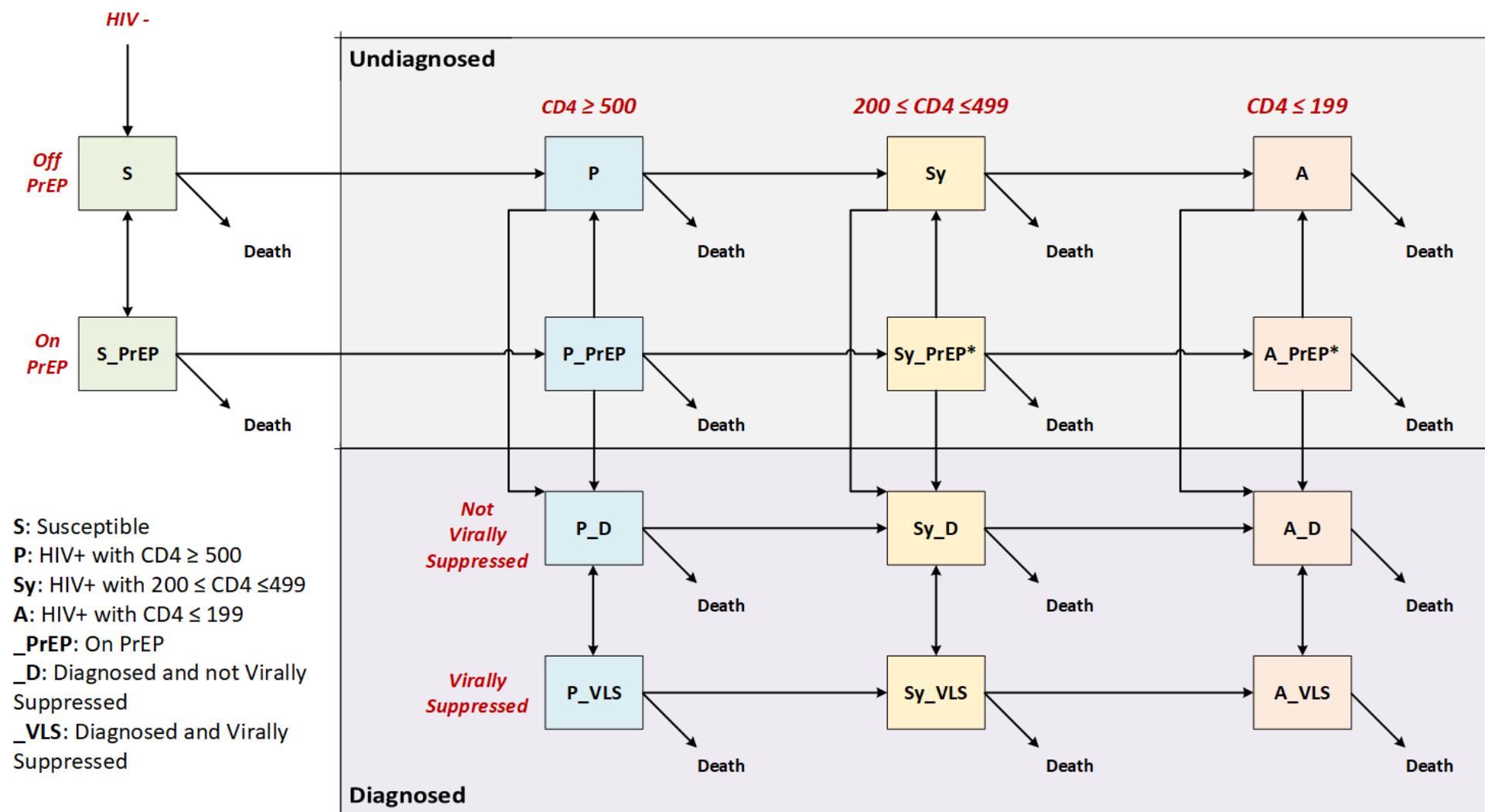
1. Develop an understanding of the system being modeled and identify characteristics that influence how the system behaves
2. Build system using mathematical formulas
3. Parameterize model with real world data
4. Check that model accurately reflect real world trends
5. Use model to compare hypothetical outcomes from “what if” scenarios

San Diego HIV Microsimulation Model

- Built a simulation of HIV among MSM in San Diego (SD)
- Simulated individuals move between health/treatment states according to probabilities specific to age, race/ethnicity
 - Data from San Diego surveillance reports, biological and medical literature
- Can use model to predict what would happen if SD increased PrEP, diagnosis, or ART performance
 - Can we reach goals in the Ending the HIV Epidemic plan?



Model Schematic



- Individuals can change states each year
- Race/Age-specific annual transition probabilities between health states
- When an MSM turns 15 they enter the simulation
- An individual can die at any stage from natural death or because of AIDS

Model Parameters

Type of Parameters

- Initial population
 - Number of MSM, proportion by race, etc.
- Health state transitions
 - Likelihood of CD4 count progression, advancing to AIDS, becoming infected based on race and age, etc.
- Disease progression
- Diagnosis probabilities
- PrEP uptake and discontinuation probabilities
- ART uptake and retention probabilities
- Adherence probabilities and effectiveness of treatments

Sources

- San Diego Association of Governments (SANDAG)
- CDPH Office of AIDS San Diego Surveillance Data
- Published HIV/AIDS research literature
- Published HIV models at state and national levels
- LGBT Center Data (Los Angeles)

****Parameters stratified by HIV stage, treatment status, race, and/or age where appropriate***

****Parameters are San Diego-specific wherever possible***

Ensuring the model reflects SD trends

Calibration: Adjusting values in the model to reflect observed trends

- Run the model over a past time period and try to match the historical trends found in trusted data

Time Frame: 2015 - 2018

Targets:

- New diagnosis*
- Diagnosed PLWH *
- Diagnosed PLWH on treatment**
- Diagnosed AIDS Deaths**

Goal is to simultaneously satisfy all targets

* Target at the aggregate level, by age, by race, and by stage

** Target at the aggregate level, by age, and by race

Research Question

- Can we meet targets outlined for the San Diego Ending the Epidemic Plan?
 - Based on America's HIV Epidemic Analysis Dashboard (AHEAD)
- What level of resources are needed to reach desired outcomes?

San Diego Ending the Epidemic Plan

- **Diagnose**
 - 95% know HIV status by 2025
- **Treat**
 - 95% receiving medical care by 2025
 - We do not capture this in our model
 - 90% VLS by 2025
- **Prevent**
 - $\geq 50\%$ of those with PrEP indications on PrEP by 2025
 - We assume 51% of MSM have indication for PrEP
- **Respond**
 - Improved response to HIV transmission clusters

Long-term Outcome

Reduce new HIV infections by 75%

**All goals are relative to the counts in 2017*

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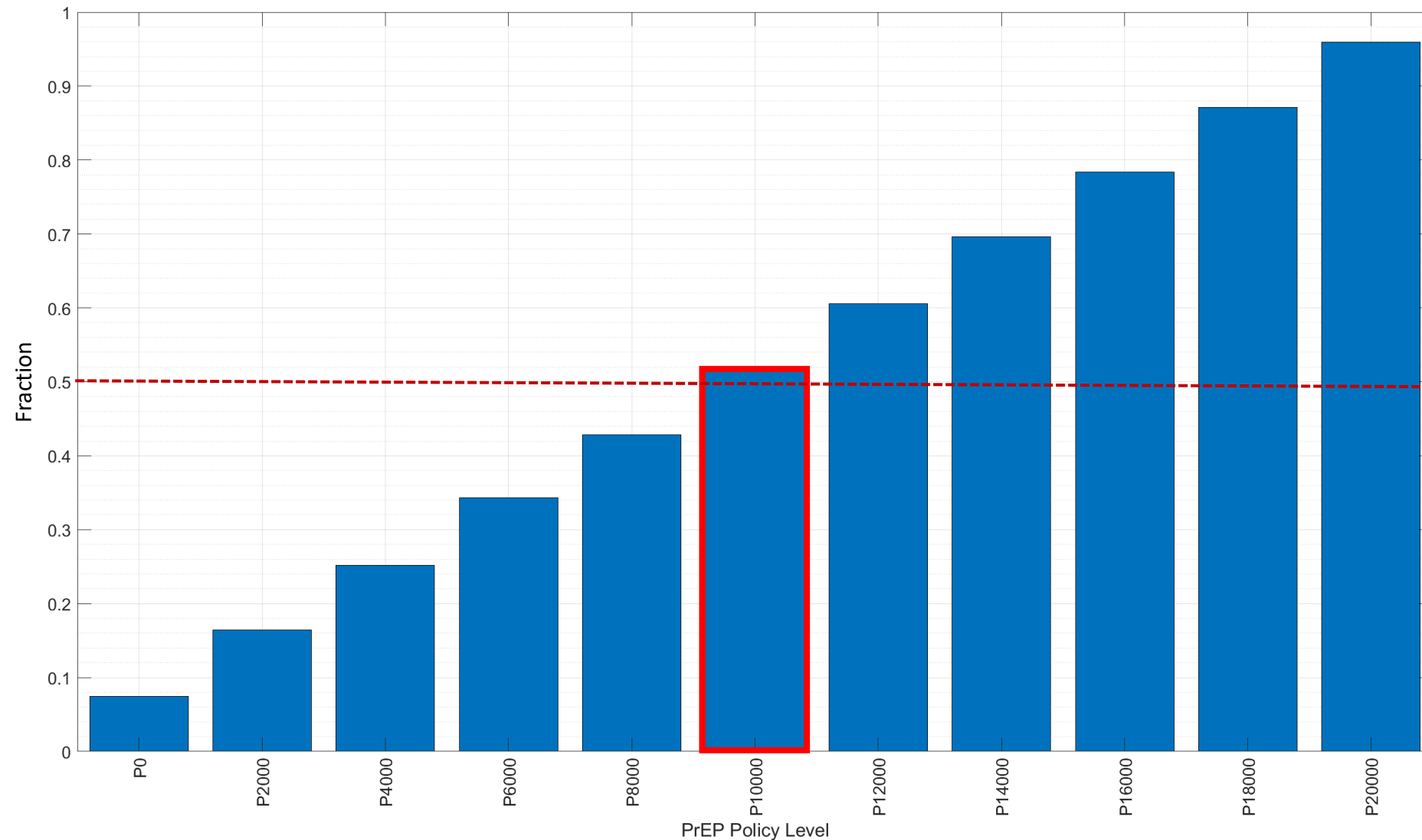
Interventions

- Each year, a fixed number of individuals transition between health/treatment states in each intervention:
 - PrEP given to HIV negative individuals
 - PrEP: 0 to 20,000 additional users per year (increments of 2000)
 - Increase number of virally suppressed PLWH
 - VLS: 0 to 1200 additional VLS PLWH per year (increments of 200)
 - Diagnose PLWH previously unaware of their status
 - New Diagnoses: 0 to 400 additional diagnoses (increments of 100)

* Higher value is approximately what is needed to approach 95-100% levels for all each goal

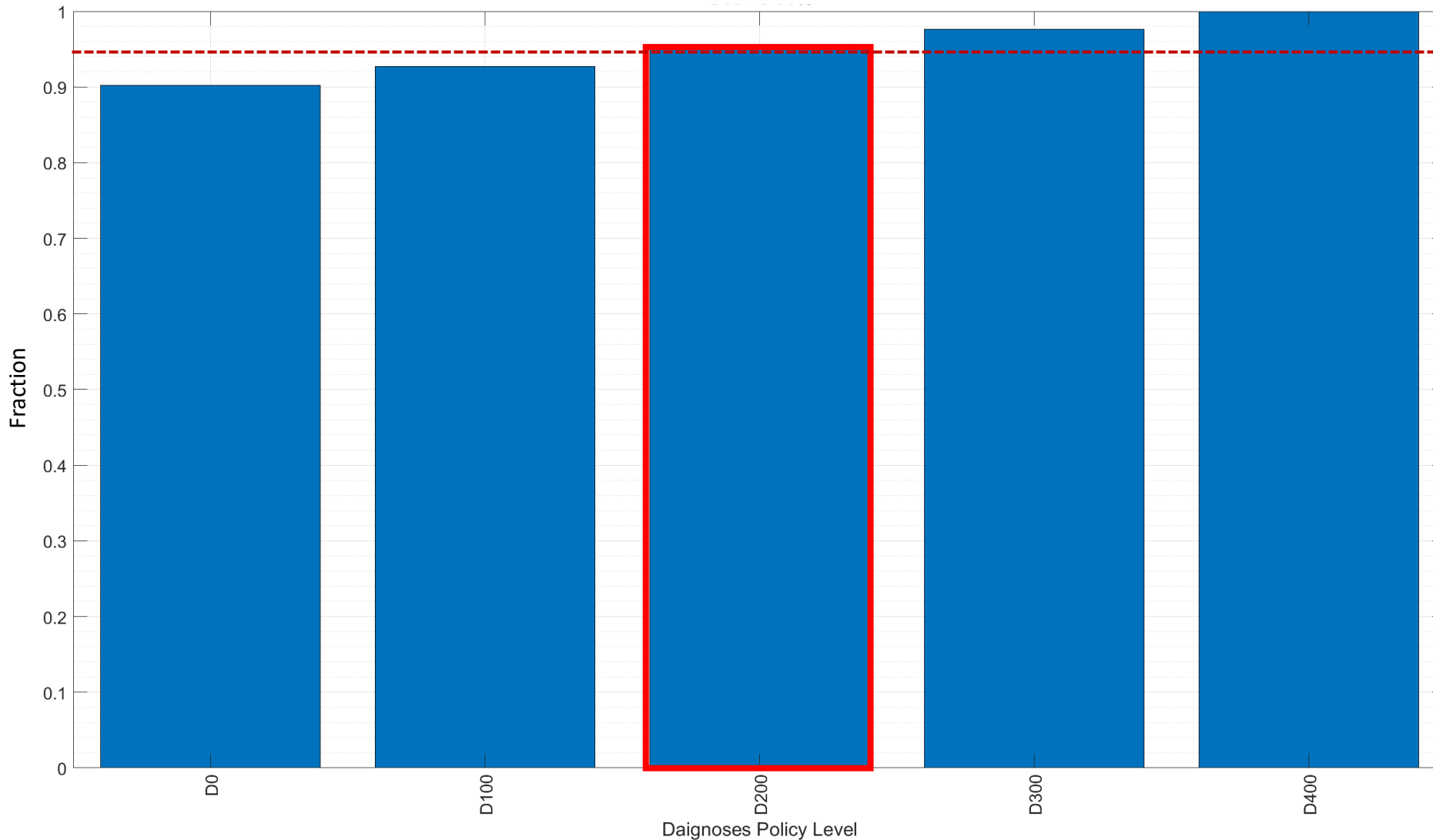
* Lower value is if the policy is not implemented

PrEP Coverage (50% Goal)



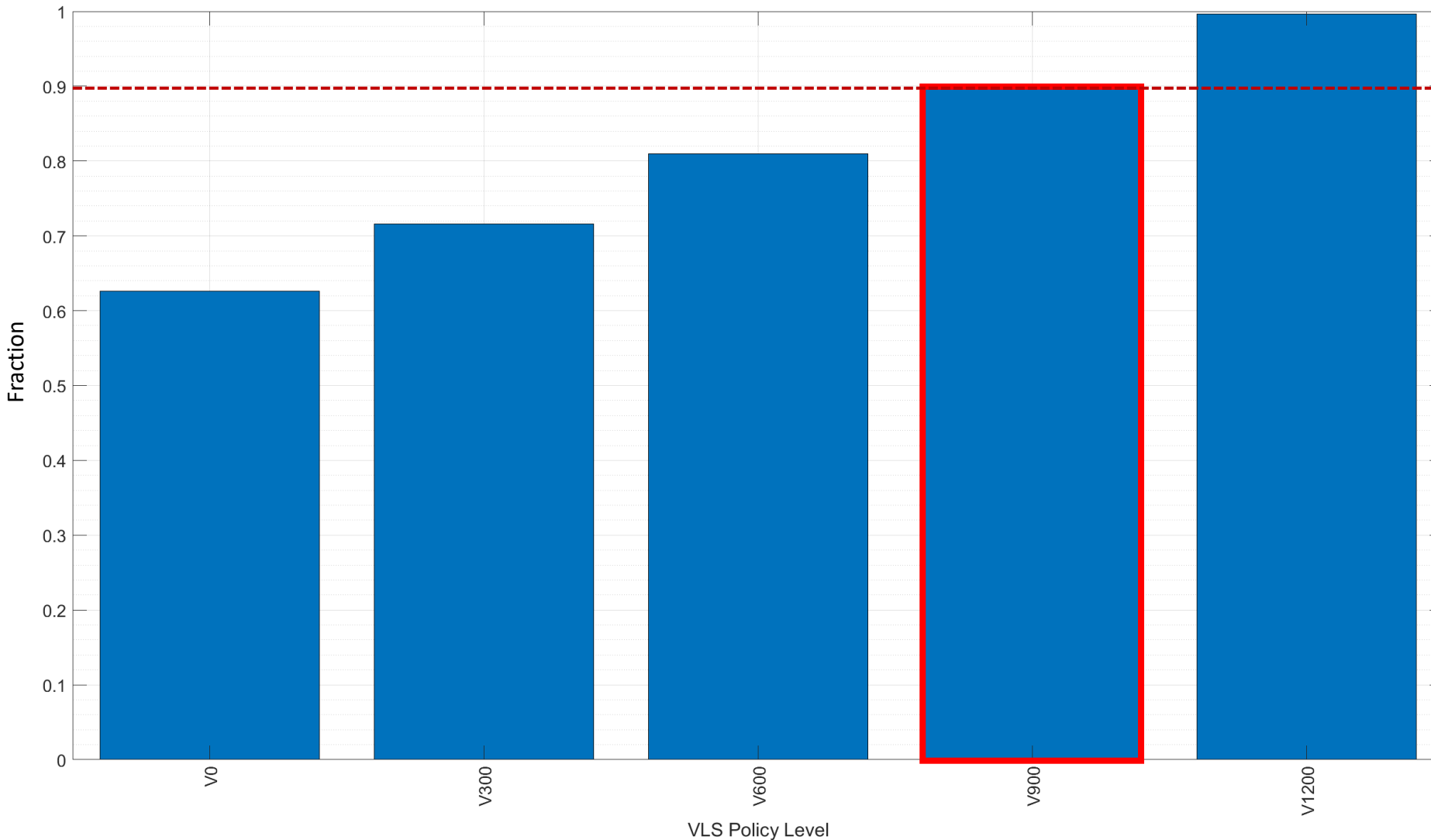
- No intervention: ~1500 start PrEP each year
- Assume 51% of MSM have indications for PrEP
- At least 10,000 additional annual PrEP initiations per year are needed to reach goal (because of high discontinuation)

Aware of HIV Status (95% Goal)



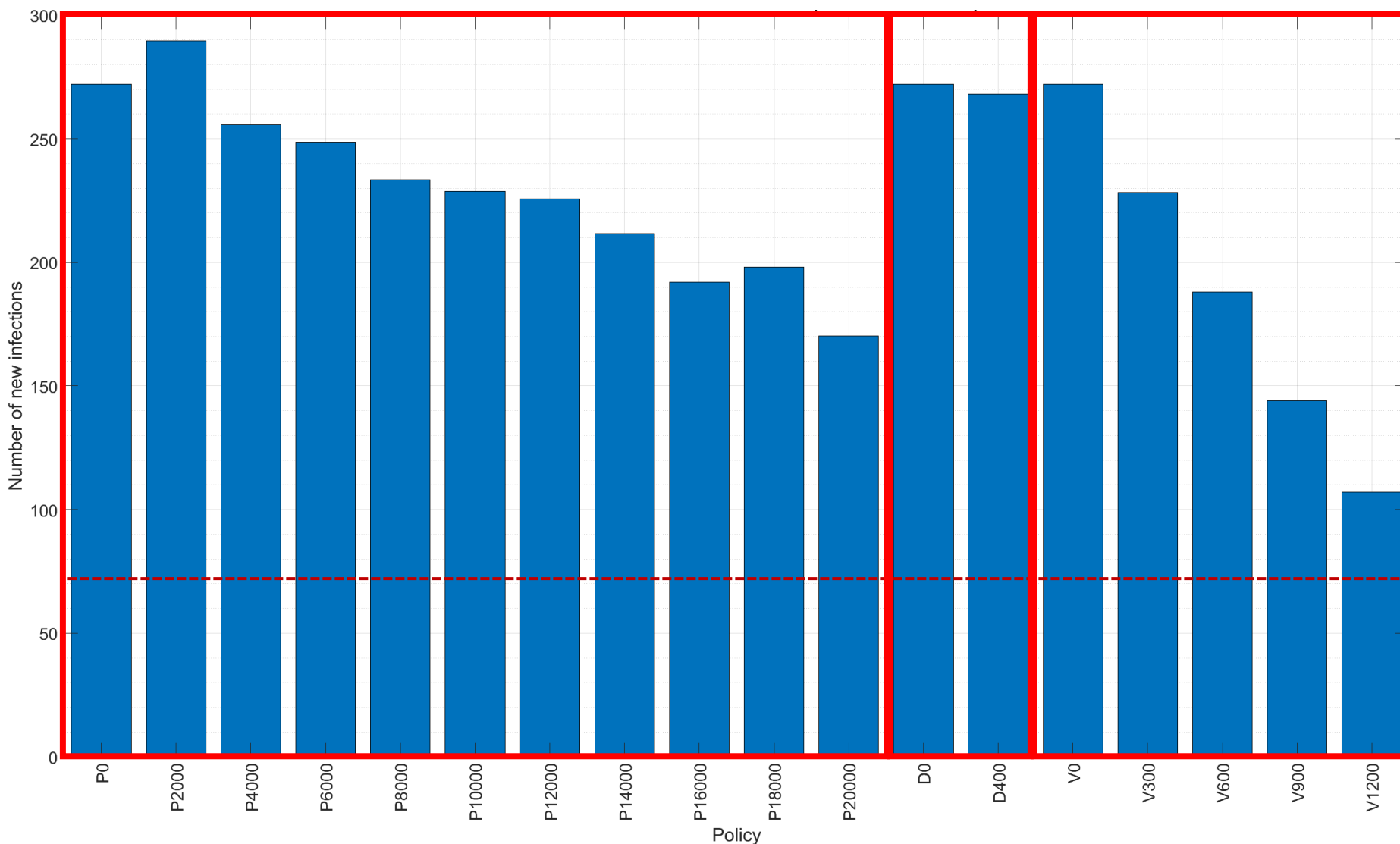
- No intervention: ~250 new diagnoses each year
- Awareness level is already very high (90%) when no new diagnosis policies are put in place.
- Reach goal if an additional 200 new diagnoses are made each year (from current levels)

VLS among those aware (90% Goal)



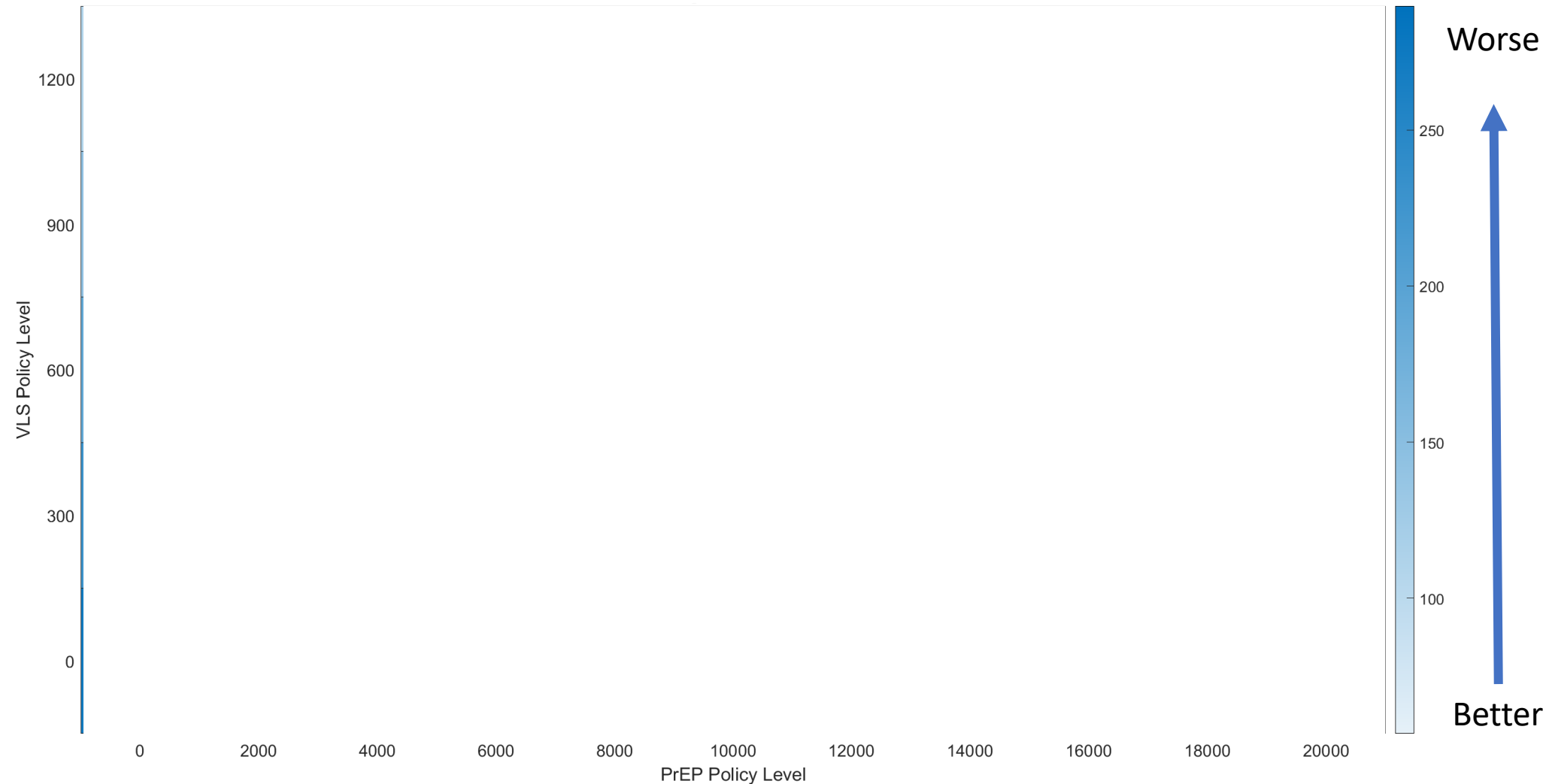
- No intervention: ~500 new individuals reach viral suppression each year
- VLS goal reached if an additional 900 individuals become virally suppressed
- If an additional 1200 people reach viral suppression each year, almost 100% of aware PLWH will be virally suppressed by 2025

Incidence (75% Reduction → 75 New MSM infections)



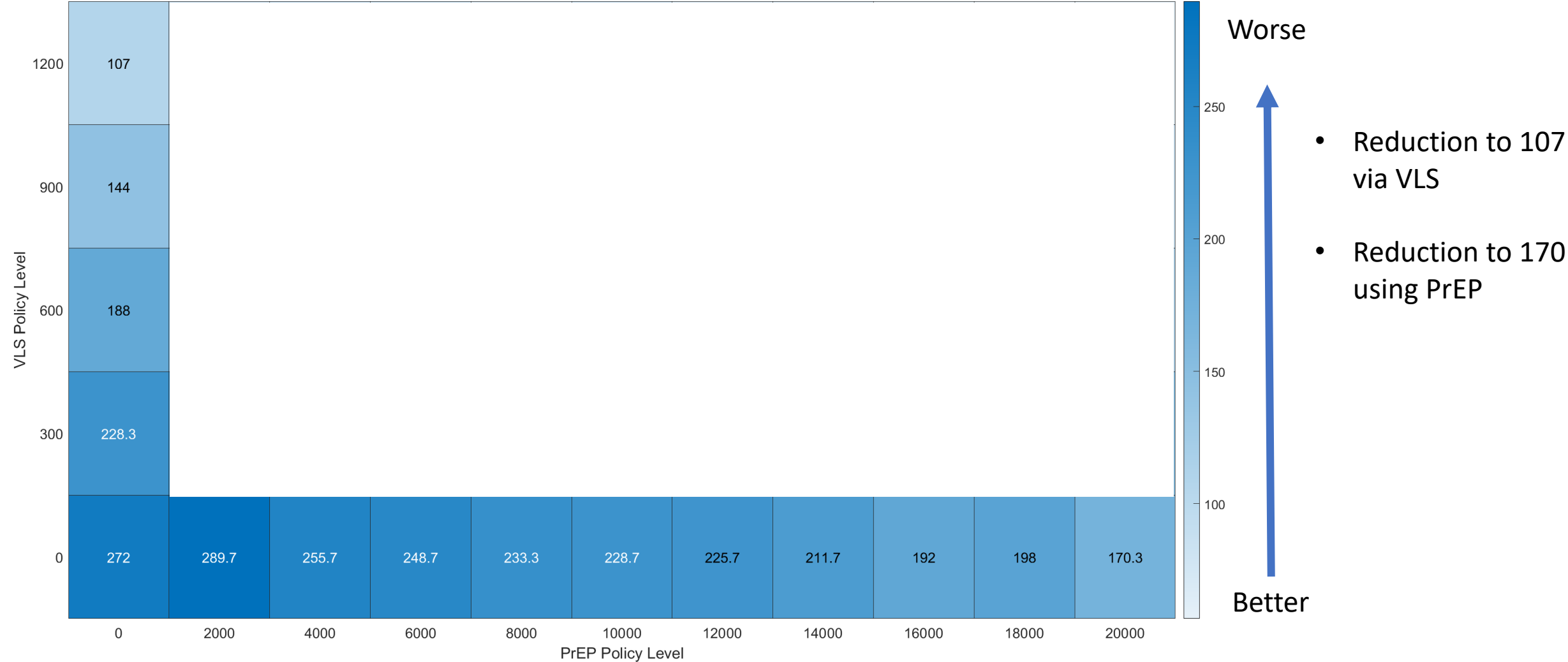
- Even large amounts of PrEP will not meet the incidence goal
- Increasing diagnoses does the least to reduce the number of infections (awareness is already high)
- Viral suppression is the most efficient (per individual affected) at reducing incidence
- Goal of 75% reduction in five years is unattainable using any single policy at these levels

Incidence Heat Map (Diagnoses Policy Level 0)

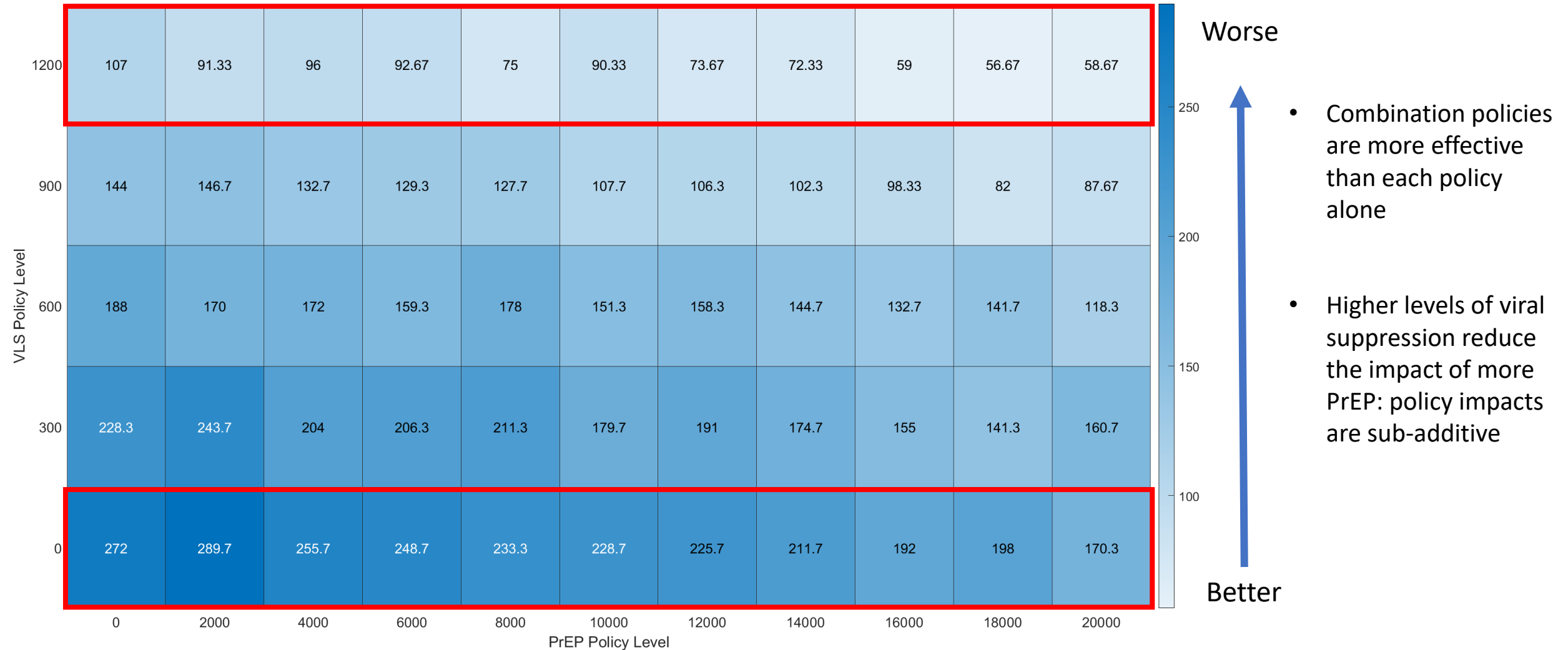


- Rows -> VLS Policy Levels
- Columns -> PrEP Policy Levels
- Values represent new cases in 2025
- Darker blue = higher incidence
- Lighter blue = lower incidence
- 75% reduction goal met when incidence is ~75

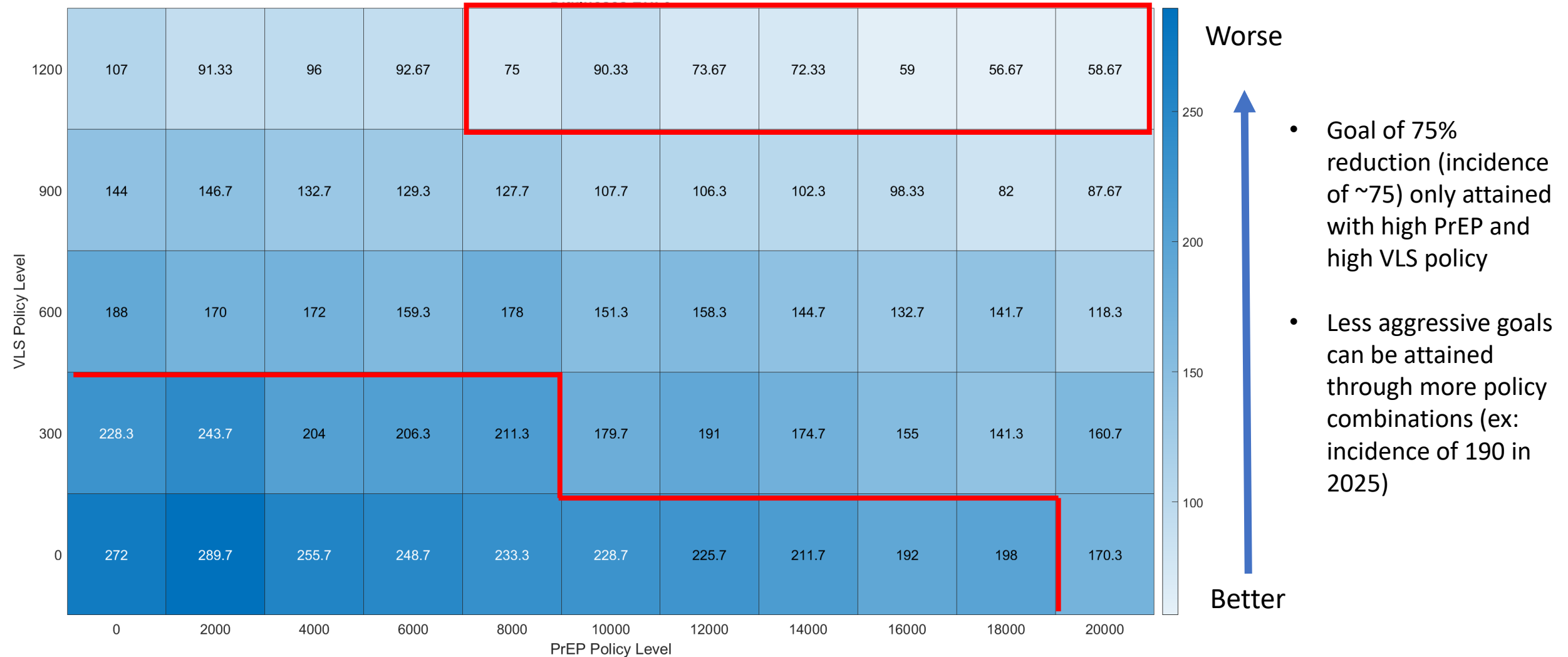
Incidence Heat Map (Diagnoses Policy Level 0)



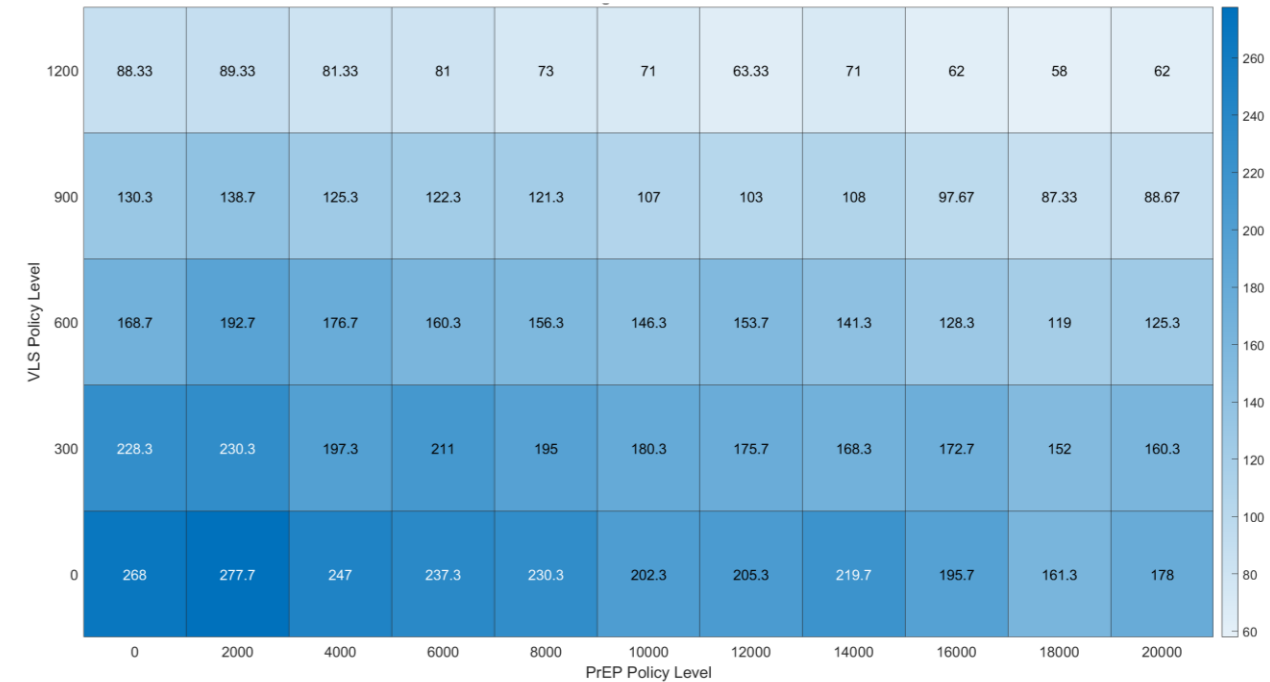
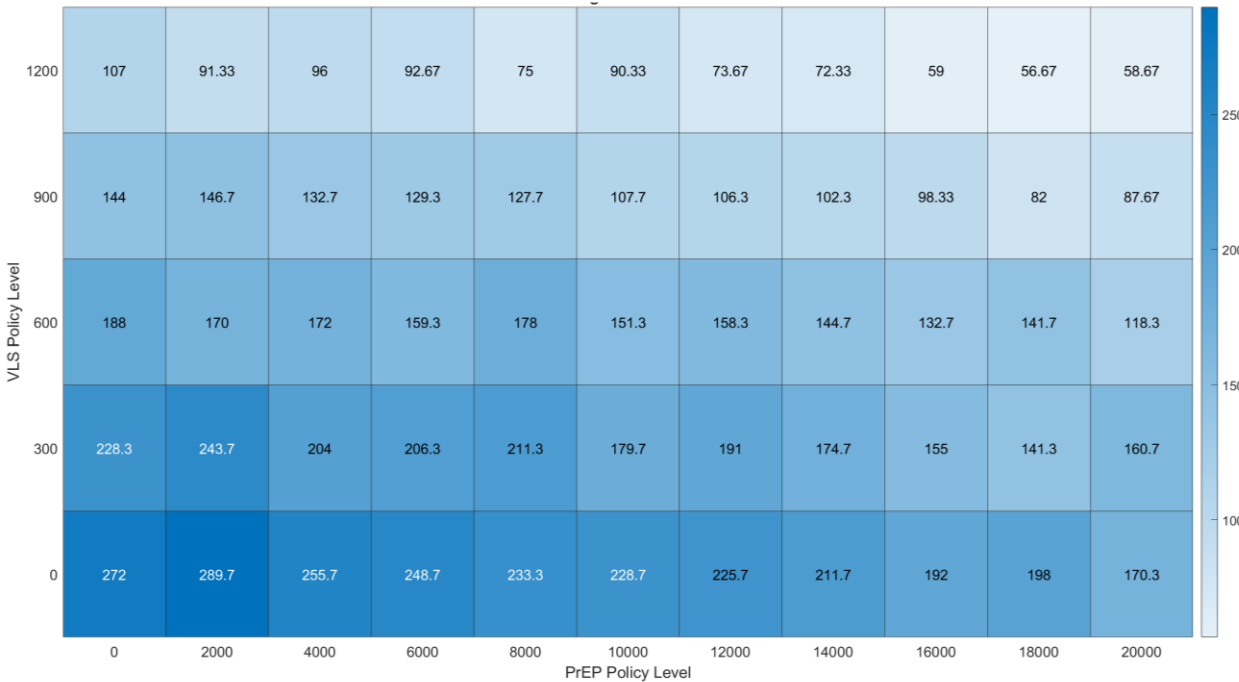
Incidence Heat Map (Diagnoses Policy Level 0)



Incidence Heat Map (Diagnoses Policy Level 0)



Incidence Heat Map (Diagnoses Policy Level 0 vs 400)



- Increasing diagnoses has minimal impact on incidence

Limitations

- Data drawn from disparate sources, and there is uncertainty around many inputs
 - Particularly transmission patterns
- Only model MSM
- Do not account specifically for risky behavior or other HIV risk factors

Conclusion

- PrEP goals are attainable with substantial investment (10,000 more / year) and can have a moderate impact on incidence
 - Decreasing discontinuation rate (not modeled) will make these PrEP coverage goals more attainable
- Awareness goals are attainable with 200 new diagnoses / year, but will have little impact on incidence
 - Possibly because awareness levels are already very high
- Viral suppression goals are attainable with 900 additional VLS / year and has biggest impact on incidence
- Overall incidence reduction of 75% can only be attained with high levels of VLS and PrEP

Questions, Discussion, and Future Work

- Are there other goals/interventions/scenarios we can evaluate?
 - Long-acting PrEP / other policies to reduce PrEP discontinuation rates
 - Effects of COVID on HIV
 - Addressing racial disparities
- Are there other population characteristics we can incorporate?
 - Housing status, movement between SD and Baja CA, etc.