Redesigning Veteran Eye Care

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Introduction

Patients in Veterans Affairs (VA) are screened for four major chronic visual diseases to minimize long-term negative outcomes, including blindness. In 2015, the VA initiated screenings performed by ophthalmic technicians in primary care clinics as part of their Technology-based Eye Care Services (TECS) program.

This project aims to guide decision-makers in the VA on **where to place eye care facilities** and **how to staff those facilities** with the available providers to improve patient access to care.

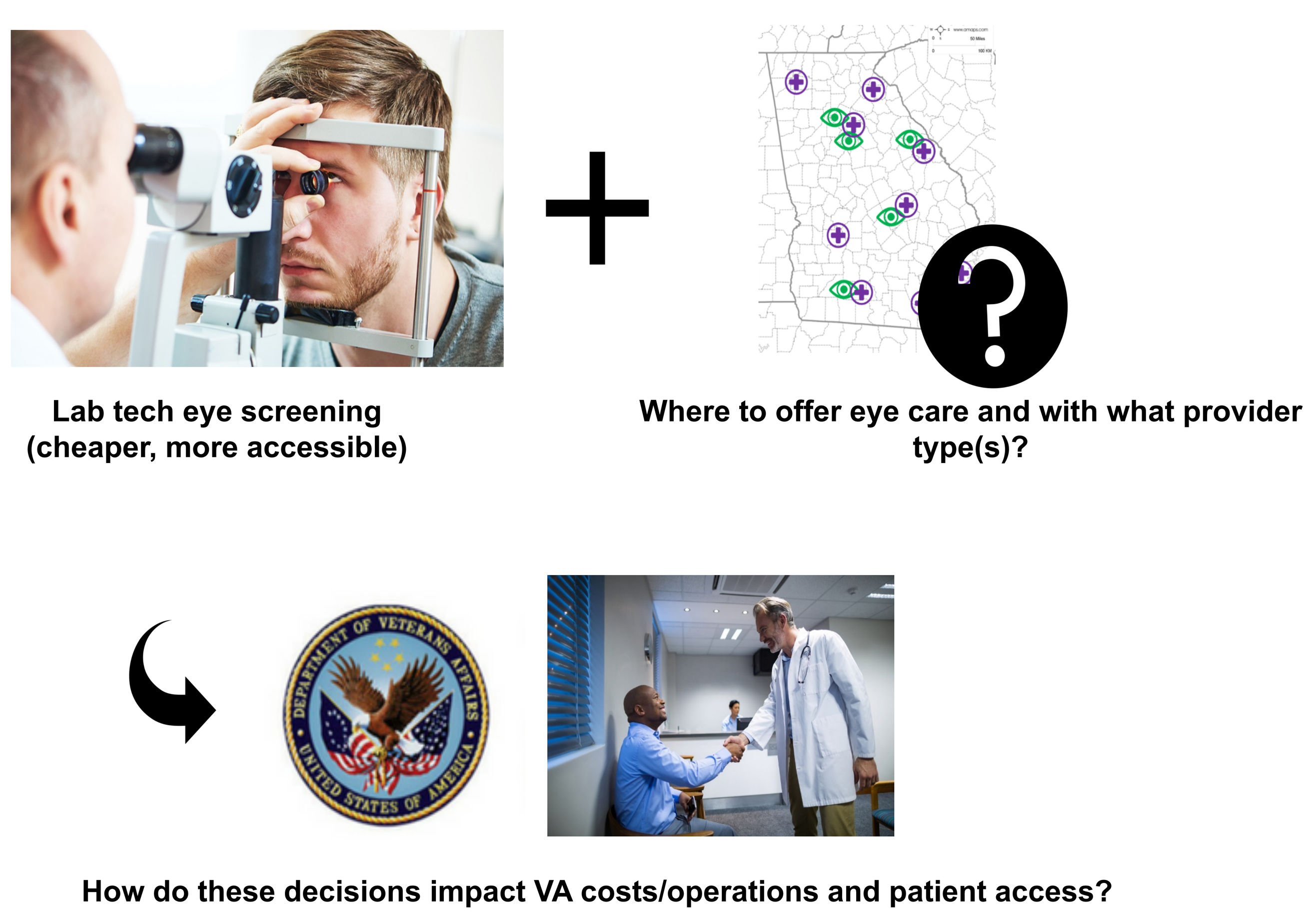

Figure 1: Images portray the underlying factors that drive the creation of the model

Objectives

1. Develop models to improve access to eye care by ensuring adequate capacity at clinics, and reasonable driving distances to eye care clinics.
2. Demonstrate how systems engineering can be applied in a clinical setting to improve patient access.
3. Design tool for clinical decision-makers to use when evaluating where to open additional eye care locations.

Models

In partnership with clinical collaborators, we developed several deterministic mixed-integer programs with varying objective functions.

	Model A: Minimize Cost	Model B: Minimize Avg. Travel Distance	Model C: Maximize Patients Screened
Constraints			
Patient Capacity	X	X	X
Patient Demand	X	X	
Provider Capacity	X	X	X
Budget		X	X
Travel distance	X		X
Utilization	X	X	X

We are currently focusing our attention on maximizing the number of patients screened. We chose this objective because the VA sets a fixed budget, and we're interested in exploring how varying the upper bound on travel distance affects the number of patients who can access to care.

Originally, this model was solved using CPLEX Solver. However, in order to create a more interactive, easy to use model, we decided to also solve the location model in Excel Open Solver. With Open Solver, the user can easily enter all inputs and press a series of buttons to solve various forms of the model.

Results and Discussion

We compare outcomes of interest from each model under different scenarios. Our outcomes of interest are costs, number of patients screened, and average distance traveled. Each model is run evaluating scenarios of our current state (12 VA eye care locations) and adding one location.

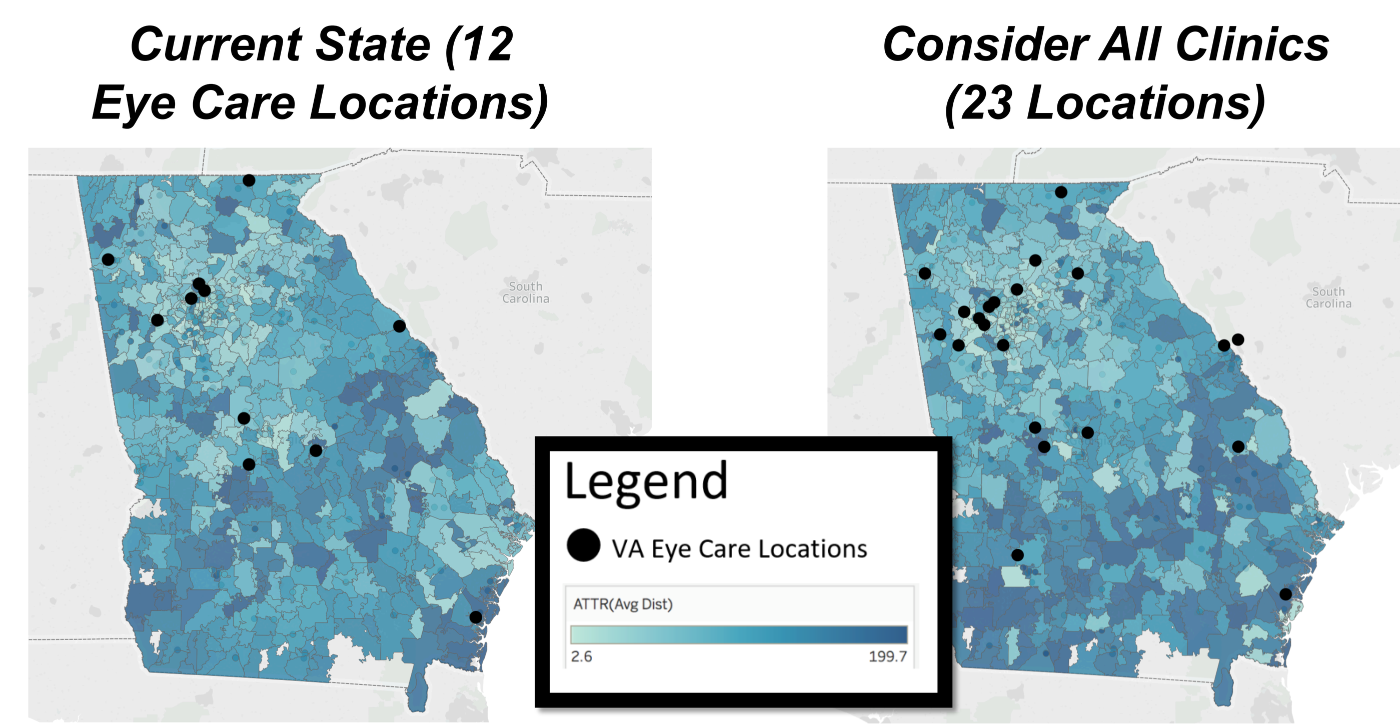

Figure 2: These maps illustrate an example of the optimal placements for eye care locations and the average distance to the nearest clinic for every zip code

These figures show the average distance traveled by patients in each zip code under the current state of VA eye care with 12 clinic locations, and when we run Model A (minimizing cost) but consider all clinic locations. We see that patients do not travel a significantly further distance on average and we are able to screen over 10,000 more patients annually. This is one example of several comparative analyses our models can facilitate.

In order to create this solution, Open Solver allows the user to select the specific regions to be considered, the desired model, as well as all of the needed input information. After approximately 10 minutes, Open Solver will produce a result specifying which hospitals to open eye clinics in, how many patients to allocate to this hospital, and the required number of health professionals needed.

Conclusions

We find that while our models yield slightly different results based on the objective function, each provides valuable insight to better understand where to locate and how to staff clinics in the VA. Compared to the current state, our models inform decision-makers of the quantitative impact that adding eye care facilities has towards patient access (both in terms of how far patients travel and how many patients can be seen) and VA system costs.

Next steps for this analysis include to:

- Incorporate care dynamics following screening. We are planning to use a basic simulation model to "follow" patients as they progress through follow-up treatment if they screen positive.
- Incorporate stochasticity. Namely, we will consider different distributions of populations of veterans in each zip code.
- Continue to review with clinicians and decision-makers in the VA to ensure model accuracy and applicability.

Acknowledgement

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