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ADDRESSING THE OPIOID EPIDEMIC: TREATMENT CAPACITY EXPANSION TO REDUCE CARE DISPARITIES FOR OPIOID ADDICTION DISORDERS

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ABSTRACT

The national opioid epidemic continues to worsen as abuse increases outpace treatment access, with many proposing additional state and federal funding for recovery services. To help public health departments plan effectively, we developed coupled models that optimize regional location of treatment facilities across any given state and simulated benefits on access delays, people receiving treatment, overdoses, and associated mortality. We optimized scenarios under expansion investments ranging from 5 to 20 additional treatment facilities across Massachusetts. Results estimate that optimally locating 20 new facilities would yield annual benefits of 18-day reductions in median treatment access delays, 2,332 prevented overdoses, and 237 avoided overdose-related deaths. These models and results can be useful to policy makers and public health officials by informing investment decisions and various tradeoff questions. Ongoing work is incorporating further complexities into the models and exploring the effectiveness of other interventions, such as treatment relapses, capacity pooling, and social distancing.

1 INTRODUCTION

Addiction to opioids continues to increase in the United States despite efforts to curb the epidemic. It is estimated that 91 people die each day from an opioid-related overdose (CDC, 2016) and 80% of people with opioid addiction disorders are not getting treatment (Saloner, 2015). National and state capacity to treat the disorder is well-below demand and drug users often face long waits to receive treatment. In Massachusetts, wait times to receive medication-assisted treatment range from 2 days to 24 weeks (Record, 2016) despite the many treatment centers that exist throughout the state. Acknowledging the gap in care, many states have allocated funding to increase capacity and access to opioid treatment options.

2 METHODS

<u>Model Development</u>: We first developed a deterministic model in ILOG IBM CPLEX to optimally locate new facilities and allocate patients to new and 161 already-existing facilities in Massachusetts, with the objective function to maximize number of patients who can access daily outpatient methadone treatment within 20 miles of their residence. A Python-based stochastic simulation also was developed to inform demand and capacity in each zip code that can either run standalone what-if scenarios or use output directly from the optimization model. The model tracks the access delays to receive treatment and the number of patients who are successfully treated, drop out during treatment, drop out while waiting in the treatment queue, overdose while waiting in queue, and fatally overdose. We ran scenarios in both models over a 2 year time period (730 days) assuming sufficient funding to add 5, 10, and 20 new facilities and compared results to a base case with no new facilities added.

<u>Model Inputs</u>: Based on state population and percentage estimates of drug users, we assumed 55,820 patients in Massachusetts are seeking opioid-related addiction treatment, where each treatment facility has a

daily capacity of 312 patients and patients must complete 365 days of methadone treatment to be considered successful. Based on limited available data, we estimated annual rates of treatment dropout (56%), treatment queue dropout (54%), overdose while in treatment queue (13%), and overdose fatality (10%). Simulation input estimates also were varied ±25% of their base case in sensitivity analyses. Distances between demand locations and treatment facilities were estimated using a matrix of 4-digit zip codes, with the simulation model (13 replications) assuming new patients arriving randomly each day seeking treatment.

3 RESULTS

Over a two-year period, adding 5, 10, and 20 new outpatient methadone treatment facilities would result in an estimated 1148, 2055, and 5238 more patients being successfully treated for opioid addiction compared to the current case. Adding 20 new facilities would result in 98% of treatment-seeking drug users being able to access outpatient care within 20 miles of their residences (Figure 1). Median delays for beginning treatment would fall from 60 days to 42, the number of patients who drop out from the treatment queue would decrease by 50%, and an estimated 2332 overdoses and 237 overdose-related deaths could be prevented (Table 1). Intervention analyses indicated the during-treatment dropout rate most affects the number of patients treated successfully compared to treatment queue dropout, overdose, and fatal overdose rates.

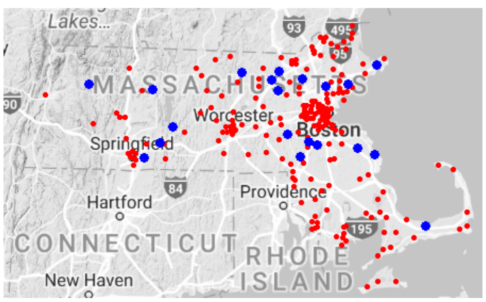

Figure 1. Existing (red) and optimal (blue) location of 20 new treatment facilities

Expected Outcomes	New Facilities Added			
	0	5	10	20
Unmet demand	7,190	5,630	4,070	950
Pts treated successfully	37,034	38,182	39,089	42,272
Dropout of tx queue	16,534	14,449	12,631	8,391
Overdoses prevented	0	488	1,051	2,332
Deaths prevented	0	46	113	237
Median wait time (days)	60	59	56	42

Table 1. Preliminary results by number of new facilities added. Pt: patient; Tx: treatment.

4 CONCLUSIONS

Given the growing demand for opioid treatment and lack of adequate funding, optimal location and operation of treatment facilities will be essential to meet demand within constrained budgets. Our modeling approach determines the optimal location for new facilities and then simulates the expected future patient and operational impact for the entire state. Results of both models are important to policy makers and public health officials as they work to improve access to treatment and expand treatment capacity. Future work is improving and expanding the optimization and simulation models by adding cost estimates and incorporating additional real-world complexities such as treatment relapse, different treatment options, and traveling farther for facilities with shorter queues.

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