WIN-WIN PROJECT

UCLA CENTER FOR HEALTH ADVANCEMENT

# *Modeling the Impact of Opioid Interventions on Health Outcomes for Los Angeles County*

*Nathaniel W. Anderson, BA*
*Corey Jacinto, MPH*
*Sarah J. Cousins, MPH*
*Frederick J. Zimmerman, PhD*

---

Center for Health Advancement
Win-Win Project

---

UCLA Fielding School of Public Health
Department of Health Policy and Management
650 Charles Young Dr. S.
31-269 CHS Box 951772
Los Angeles, CA, 90095-1772
(310) 206-5613
healthadvance@ucla.edu

---

June 2021

# Table of Contents

# Table of Figures

# Introduction

Opioid use disorder is serious public health problem associated with elevated risk of death, injury, hospitalization and poor social conditions. Overdose from substance use is a leading cause of death in the United States. Of these deaths, 70% involve opioids, such as heroin, fentanyl and other synthetic opioids and prescription opioids. As of 2017, nearly three-quarters of overdose deaths in Los Angeles (L.A.) involved prescription opioids. Rates of hospitalizations and emergency department visits in L.A. County continue to climb causing a significant burden on individuals, families, communities and the healthcare system.

While the opioid crises continues to concern public health officials, systematic changes provide promise for reducing the use of opioids and associated risks. In 2015 the California Department of Health Care Services' (DHCS) Drug Medi-Cal Organized Delivery System (DMC-ODS) Waiver was approved and 44 of California's 52 counties have opted into the waiver. For L.A. County, the DMC-ODS provided a pathway to increase access to substance use disorder treatment services for adolescents and adults who are Medi-Cal eligible. Additionally, it allowed for the utilization of innovative interventions and standards to improve health outcomes and assist residents in obtaining recovery from substance use. Three of these innovative programs include the Expansion of Buprenorphine Access, Recovery Bridge Housing, and Fentanyl Test Strips. It is well established that medication-assisted treatments for opioid use disorder, also known as MOUD (e.g., naltrexone, methadone, Buprenorphine etc.), and stable housing options improve substance use outcomes. While generally harm reduction strategies may improve substance use outcomes, the evidence on the use of fentanyl test strips is emerging. Using the best available evidence, an evaluation was conducted to predict the impact of these opioid use disorder prevention and treatment programs on health outcomes, cost savings and return on investment for L.A. County.

In 2019, the Win-Win Project received support from L.A. County Department of Public Health Division of Substance Abuse Prevention and Control (DPH-SAPC) to model these three programs that aim to improve opioid use outcomes: Expansion of Buprenorphine Access, Recovery Bridge Housing, and Fentanyl Test Strips. The Win-Win project is a long-term initiative of the Center for Health Advancement at the Fielding School of Public Health, UCLA. It provides credible science that drives real-world policy change by showing the education, crime and health impact to populations and value to governments of policies, systems, and programmatic innovations. The project provides a standardized, unbiased economic analysis of interventions to help public health officials make informed policy and program decisions and engage in cross-sectoral collaboration. The Win-Win models can answer: How much will it cost in my area? What is the return-on-investment for my government agency? How long does it take to have an effect? What health impact can I achieve with a given dollar allocation? The results of these models are included in this report, the goal of which is to identify the most promising pathways for progress in opioid use outcomes that will inform policy-making, advocacy, funding, and research in L.A. County.

# Expansion of Buprenorphine Access

## Problem & Solution

In 2020, opioid related deaths increased by a rate of 77% from 2019, which is costly both in the burden experienced by families and communities as well as the increased utilization of medical and social services. Buprenorphine is a partial agonist; it partially attaches to brain's opioid receptors, reducing craving for opioids. Unlike methadone, buprenorphine has a "ceiling effect" whereby it is not possible to increase the dose for euphoric effects. Use of MOUDs, like buprenorphine, is an evidenced-based treatment to reduce overdose from opioid use and other opioid related consequences. It is generally more accessible than methadone, which can legally only be dispensed at opioid treatment programs. In contrast, prescribers must meet training requirements and buprenorphine patient caps. There has been some evidence that buprenorphine is less effective than methadone in terms of MOUD retention. Expanding Buprenorphine Access aims to improve health outcomes, improve health outcomes for children of mothers with opioid use disorder, decrease involvement in the criminal justice system, and decrease healthcare utilization.

## Program Description

Expanding Buprenorphine Access aims to increase access to medication-assisted treatment for opioid use disorder (MOUD) in L.A. County. To increase access to buprenorphine across the county, particularly within specialty SUD programs and identified priority geographic areas, DPH-SAPC developed patient-focused materials in both English and Spanish to highlight available MOUD options in the community. One of the goals of these materials is to encourage and empower individuals to ask their provider about medication as a treatment option. It is especially important that LAC's most vulnerable residents and underserved communities have expanded access to MOUD. DPH-SAPC has prioritized and launched MOUD awareness campaign in SUD treatment sites across the county and provided MOUD materials to SUD prevention and treatment sites and other sites across county. Enabling broader access to MOUD will improve health outcomes and enhance opportunities for sustained recovery while also decreasing overall drug overdose death rates.

## Implementation Notes and Model Assumptions

- To model the effects of the expansion of buprenorphine we relied on the best evidence regarding MOUD. Based on the control treatments used in the studies we located, the model assumes that usual care refers to a placebo treatment.
- It is well-established that the specific MOUD should be determined on the individual's profile (e.g., physical health history, severity of OUD, preferences, etc.) and in consultation with a MOUD provider. Some individuals may respond differently to different MOUDs.
- The studies reviewed may have examined reduced opioid use as well as "abstinence." To illustrate, many studies on buprenorphine included an outcome of "percent negative tests", where the denominator is the number of participants by the number of weeks the study took

place. Therefore, we the results section for the expansion of buprenorphine refers to "reduced opioid use."

- We tailored the number of participants for each intervention to match existing levels of capacity in L.A. County. However, there is good reason to believe that with greater resources, more persons would enroll than we modeled. For example, we estimate that the county could enroll 4% of the population with opioid use disorder in buprenorphine, which is in contrast with the results from a study from Vancouver, Canada that found a willingness to enroll as high as 17% among opioid users.
- While we have taken considerable effort to model the impact of the intervention across different Service Planning Areas of LA County, as well as by race/ethnicity, only some of the baseline data (hospitalization, ED use, and mortality) is specific to the opioid population at this level of stratification. Therefore, the program may actually have more heterogeneous effects than are modeled here (i.e. if counterfactual reduced opioid rates without the intervention vary greatly by geography or demographics).
- Furthermore, there is a paucity of longitudinal studies in outcomes like housing, health, employment. Most longitudinal studies focus on mere retention in treatment. Additionally, the models calculate benefits from those who stop using opioids, which may be conservative given those who employ harm reduction strategies may also benefit from program expansion.
- See the methods appendix for additional details on model assumptions and data sources.

## Target Population

Our model estimates that there are approximately 175,000 adults with opioid use disorder in L.A. County. This was based on county-level estimates of opioid use conducted by the Urban Institute[1]. The model assumes a county capacity participation rate of 4% for and a retention rate of 62% at 6 months (4,300 adults covered at 6 months).

## Comparison to Treatment as Usual

The modeled effectiveness of the program is presented below in comparison to treatment as usual. In most cases, this treatment as usual is whatever the County is currently delivering to those without access to buprenorphine. For the outcome of neonatal abstinence syndrome, this usual treatment is access to methadone.

## Cost Assumptions

The program has an estimated cost of $2,295 per adult retained at the end of six months. This estimate is scaled down for participants that drop out of the treatment over the course of the intervention.

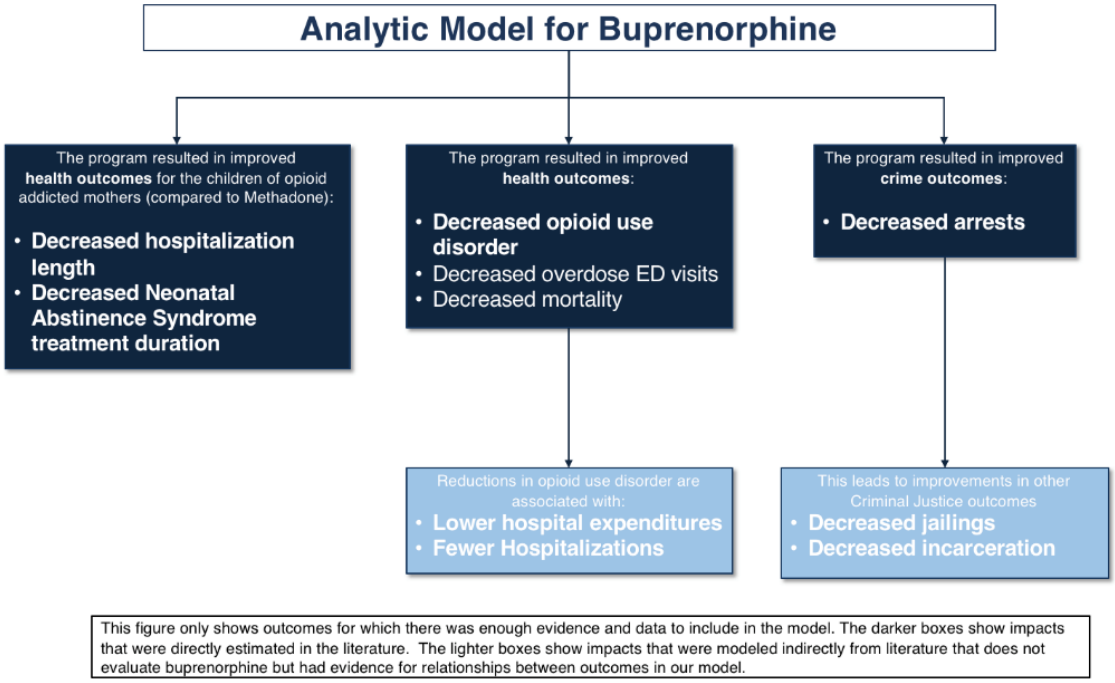
[1] Source: https://www.urban.org/policy-centers/health-policy-center/projects/california-county-fact-sheets-treatment-gaps-opioid-agonist-medication-assisted-therapy-oa-mat-and-estimates-how-many-additional-prescribers-are-needed

## Analytical Framework

We conducted a review of high-quality evaluations that studied the impact of the buprenorphine programs. The outcomes of these studies are visualized below in the dark blue boxes. We then conducted a literature review of outcomes that have been shown to be associated with the direct outcomes of the program. These are visualized below in the light blue boxes.

Figure 1 on the next page illustrates the analytical model.

### Figure 1. Analytical Model for Expanding Buprenorphine Access




## Modeling Results

The primary outcomes for expanding buprenorphine fall into three broader categories. First, program effects on health outcomes of people with opioid use disorder (i.e., opioid use and mortality) retained at six months. These outcomes lead to secondary outcomes of lower healthcare utilization and cost savings. Second, the health outcomes of infants exposed to opioid use among mothers given buprenorphine compared to Methadone. Third, criminal justice involvement as measured by arrests and related costs. These outcomes lead to secondary outcomes of fewer incarcerations and thus fewer costs related to incarceration. Results presented in the next section reflect key takeaways at the county level. Where the sample size is sufficient enough, results are also grouped by service planning area and race or ethnicity.

The next section of this report will describe key takeaways across the county as well as the program's return on investment.

## Key Takeaways Countywide

Our model estimates an approximate cost of $2,300 per adult retained at six months for clinic-related costs, enrolling and retraining 4,370 adults in L.A. County (a 4% take-up rate and a 62% retention at 6 months), the following results can be expected after implementation:

**$9.1M saved in healthcare utilization**

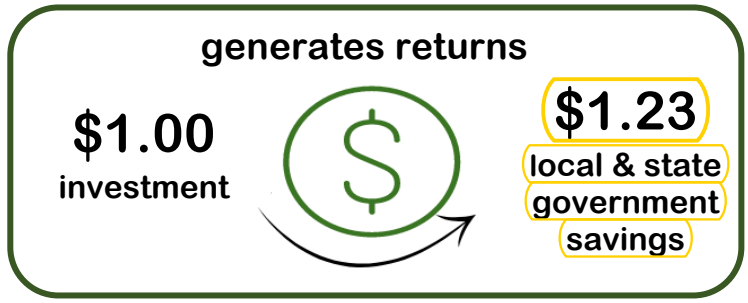
**1,492 fewer adults using opioids**
**23 fewer hospitalizations**
**50 fewer ED visits due to opioid related overdoses**

**14 fewer opioid overdose deaths and 57 fewer deaths overall among people with opioid use disorder**

**9 less newborns exposed to opioids require hospital care, saving 11.9K in costs**
**6 fewer days in treatment among newborns exposed to opioids**

**617 fewer arrests leads to:**

- ✓ **$2.8 M saved from fewer arrests**
- ✓ **Over $2.3 M saved from reduced incarceration costs**



The next section of this report will describe anticipated outcomes by Service Planning Area and race/ethnicity. The third section will describe the return on investment.

## Results by Service Planning Area and Racial/Ethnic Group

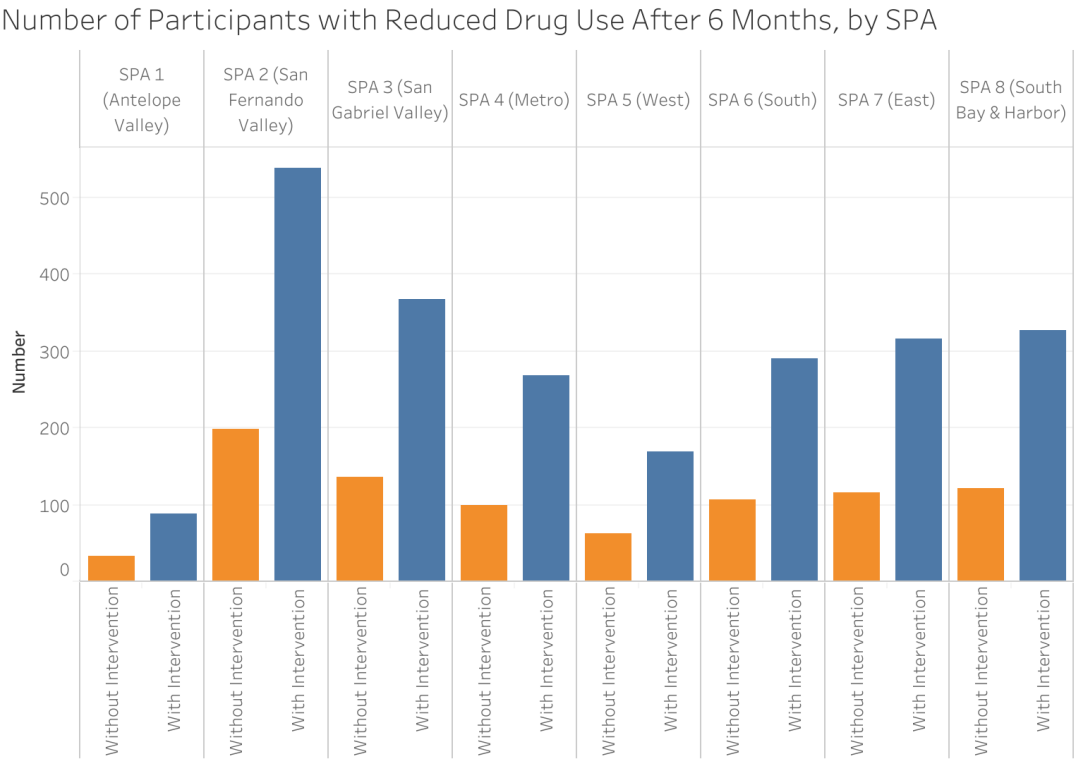
### Health Outcomes

Opioid use and mortality were measured by days of use, number of overdoses, opioid-related overdose deaths and all-cause mortality. With regard to days of use, the model assumed that 54% of the population who received and were retained on buprenorphine for 6 months would have reduced opioid use at 6 months compared to 20% of the population who did not receive buprenorphine. This assumes that methadone delivery stays the same given the capacity in L.A. County.

#### *Decreased Number of Individuals using Opioids*

Model results provided below for the number of participants with reduced opioid use after 6 months by Service Planning Area as well as by race/ethnicity.

Figure 2. Increased Number of Participants with Reduced Opioid Use after 6 Months by Service Planning Area




Countywide the impact of expanding buprenorphine access is estimated to result in an estimated 1,492 fewer adults with opioid use problems. As seen in Figure 2 above, Service Planning Area (SPA) 2 would have the largest number of participants with reduced opioid use at 6 months of retention on buprenorphine. Comparatively, SPA 1 would have the smallest number of participants with reduced opioid use at 6 months.

Figure 3. Increased Number of Participants with Reduced Opioid Use after 6 Months by Race/Ethnicity

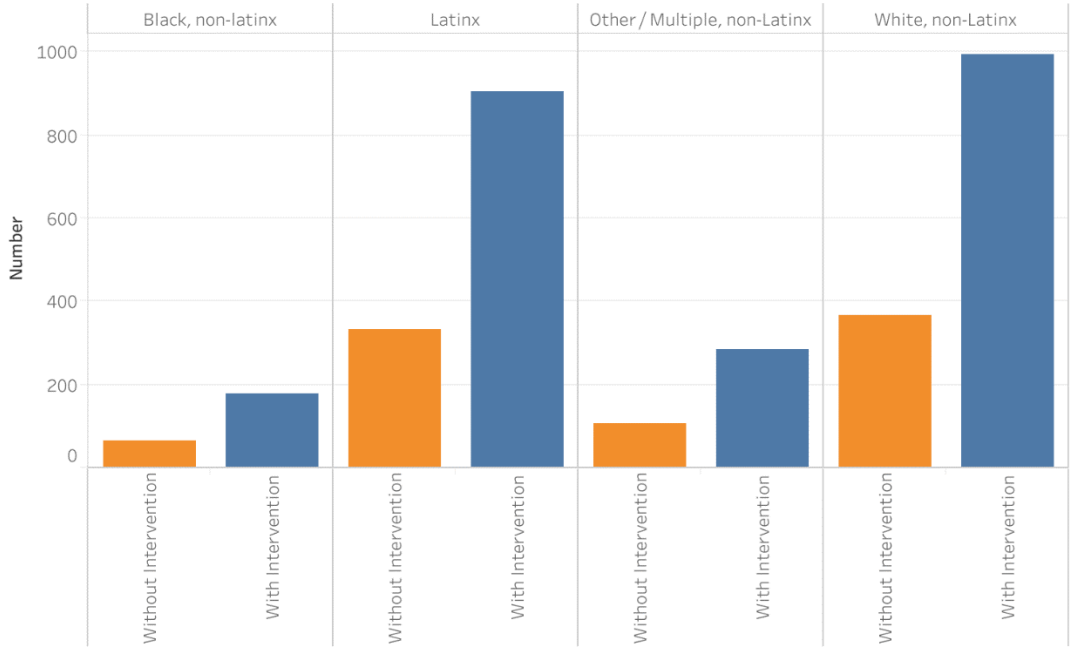



Figure 3 above illustrates that Non-Latinx White as well as Latinx populations would have the largest number of participants with reduced opioid use at 6 months of retention on buprenorphine. Comparatively, Non-Latinx black populations and other non-Latinx or multi-racial populations would have the smallest number of participants with reduced opioid use at 6 months.

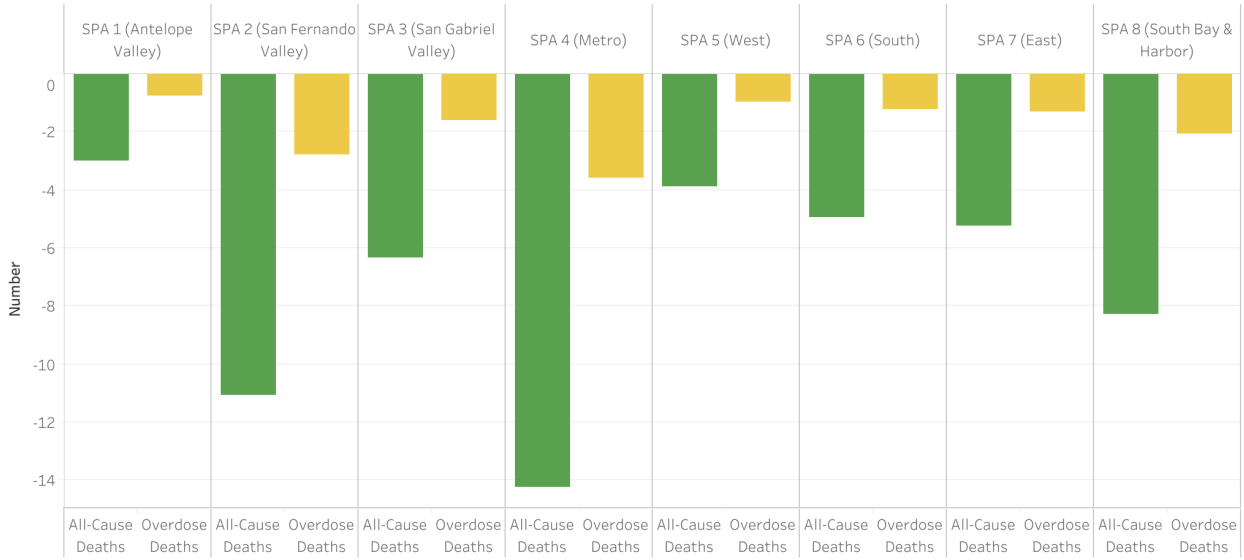
### *Reductions in All-Causes of Death and Opioid Related Overdose Deaths*

Medication for opioid use disorder (MOUD) may save the lives of individuals with opioid use disorder. As noted earlier, the model estimates that the expansion of buprenorphine may result in 50 fewer opioid-related ED visits from overdose (1.1 percentage point decline among participants; 54.5% decline among participants), 14 fewer opioid related overdose deaths (3.3 fewer deaths per 1,000 among participants; 69.6% decline among participants), and 57 all causes of deaths (13.1 fewer deaths per 1,000 among participants; 54.7% decline among participants), countywide. Highlights at the SPA-level include:

- Antelope Valley SPA has the largest percentage point decline in ED visits
- Metro SPA has the largest percentage point decline for both mortality outcomes
- Whites and other/multiple have the largest percentage point decline in ED visits
- Blacks have the largest percentage point decline for both mortality outcomes

Figure 4 and Figure 5 illustrate reductions in opioid-related overdose deaths and all causes of death by SPA and by race/ethnicity.

Figure 4. Reductions in All-Cause Deaths and Opioid Related Overdose Deaths by Service Planning Areas




SPAs 4 and 2 would have the largest reductions in the number of participants in *all causes of death* among program participants. Conversely, SPAs 3, 5, 6 and 7 would have the lowest reduction in the number of *all causes of death* among people with opioid use disorder. With regard to *opioid-related overdose deaths*, SPA 4 and 2 would have the largest reduction in the number of *deaths.* Remaining SPAs have a 1 or 2 fewer opioid-related overdose deaths. See Figure 4 above.

Figure 5. Reductions in All-Cause Deaths and Opioid Related Overdose Deaths By Race/Ethnicity

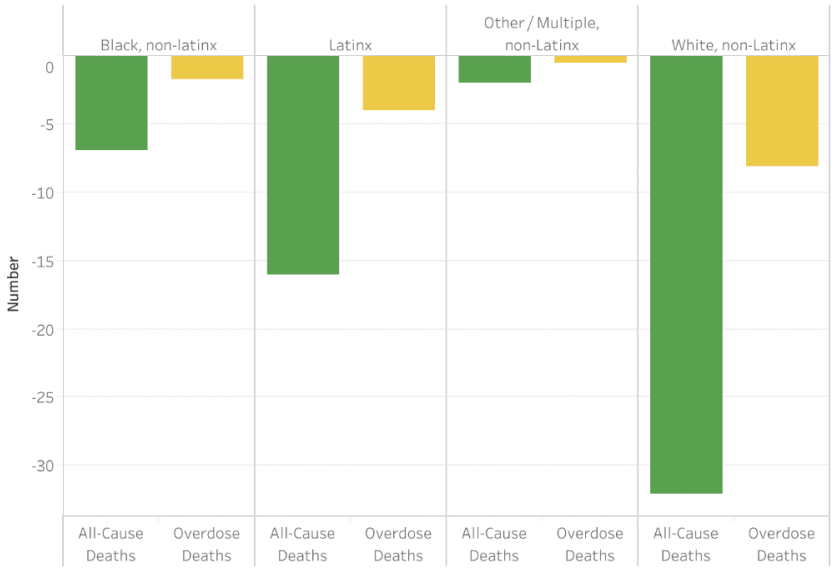



Figure 5 illuminates that the greatest reductions in the number of *all cause death* among individuals with opioid use disorder are among non-Latinx White as well as Latinx population, followed by non-Latinx black and other non-Latinx or multi-racial populations. This pattern continues with regard to *opioid-related overdose deaths*.

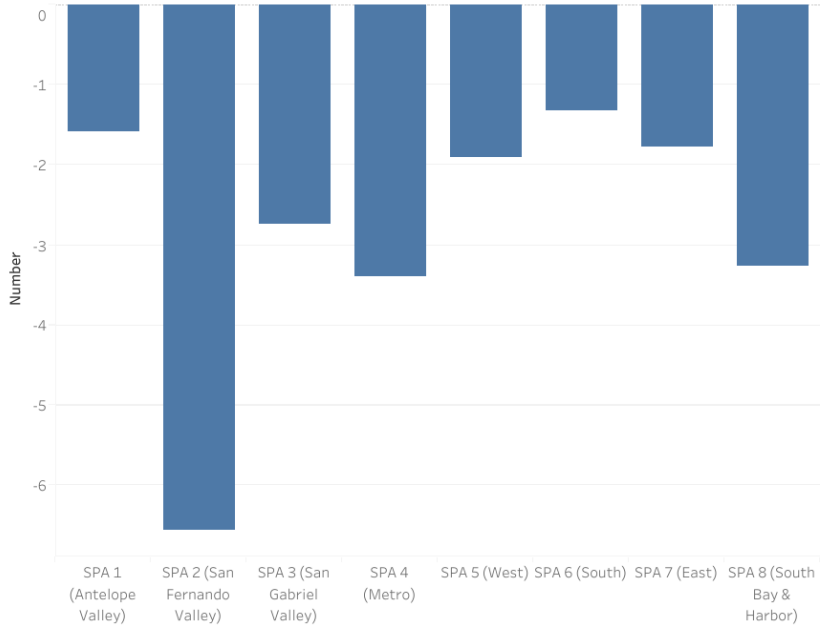
## Healthcare utilization

Healthcare utilization was primarily measured by opioid related emergency department visits from overdose. Furthermore, reduced hospitalization is a secondary outcome from a reduction of opioid use. Results are presented by service planning area and racial/ethnic group.

### *Decreased opioid-related emergency department use*

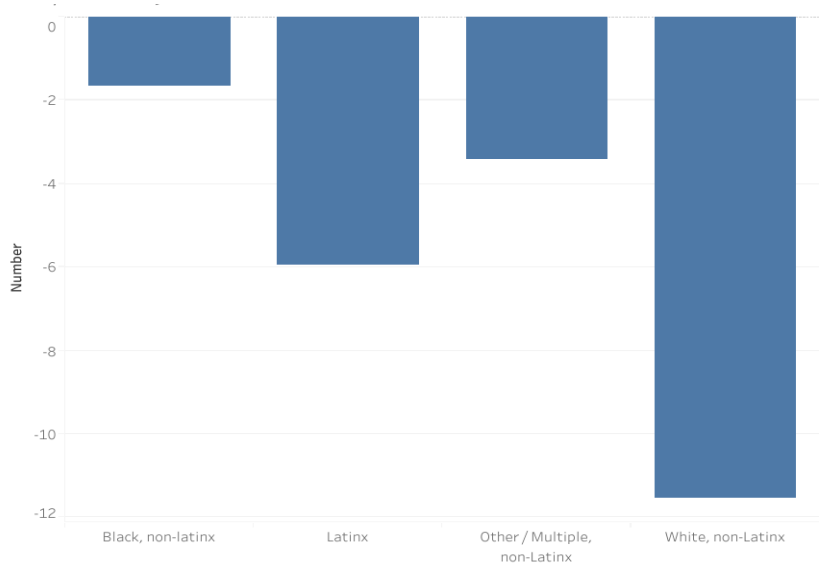
The expansion of buprenorphine is estimated to reduce all-emergency department visits from overdose by 50 visits countywide. Figure 6 and Figure 7 below illustrate reductions in opioid-related hospital use within six months of the buprenorphine by SPA and race/ethnicity.

Figure 6. Reductions in All-Emergency Department Visits from Overdose by Service Planning Area




As seen in Figure 6 above, the largest reductions in the number of overdoses at 6 months with intervention is seen in SPA 2.

Figure 7. Reductions in All-Emergency Department Visits from Overdose by Race/Ethnicity

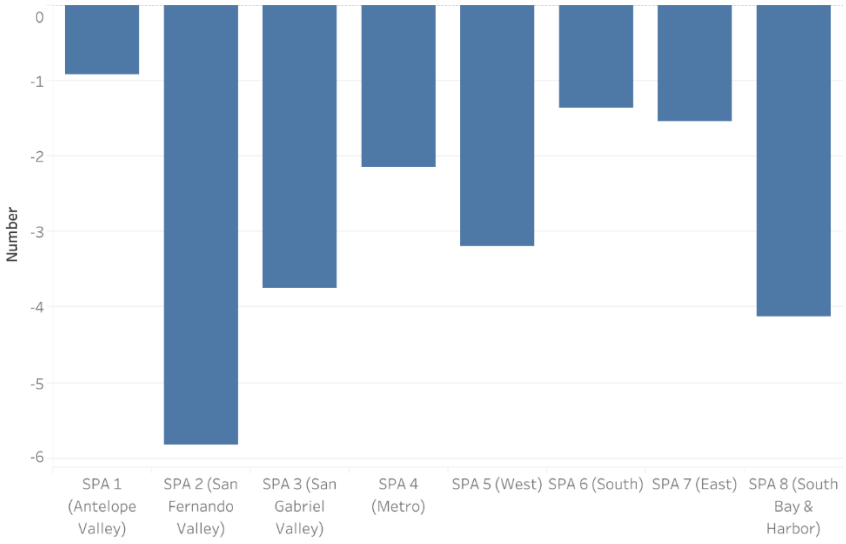



As seen in Figure 7, the largest reductions in the number of overdoses at 6 months with intervention is seen among non-Latinx populations.

*Decreased opioid-related hospitalizations*

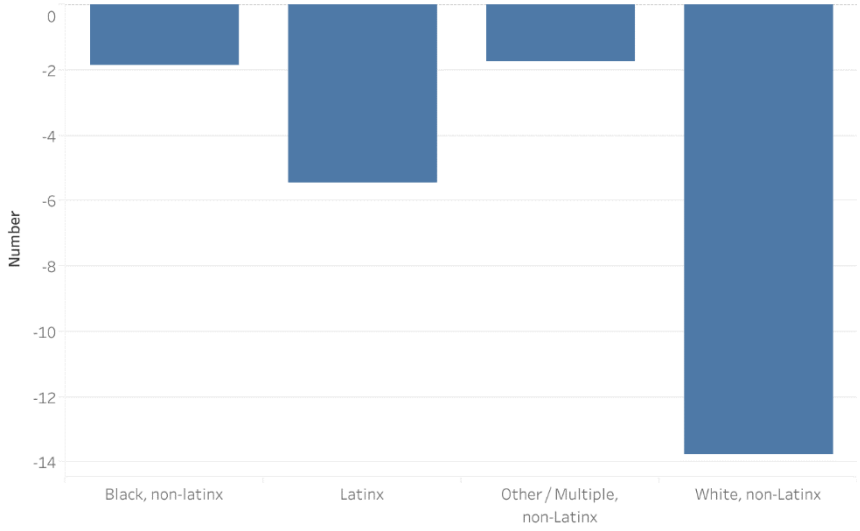
The expansion of buprenorphine is estimated to lower hospitalizations via reduced drug use by 23 visits countywide. Figure 8 and Figure 9 below illustrate reductions in opioid-related hospital use within six months of the buprenorphine by SPA and race/ethnicity.

Figure 8. Reductions in Hospitalizations by Service Planning Area




As seen in Figure 8 above, the largest reductions in the number of hospitalizations at 6 months with intervention is seen in SPA 2.

Figure 9. Reductions in Hospitalizations by Race/Ethnicity




As seen in Figure 9, the largest reductions in the number of hospitalizations at 6 months with intervention is seen among non-Latinx populations.

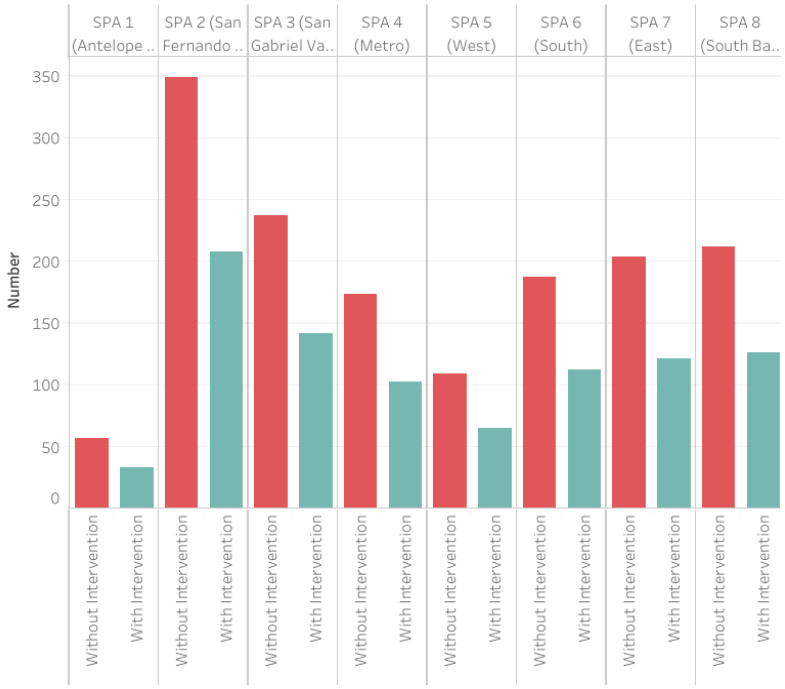
## Criminal Justice Outcomes

Criminal justice outcomes were measured as the number of arrests as well as the number of prison or jail incarcerations. Additionally, the outcomes were compared by expanding buprenorphine access versus treatment as usual, assuming a 35% and 21% arrest rate, respectively.

### *Decreased number of arrests compared to no intervention*

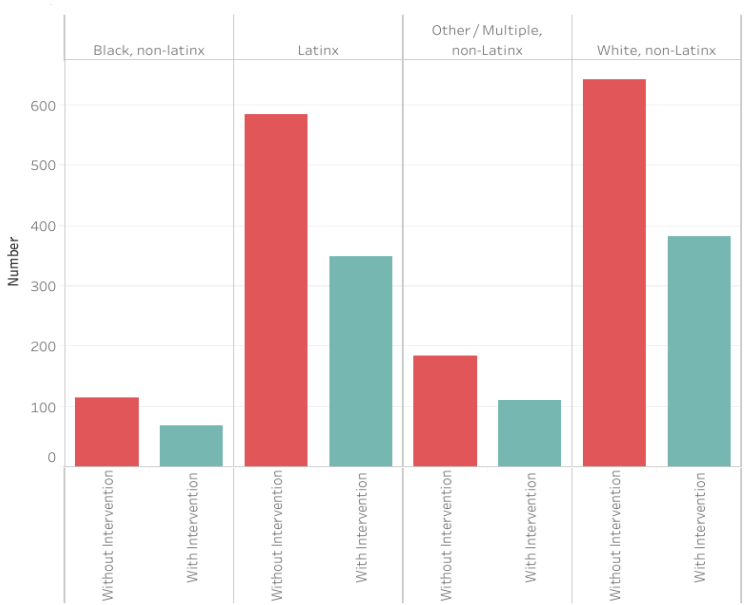
Countywide it is estimated that the expansion of buprenorphine access will result in 617 fewer arrests for either felonies or misdemeanors. Figure 8 and 9 illustrates the decreased number of arrests of felonies and misdemeanors as well as number of prison and jail incarcerations from expanding buprenorphine compared to methadone. Figure 8 provides the comparison by SPA while Figure 9 provides the comparison by racial/ethnic group.

Figure 10. Reductions in the Number of Arrests Compared to Treatment as Usual by Service Planning Area




Without the expansion of buprenorphine at six months SPA 2 would experience the heaviest burden of the number of arrests. With the expansion of buprenorphine, all SPAs have a reduction in arrests. See Figure 10.

Figure 11. Reductions in the Number of Arrests Compared to Treatment as Usual by Race/Ethnicity



With the expansion of buprenorphine, non-Latinx white and Latinx populations experience the greatest reductions in the number of arrests. See Figure 11 above.

### *Decreased arrest and incarcerations among program participants*

Figure 12 and 13 display the decreased number of arrests of felonies and misdemeanors as well as number of prison and jail incarcerations from expanding buprenorphine by SPA and racial/ethnic group, respectively.

Figure 12. Reductions in the Number of Arrests and Incarceration by Service Planning Area

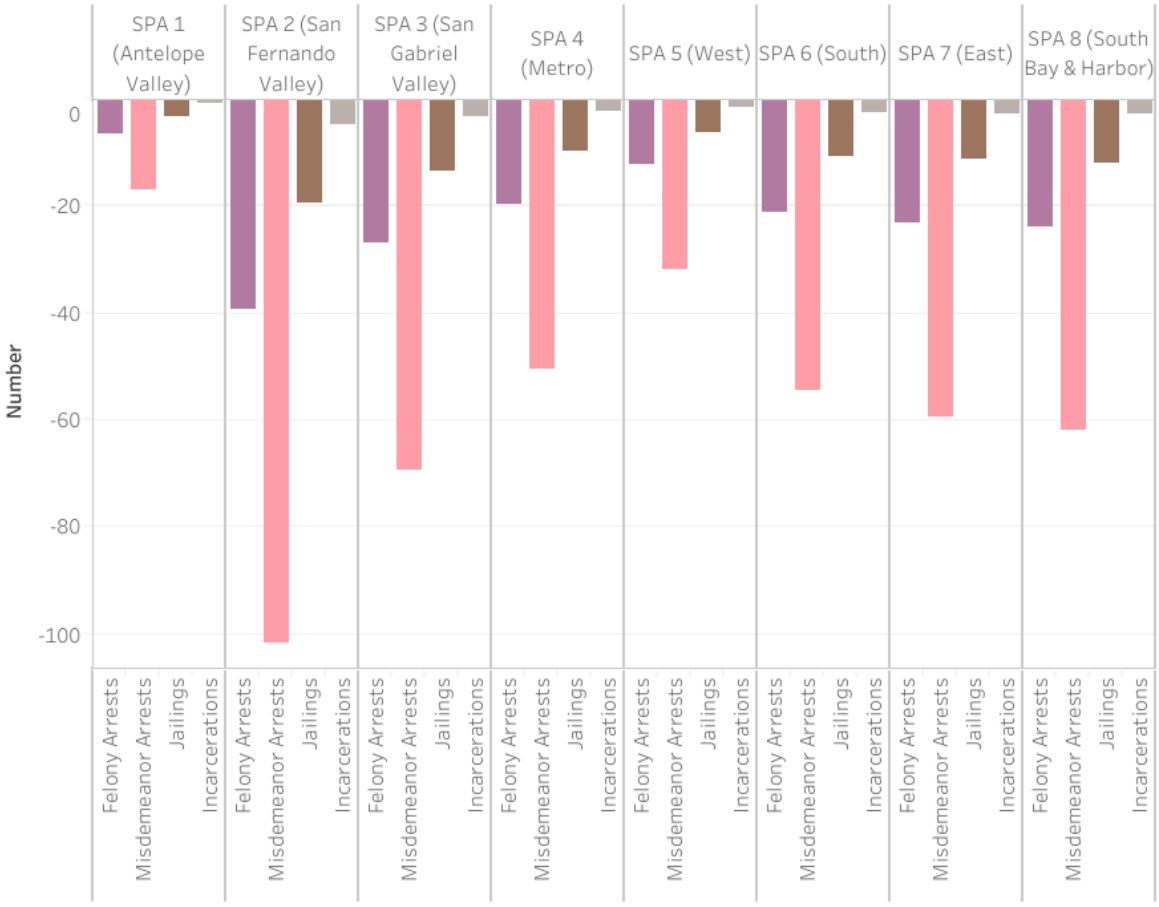



Figure 12 above illustrates the decreased number of arrests of felonies, misdemeanors, jail and prison incarcerations by SPA. Similar to overall arrests, with regard to felony arrests, SPA 2 experiences the highest decreases in arrests. Conversely, SPA 1 experiences the lowest decreases in arrests. These patterns persist with regard to incarceration in jail or prison.

Figure 13. Reductions in the Number of Arrests and Incarceration by Race/Ethnicity

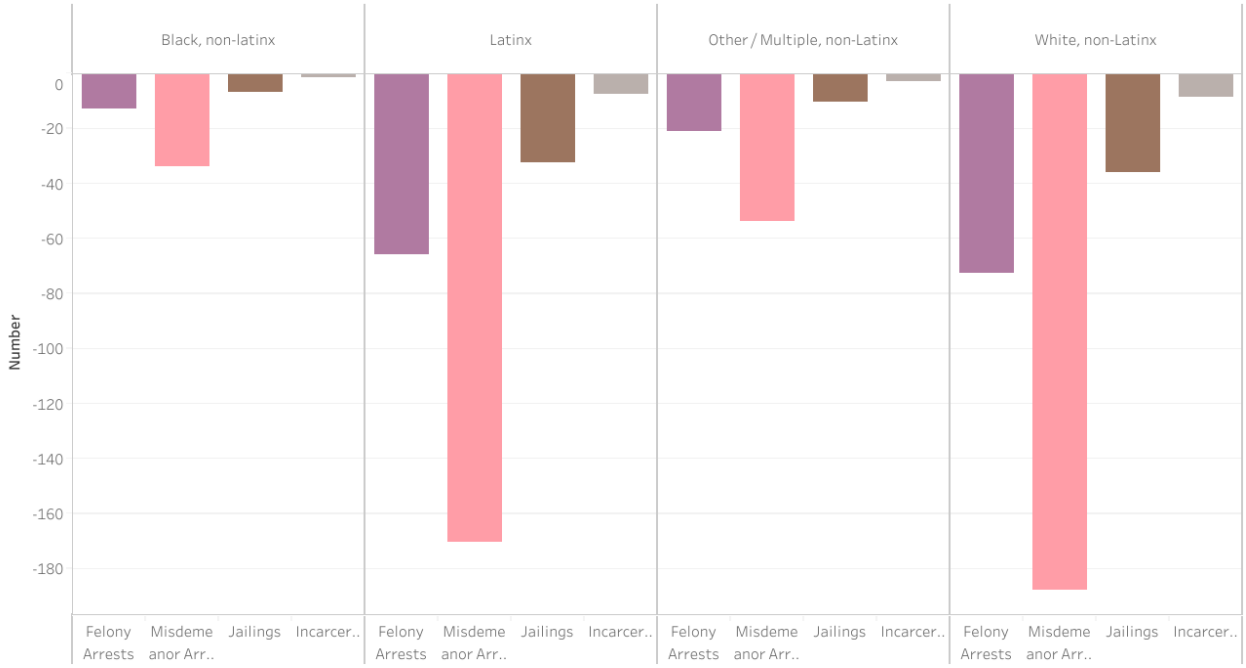
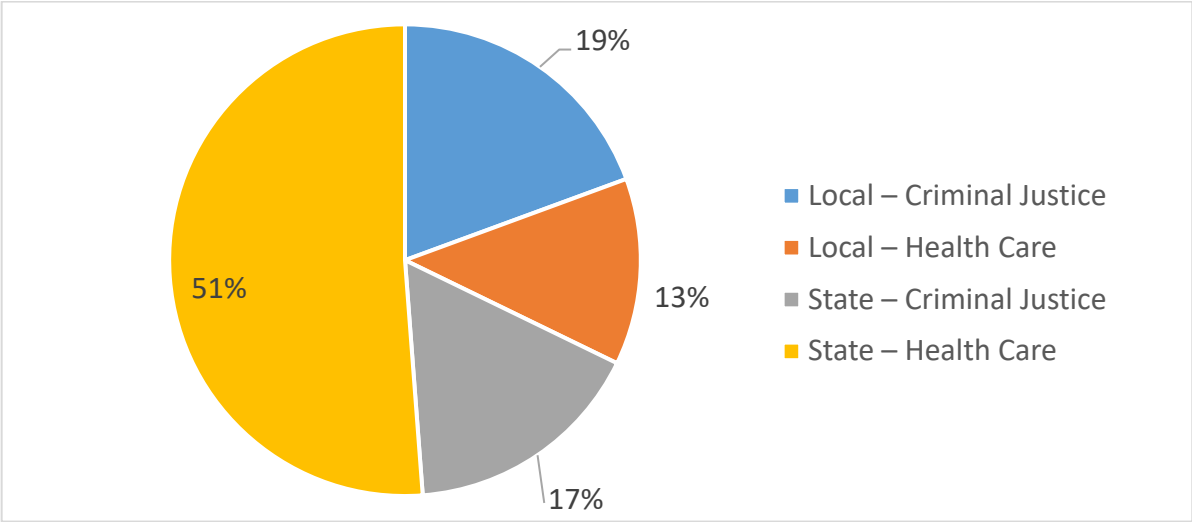



Figure 13 above illustrates the decreased number of arrests of felonies, misdemeanors, jail and prison incarcerations by SPA. Non-Latinx white and Latinx populations experiences the highest decreases in felony or misdemeanor arrests and incarceration in jail or prison.

## Return-on-Investment

The estimated return on investment represents the additional dollars that would flow to governments through reduced costs or increased revenues. These represent actual savings, not just hypothetical improvements in social value. For this reason, the estimates do not include commonly measured social benefits such as the value of a statistical life, gains in productivity or the hedonic costs of pain and suffering. Total program costs for over the six-month intervention would be $11.6 million but would generate $14.2 million in savings. The returns to state government and local would be $1.23 per dollar invested. Twenty percent of these savings would go to the local government whereas the remaining savings would go to the state.

Figure 14. Cost Savings by Government Source and Type




As seen in Figure 12, over half of (51%) the cost savings are attributed to state health care savings ($9.1 million), followed by criminal justice savings at the local or state level ($2.7 million and $2.4 million respectively). Local health care savings constitute $1.8 million in savings. All savings occur within two years.

# Recovery Bridge Housing

## Problem & Solution

Recovery housing provides housing solutions for individuals who use substances like opioids. Studies have consistently found that safe substance free housing has positive effects on substance use, employment, income and reduced interactions with the criminal justice system. Expanding Recovery Bridge Housing aims to improve substance use, employment and homelessness outcomes while decrease involvement in the criminal justice system.

## Program Description

Recovery Bridge Housing is an substance free-based, peer supported housing that combines a subsidy for recovery residences with concurrent treatment of substance use disorder and withdrawal management settings. Expanding DPH-SAPC's Recovery Bridge Housing for individuals concurrently enrolled in SUD treatment provides an opportunity for stability on basic needs like safe living arrangements to begin working towards substance use goals or to sustain recovery achievements gained through treatment. The program allows for stays up to 90 days which can be extended for up to six months.

## Implementation Notes and Model Assumptions

- We reviewed the studies on the use of medication-assisted treatment within recovery housing homes. However, these studies were too preliminary to be incorporated into the model.
- Several studies on recovery housing require abstinence and refer to abstinence as an outcome. However, this term "abstinence" is a term that is no longer utilized within the substance use disorder field. Although the term "abstinence" negates harm reduction strategies as well as fails to recognize that substance use disorder is a chronic health condition, it is the prevalent outcome in studies on recovery housing. However, to avoid the use of a potentially stigmatizing term, we refer to "reduced opioid use." Furthermore, it is possible that the model underestimates the effects of recovery bridge housing. Considering substance use a chronic health condition, some recovery bridge housing may have policies and procedures to offer support to residents in light of relapse rather than removing the resident from the home immediately following suspected or confirmed substance use.
- Research has examined combination of medication-assisted treatment within recovery housing homes. However, this research was too preliminary to make it into this analysis.
- As noted earlier we tailored the number of participants for each intervention to match existing levels of capacity. However, there is good reason to believe that with greater resources, more persons would enroll than we modeled. We estimate approximately 2,000 opioid users experiencing homelessness in LA County could participate in a recovery housing program at existing financing levels. This makes up approximately one eighth of the population experiencing homelessness in the county, but since opioid use among this population is at much higher rates, there is the potential to enroll more than the 2,000 modeled here.

## Target Population

All adults with opioid use disorder in L.A County are eligible for the Recovery Bridge Housing. The model assumes a county capacity to enroll of 1.5% for and a retention rate of 75% at 6 months (about 230 adults covered at 6 months).

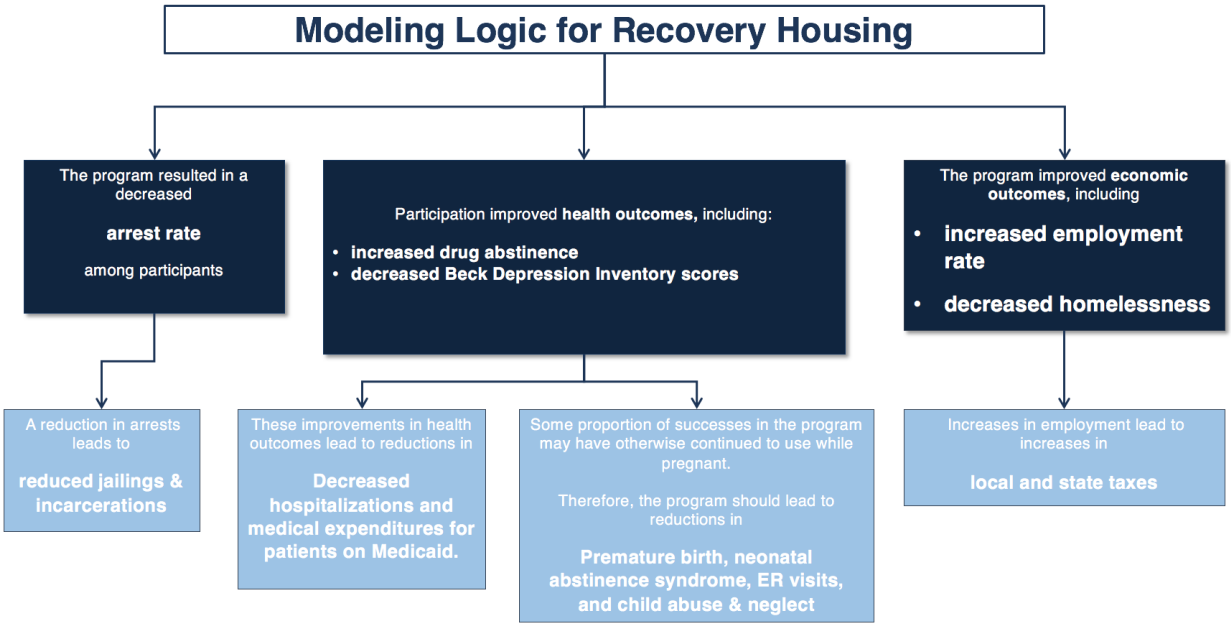
## Cost and Program Assumptions

The program is assumed to run for 6 months, at an estimated cost of $695 per month per adult retained at 6 months. This period is chosen because most of the studies in the literature followed people for 6 months and estimated the effects for the population retained at 6 months.

## Analytical Framework

We conducted a review of high-quality evaluations that studied the impact of the housing programs. The outcomes of these studies are visualized below in the dark blue boxes. We then conducted a literature review of outcomes that have been shown to be associated with the direct outcomes of the program. These are visualized below in the light blue boxes.

Figure 15. Analytical Model for Expanding Recovery Bridge Housing




This figure only shows outcomes for which there was enough evidence and data to include in the model. The darker boxes show impacts that were directly estimated in the literature. The lighter boxes show impacts that were modeled indirectly from literature that does not evaluate recovery housing but had evidence for relationships between outcomes in our model.

## Limitations

We did not find in the literature estimates of program effectiveness for reduced drug use, or reduced overdoses as outcomes.

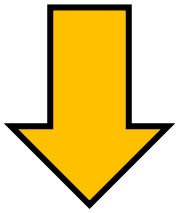
## Modeling Results

The primary outcomes for Recovery Bridge Housing fall into three broader categories. First, program effects on health outcomes of people with opioid use disorder (i.e., opioid use and depression). These outcomes lead to secondary outcomes of decreased hospitalizations and medical expenditures for patients on Medicaid and improvements in infant health and child welfare. Second, arrest rates which lead to secondary outcomes of reduced incarcerations. Third, economic improvements in employment and homelessness which lead to secondary outcomes of local and state tax revenue. Results below first present key takeaways at the county level. Where the sample size is sufficient enough, results are also grouped by service planning area and race or ethnicity. The next section of this report will describe key takeaways across the county as well as the return on investment.

## Key Takeaways Countywide

For an estimated cost of $695 per adult retained at six months for enrolling and retaining an estimated 1,900 adults in L.A. County (a 1.5% capacity to enroll and a 75% retention at 6 months), the following results can be expected within 2 years after implementation:

**For a program covering an estimated 1,900 adults in LA County:**



**445 fewer adults using opioids**

**365 more employed within the first year, resulting in over $1.5 million additional taxes**

**84 fewer people with depression**
**Over $150 K saved in medical costs**

**237 fewer people experience homelessness saving more than $600 K**

**Over $250 K saved in child welfare and infant care**

- ✓ **16 fewer deaths and 125 fewer hospitalizations**
- ✓ **57.1% reduction in deaths**


The next section of this report will describe anticipated outcomes by Service Planning Area and race/ethnicity. The third section will describe the return on investment.

## Results by Service Planning Area and Racial/Ethnic Group

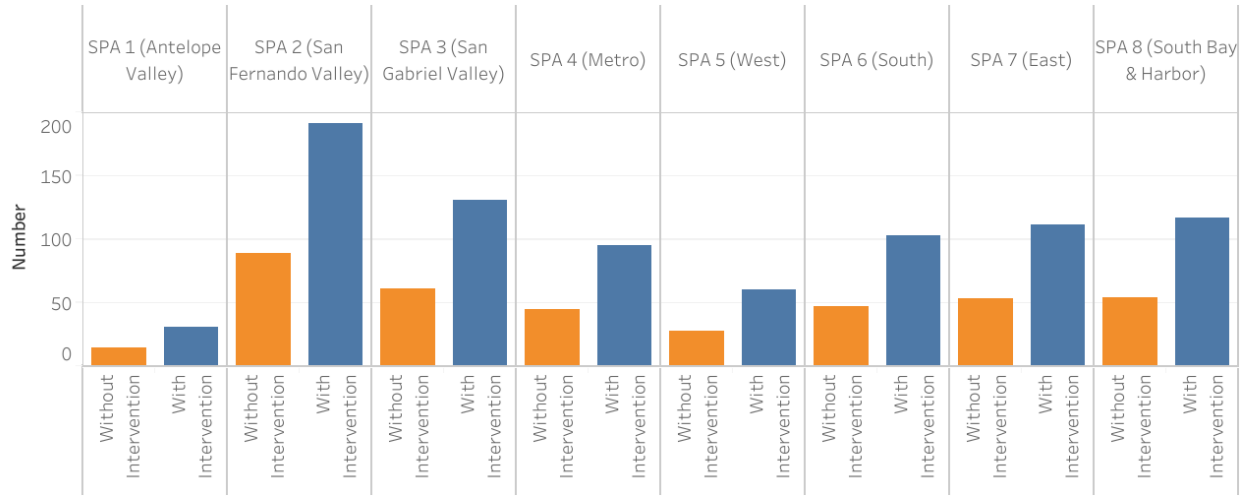
### Health Outcomes

Health outcomes were measured reduced opioid use and depression. With regard to reduced opioid use, the model assumed that 43% of the population who received and retained on recovery housing at 6 months would have reduced opioid use at 6 months compared to 20% had they not been provided with the intervention.

#### *Increased Number of Individuals with No Opioid Use*

Model results provided below for the number of participants not using opioids after 6 months by Service Planning Area as well as by race/ethnicity.

Figure 16. Number of Participants with Reduced Opioid use after 6 Months by Service Planning Area




Countywide the impact of Recovery Bridge Housing is estimated to result in 445 fewer adults with opioid use problems. As seen in Figure 16 above, SPA 2 would have the largest number of participants with reduced opioid use at 6 months of retention. Comparatively, SPA 1 would have the smallest number of participants with reduced opioid use at 6 months.

Figure 17. Number of Participants with Reduced Opioid Use after 6 Months by Race/Ethnicity

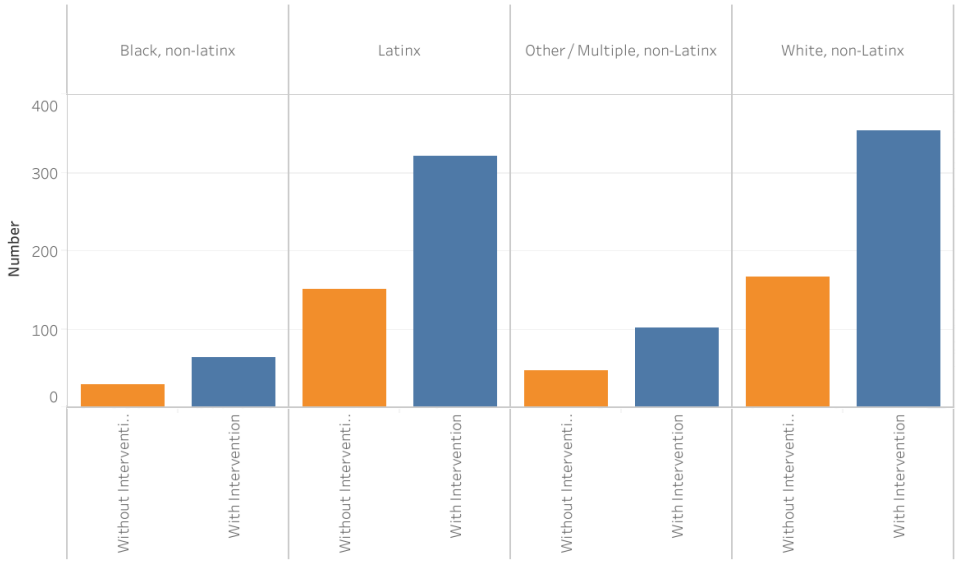
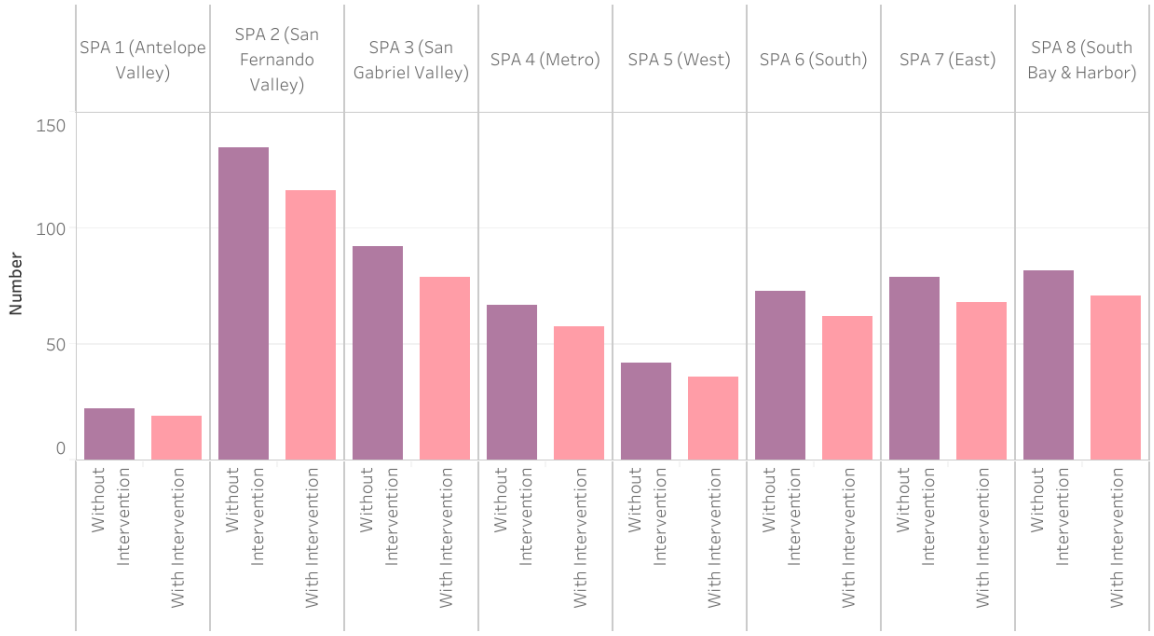



Figure 17 above illustrates that Non-Latinx White as well as Latinx populations would have the largest number of participants with reduced opioid use at 6 months of retention in Recovery Bridge Housing, followed by non-Latinx black populations and other non-Latinx or multi-racial populations.

### *Decreased Number of Individuals with Depression*

Model results provided below for the number of participants suffering from depression after 6 months by Service Planning Area as well as by race/ethnicity.

Figure 18. Decreased Number of Participants Depressed after 6 Months by Service Planning Area




Recovery Bridge Housing is estimated to result in 84 fewer adults with depression at six months. As seen in Figure 18 above, SPA 2 would have the largest reduction in the number of participants depressed at 6 months of retention. Comparatively, SPA 1 would have the smallest number of participants depressed at 6 months.

Figure 19. Decreased Number of Participants Depressed after 6 Months by Race/Ethnicity

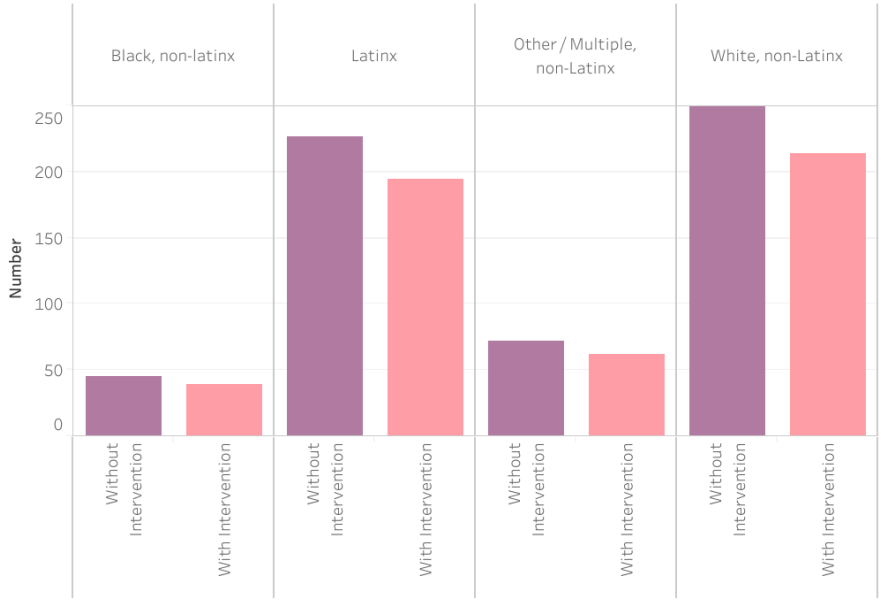


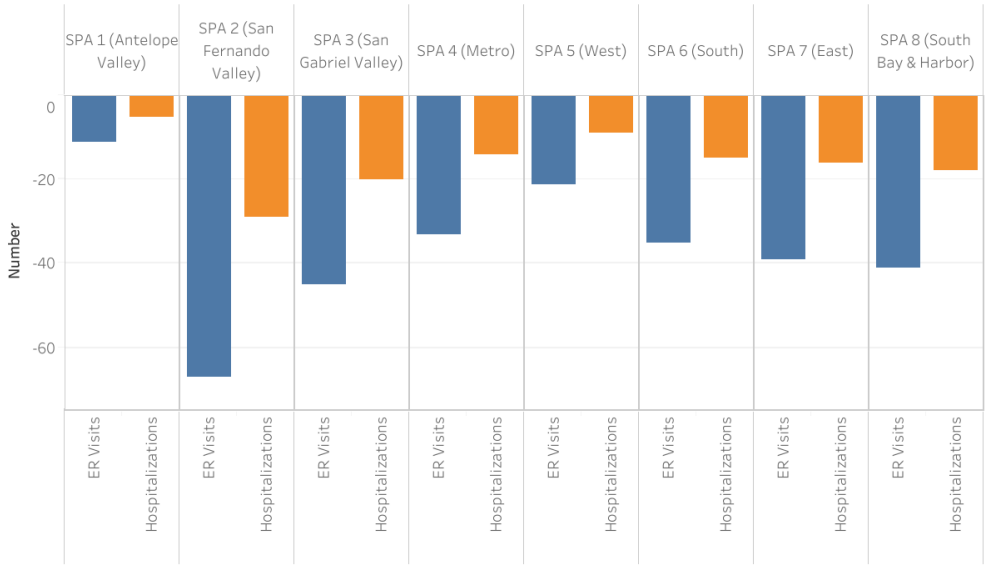

Figure 19 above illustrates that Non-Latinx White as well as Latinx populations would have the largest reduction in the number of participants depressed at 6 months of retention in Recovery

Bridge Housing, followed by other non-Latinx or multi-racial populations and non-Latinx black populations.

### *Reductions in Healthcare Utilization*

Reductions in healthcare utilization is a secondary outcome of reduced opioid use and reduced depression rates among program participants who are retained in Recovery Bridge Housing for six months. Healthcare utilization was measured as the number of hospitalizations and emergency department visits. Countywide Recovery Bridge Housing may result in 125 fewer hospital visits and 292 emergency department visits. Figure 20 and Figure 21 illustrate reductions emergency department visits and hospitalizations by SPA and by race/ethnicity respectively.

Figure 20. Reductions in Healthcare Utilization by Service Planning Areas




SPA 2 and 3 would have the largest reduction in the number of Emergency Department Visits and Hospitalization, while SPA 1 and 5 would have the smallest reductions.

Figure 21. Reductions in Healthcare Utilization by Race/Ethnicity

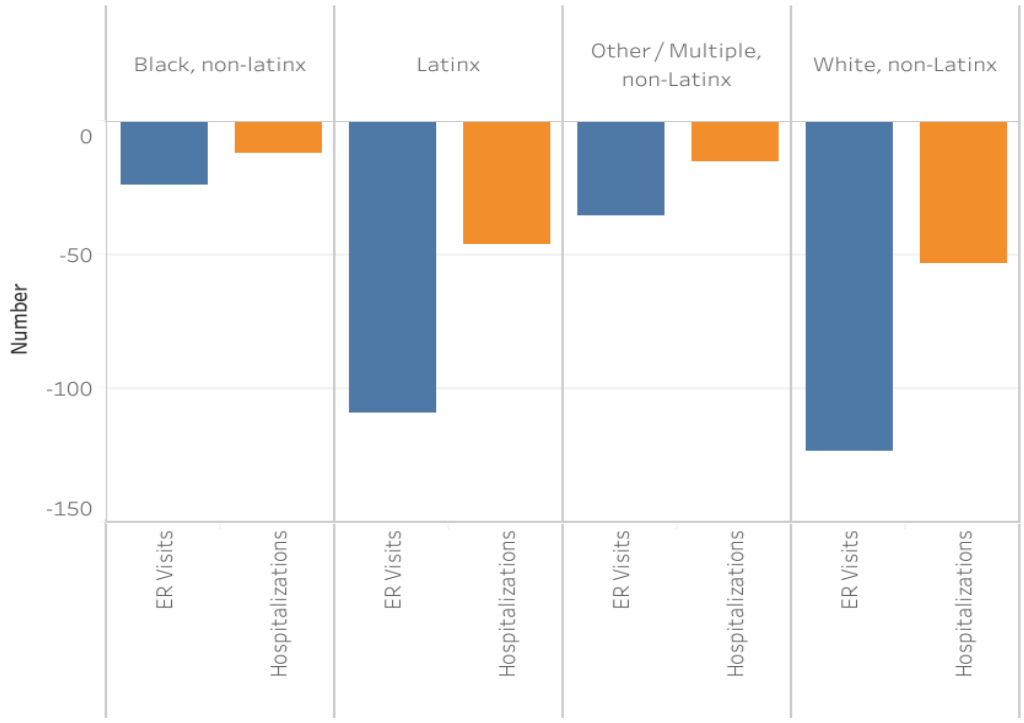



Figure 21 above illustrates that Non-Latinx White as well as Latinx populations would have the largest reduction in the number of Emergency Department visits and Hospitalizations, followed by other non-Latinx or multi-racial populations and non-Latinx black populations.

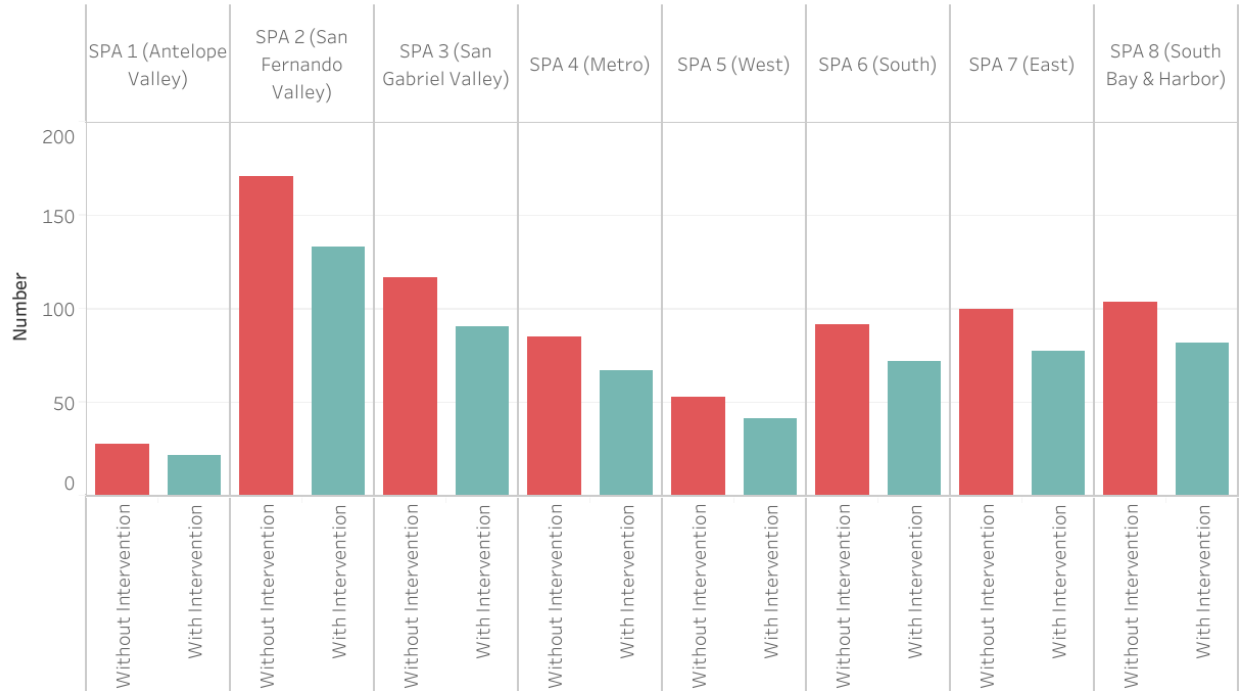
## Criminal Justice Outcomes

Criminal justice primary outcomes were measured as the number of arrests as well as the secondary outcome of reduced prison or jail incarcerations. The model assumes that without the intervention, the probability of arrest within 6 months is 38% whereas with the intervention the arrest is about 30% among program participants. The model also assumes that of arrests, about 72% are for misdemeanors compared to about 28% for felonies.

### *Decreased number of arrests compared to no intervention*

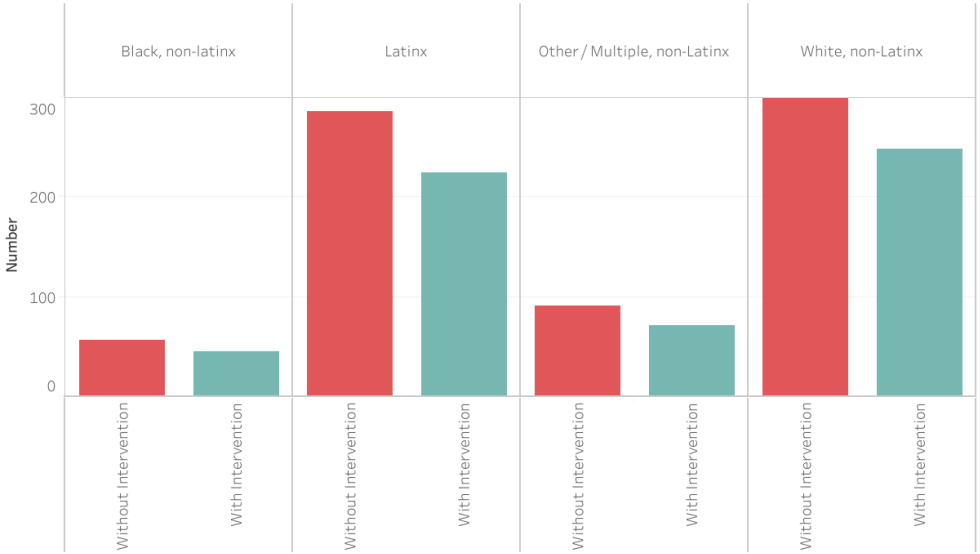
Countywide it is estimated that the Recovery Bridge Housing will result in 162 fewer arrests for either felonies or misdemeanors. Figure 22 and 23 illustrates the decreased number of arrests of felonies and misdemeanors as well as number of prison and jail incarcerations from expanding buprenorphine. Figure 22 provides the comparison by SPA while Figure 23 provides the comparison by racial/ethnic group.

Figure 22. Reductions in the Number of Arrests Compared to Treatment as Usual by Service Planning Area




Recovery Bridge Housing could result in 162 fewer arrests countywide. In addition, SPA 2 may experience the largest reduction in arrests while SPA 5 experiences the smallest reduction in the number of arrests. See Figure 22 above.

Figure 23. Reductions in the Number of Arrests Compared to Treatment as Usual by Race/Ethnicity

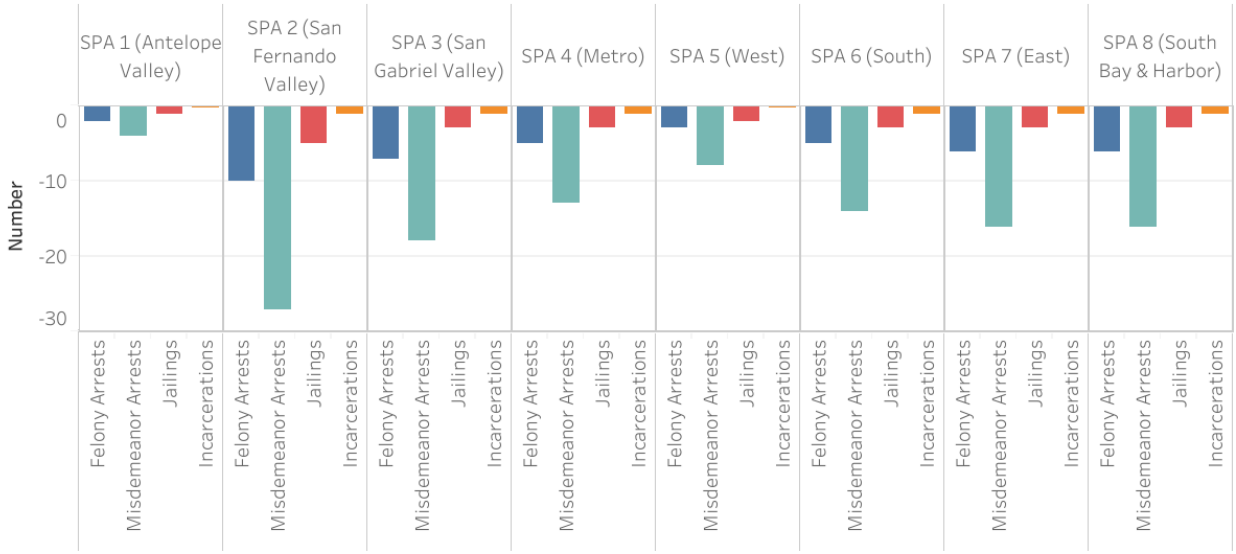



As seen in Figure 23 above, Recovery Bridge Housing could result in fewer arrests by all racial/ethnic groups, with the largest reductions among non-Latinx white population and the smallest reductions among non-Latinx black population.

*Decreased arrest and incarcerations among program participants*

Reductions in incarceration is a secondary outcome of reduced arrests among program participants retained at six months. Figure 24 and 25 display the decreased number of arrests of felonies and misdemeanors as well as number of prison and jail incarcerations among program participants by SPA and racial/ethnic group, respectively.

Figure 24. Reductions in the Number of Arrests and Incarceration by Service Planning Area




The Recovery Bridge Housing may result in 45 fewer felony arrests, 117 fewer misdemeanor arrests, 22 fewer jail incarcerations and 5 fewer prison incarcerations in L.A. County. Figure 24 above illustrates the decreased number of arrests of felonies, misdemeanors and incarcerations by SPA. SPA 2 may experience the highest decrease in the number of felony or misdemeanor arrests, jail incarcerations. Conversely, SPA 7 and 8 experience the lowest number of felony and misdemeanor arrests. SPA 1 may experience the lowest decrease in the number of jail incarceration. Most SPAs experience at a decrease of 1 incarceration, except for SPA 1 and 5 (0 incarcerations).

Figure 25. Reductions in the Number of Arrests and Incarceration by Race/Ethnicity

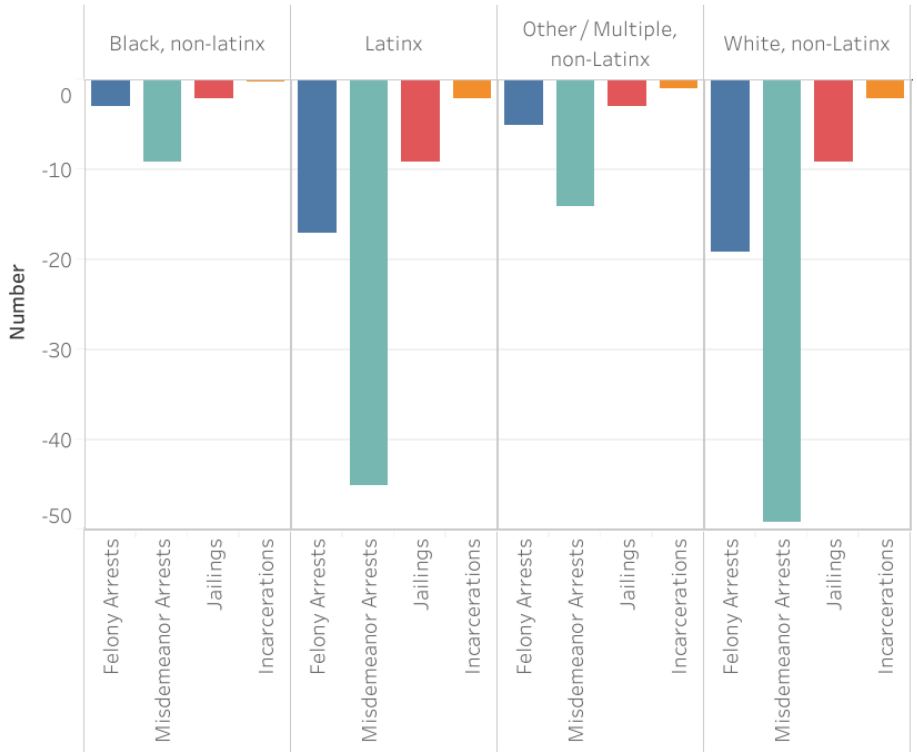



Figure 25 above illustrates the decreased number of arrests of felonies, misdemeanors, jail and prison incarcerations by race/ethnicity. Non-Latinx white and Latinx populations experiences the highest decreases in felony or misdemeanor arrests as well as jail or prison incarcerations.

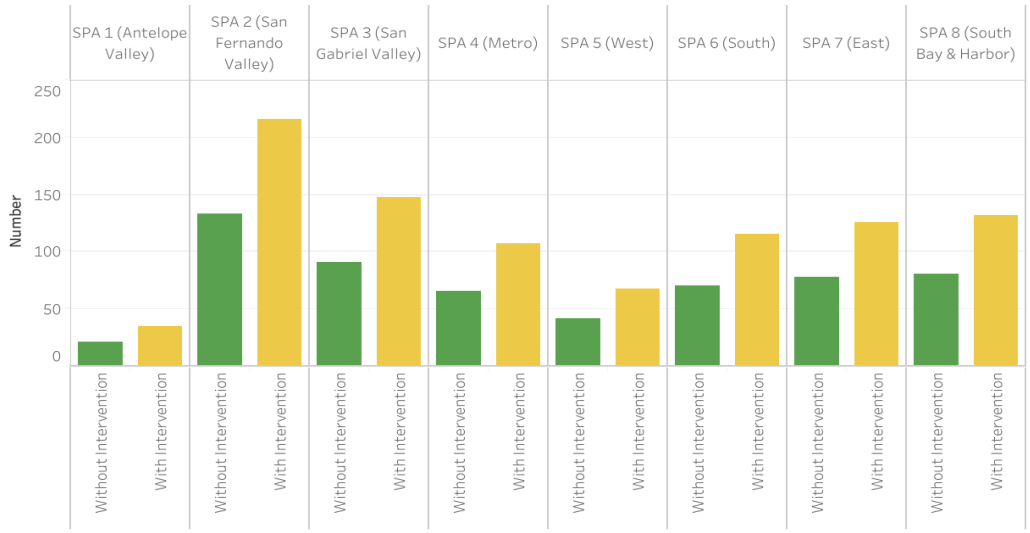
## Economic Outcomes

Economic outcomes were measured as employment and homelessness rates. The model assumed that about 48% of the population who received and retained on Recovery Bridge Housing would be employed at 6 months compared to 30% without the program. In addition, the model assumes 4% of the population who receive and retain on the program will experience homelessness compared to 16% had they not received the intervention.

### *Increased Number of Individuals Employed*

Model results provided below for the number of participants employed after 6 months by Service Planning Area as well as by race/ethnicity. Figure 24 and 25 illustrates the increased number of people employed compared to no intervention at 6 months by SPA and race/ethnicity respectively.

Figure 26. Employment among Participants without and with Intervention by Service Planning Area




Recovery Bridge Housing may result in 365 more individuals employed at six months, compared to no program. Figure 26 above illustrates the increased number of people employed compared to no intervention at 6 months by SPA.

Figure 27. Employment among Participants without and with Intervention by Race/Ethnicity

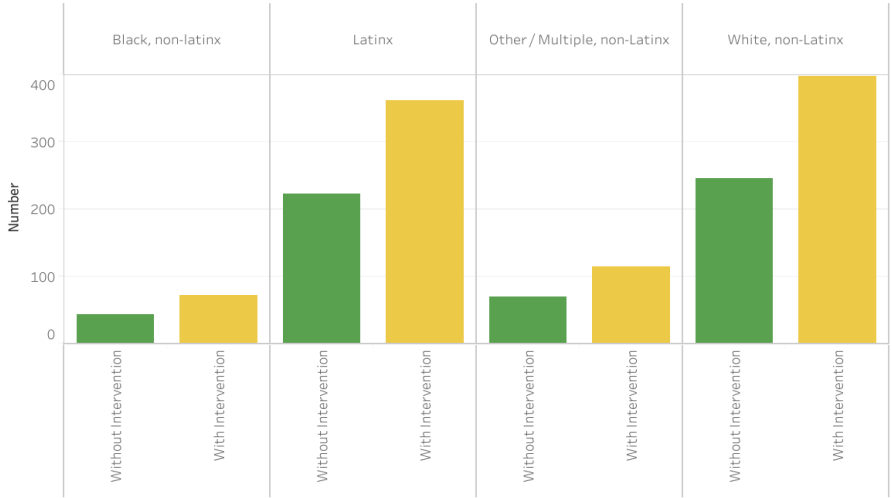
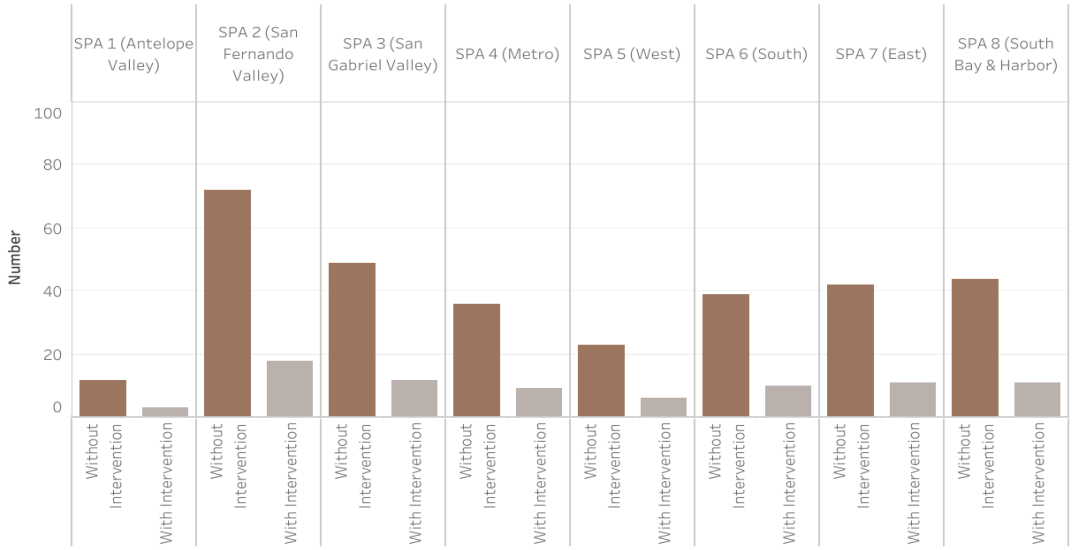



Figure 27 above illustrates that non-Latinx white and Latinx populations experiences the highest increase in the number of program participants employed at six months compared to no intervention, followed by other/multi-racial populations and non-Latinx black populations.

### *Decreased Number of Individuals Experiencing Homelessness*

Figure 28 and 29 illustrates the decrease in the number of people who experience homelessness compared to no intervention at 6 months by SPA and race/ethnicity respectively.

Figure 28. Reductions in the Number of Participants Experiencing Homelessness at 6 Months by Service Planning Area




Recovery Bridge Housing may result in 237 fewer individuals who experience homelessness at six months, compared to no program. Figure 28 above illustrates the decreased number of people experiencing homelessness compared to no intervention at 6 months by SPA. In SPA 2, experiences the largest reduction in the number individuals who experience homelessness. Conversely, in SPA 5, experiences the smallest reductions.

Figure 29. Reductions in the Number of Participants Experiencing Homelessness at 6 Months by Race/Ethnicity

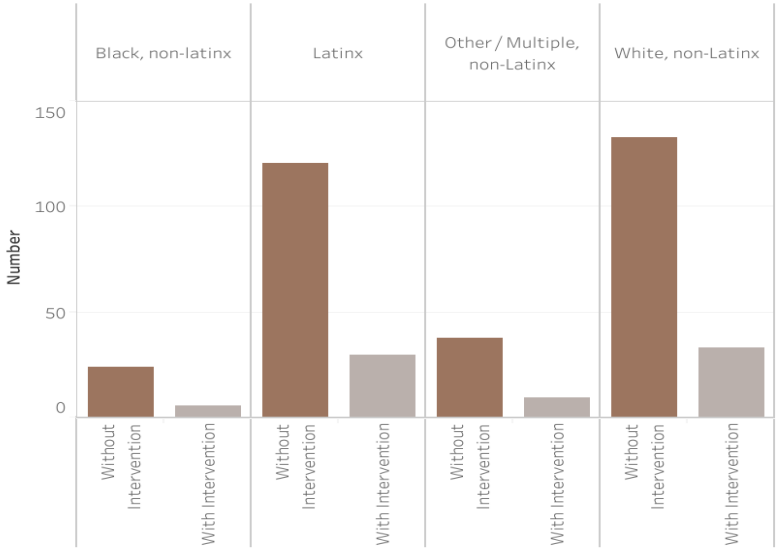
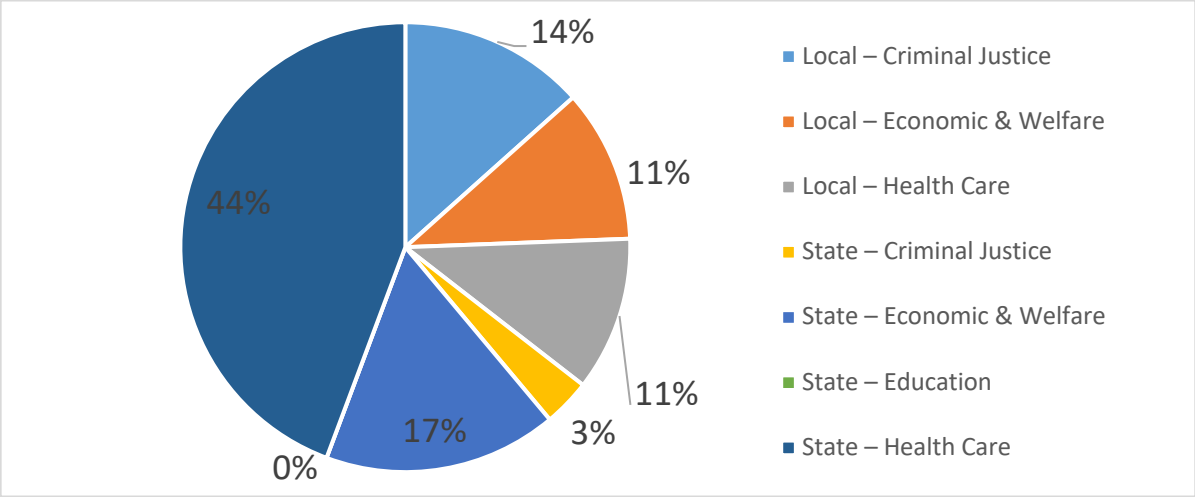


Figure 29 above illustrates that non-Latinx white and Latinx populations experiences the largest decreased in the number of program participants who experience homelessness at six months compared to no intervention, followed by other/multi-racial populations and non-Latinx black populations.

### Return-on-Investment

Total program costs for program for one year would be $9.2 million but would generate $8.0 million in savings. The returns to state government and local would be $0.87 per dollar invested. The return on investment occurs within the first two years of the program. Thirty-five percent of these savings would go to the local government whereas the remaining savings would go to the state. As a reminder, the estimated return on investment represents the additional dollars that would flow to governments through reduced costs or increased revenues. The estimates do not include commonly measured social benefits such as the value of a statistical life, gains in productivity or the hedonic costs of pain and suffering.

Figure 30. Cost Savings by Government Source and Type




As seen in Figure 30, just under half of (44%) the cost savings are attributed to state health care savings ($3.5 million), with an additional 11% ($890 thousand) going to local health care savings. This is followed by economic and welfare savings at the state and local level (27%; $1.3 million and $880 thousand respectively), criminal justice savings at the local or state level (17%; $1.1 million and $270 thousand, respectively) and education at the state level (0.5%; $40 thousand).

# Fentanyl Test Strips

## Problem & Solution

Fentanyl is a synthetic opioid for treating severe pain. Given it is 50 to 100 times more potent than morphine it has been attributed to a sharp increase in deaths nationwide. According to a recent DPH-SAPC report on accidental deaths pre-and post- pandemic, fentanyl is the second most commonly reported substance attributed to accidental these overdose deaths in L.A. County. This reflects a two-fold increase in accidental deaths since 2019. Anecdotally L.A. County law enforcement report increased seizures of illicitly manufactured fentanyl, counterfeit pills such as opioids or sedatives that contain fentanyl in the L.A. region over the past several years. The Office of National Drug Control Policy, the Centers for Disease Control and Prevention, the Substance Abuse and Mental Health Services Administration support the use of Fentanyl test strips as a harm reduction strategy to identify fentanyl in substances of use and prevent overdose. Fentanyl test strips provide L.A. County residents with an opportunity to reduce risk of overdose by identifying substances containing fentanyl and taking the appropriate harm reduction strategies.

## Program Description

Harm reduction providers in L.A. County distribute fentanyl test strips to help individuals who use substances identify illicit drugs containing fentanyl. Providers also educate individuals who use substances the limitations of the fentanyl test strips (i.e., cannot detect substance analogs and may not be fully reliable due to variability in chemical composition of fentanyl analogues). Nonetheless, fentanyl test strips provide an important opportunity to reduce overdose deaths and injury.

## Implementation Notes and Model Assumptions

The emerging literature suggests that Fentanyl test strips may be an additional strategy to evidence-based interventions and harm reduction strategies to reduce the risk of overdose deaths. Fentanyl test strips (FTS) are a nascent product and targeted interventions using them are in the early stages of development and implementation. Consequently, the extant literature concerning FTS is scant. However, a recent Office of National Drug Control Policy brief concluded that “early studies suggest that FTS may be a good addition to current evidence-based overdose prevention and harm reduction efforts”. There is evidence of willingness to use the strips and potential behavior modifications. Although there may be some concern that people with opioid use disorder may intentionally seek out fentanyl and that FTS may therefore increase harm, the evidence, although limited, does not support this. The use of FTS leads to protective health behaviors including using smaller amounts of drugs and/or disposing drugs. These protective behaviors lead to a decreased risk of overdose. This decreased overdose risk leads to improved health comes including decreases in ED visits, hospitalizations, and fentanyl-related mortalities. However, there is no evidence of impact on modeled outcomes. As a result, the model inputs require a “ballpark” model methodology. The FTS model posits crucial assumptions that could significantly impact its projections of intervention effectiveness. First, for all outcomes it is tenuously assumed that 100% of all three outcomes occur among non-fentanyl seekers. Second, the model assumes the effect on ED visits, hospitalizations, and fentanyl-

related mortality is the same as it is for fentanyl-induced overdose. Despite the model, the impact of FTS may be modest, depending on uptake. The impact of FTS is ultimately driven by uptake. Modeling is limited to the effects on opioid users who are non-fentanyl seeking. There could be significant spillover effects if the strips reach non opioid users (e.g., cocaine, methamphetamine) or if they reach non-fentanyl opioid users via fentanyl seeking opioid users.

The model assumes that each test strip cost one dollar. Using an annual baseline cost of $6.3 million, the FTS intervention will prevent 74 deaths from fentanyl-related overdose at a cost of $85,161 per overdose death averted. Whether this is deemed cost effective is contingent upon decision makers' willing to pay threshold. The cost-effectiveness of an FTS intervention will be heavily influenced by the actual cost of running the program. A number needed to treat (NNT) analysis estimates that 1,640 non-fentanyl seeking adults with OUD must be treated by the intervention in order to avoid one fentanyl-related overdose mortality. Most strips are distributed through already-existing harm reduction programs, so the overhead cost is quite low. If LA County anticipates lower program costs, then the appeal of the intervention would increase. For example, if the actual costs to LA County are 25% lower than the baseline figure ($4.73 million), the cost per overdose averted would be $58,338. The relatively low number of ED visits and hospitalizations averted is most likely attributable to the fact that fentanyl is so potent that if an individual overdoses then the likelihood of a quick death is quite significant so there is little need for hospitalizations or ED visits. Consequently, ED related cost savings ($134,910) and hospitalization related cost savings ($39,926) are negligible compared to the estimated baseline cost of the program.

## Target Population

The model estimates that approximately 120,750 adults in Los Angeles County could potentially receive test strips. The model assumes that each test strip costs one dollar and an intervention penetration rate of 46% and a 95% willingness to use the strips. Consequently, the intervention is expected to reach about 52,309 non-fentanyl seeking adults living with OUD.

The expansion of access to Fentanyl Test Strips could also have an impact on those who are fentanyl-seeking. Anecdotal evidence suggests that those who are fentanyl-seeking may use FTS to verify their supply, but that doing so does not apparently increase the risk of harm. Because there is very little formal research in this area, these effects are not modeled here.

## Cost Assumptions

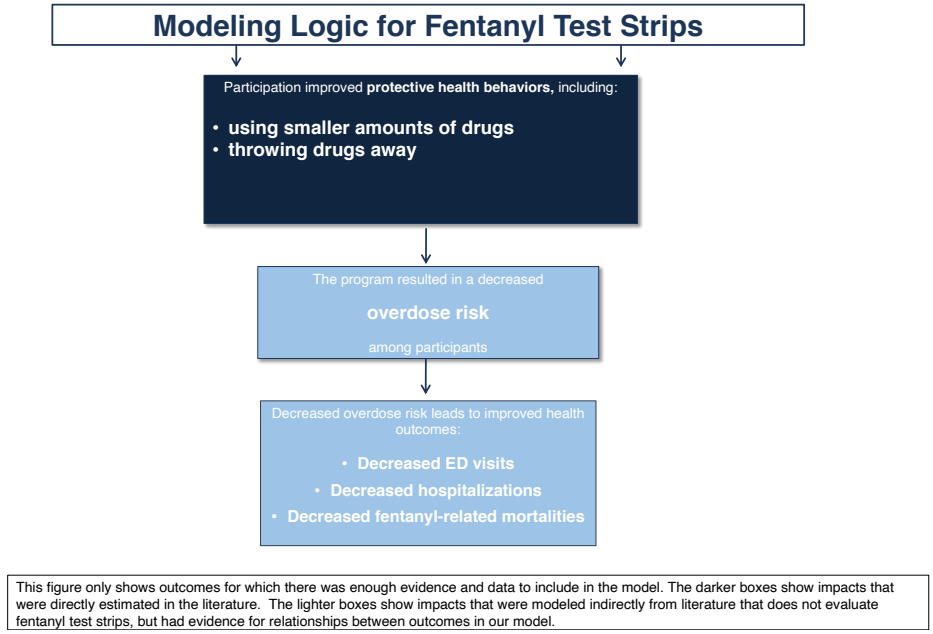
The model estimates that the program has an approximate annual total cost of $6.3 million which equates to $523,000 per month. This is based on the target population, intervention penetration rate, willingness to use, and a monthly cost of $10 for each individual supplied with test strips.

## Analytical Framework

We conducted a review of high-quality evaluations that studied the impact of the fentanyl testing strips. The outcomes of these studies are visualized below in the dark blue boxes. We then

conducted a literature review of outcomes that have been shown to be associated with the direct outcomes of the program. These are visualized below in the light blue boxes.

Figure 31. Analytical Model for Fentanyl Test Strips



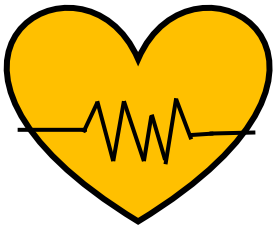

## Modeling Results

The Fentanyl Test Strip program may increase harm reduction behaviors such as using smaller amounts of opioids or discarding opioids that are too risky to use. In turn this would reduce the risk of opioid overdose. Thus, primary outcomes include decreased emergency department visits, hospitalizations and fentanyl-related mortalities.

Results below first present key takeaways at the county level. Where the sample size is sufficient enough, results are also grouped by service planning area and race or ethnicity. The next section of this report will describe key takeaways across the county.

## Key Takeaways Countywide

The main takeaway is the utility of this intervention comes from the fentanyl induced overdose mortalities averted. The following results can be expected after implementation:



**27 fewer emergency department visits**

**8 fewer hospitalizations**

**74 fewer fentanyl related deaths**

**The number needed to treat is 1,640.**

Please note that the results do not include a return-on-investment estimate. The program's value is derived from the mortalities averted.

The next section of this report will describe anticipated outcomes by Service Planning Area and race/ethnicity. The third section will describe the return on investment.

## Results by Service Planning Area and Racial/Ethnic Group

### *Decreased Hospitalization Utilization*

Figure 32 and Figure 33 illustrate reductions Fentanyl-related hospitalizations compared to without the FTS program by SPA and by race/ethnicity respectively.

### Figure 32. Reductions in Fentanyl-related Hospitalizations with and without the FTS Intervention by Service Planning Areas

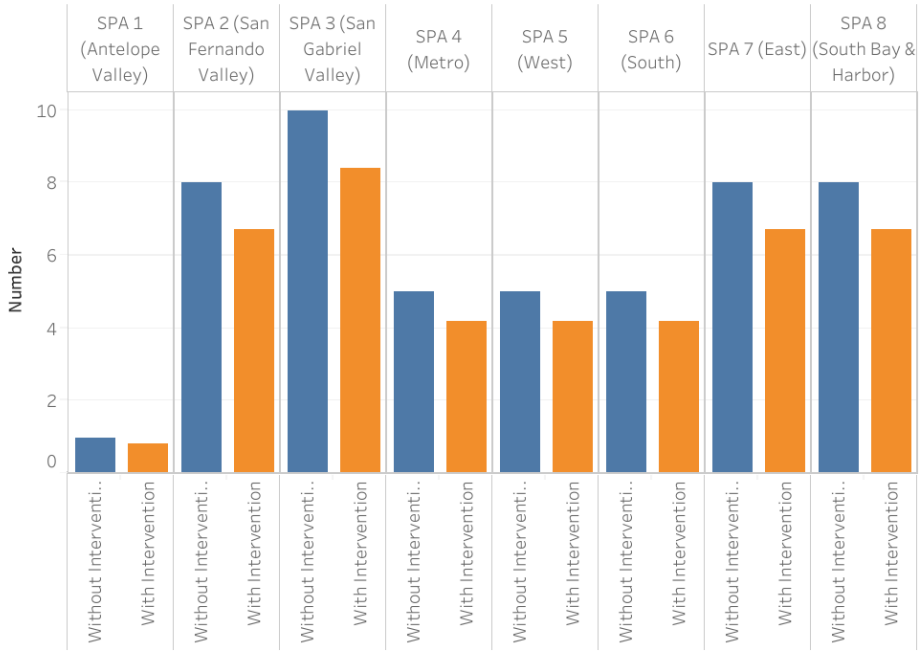



Figure 32 illustrates that SPA 2 and 3 have the largest reductions Fentanyl-related hospitalizations compared to without the FTS program.

Figure 33. Reductions in Fentanyl-related Hospitalizations with and without the FTS Intervention by Race/Ethnicity

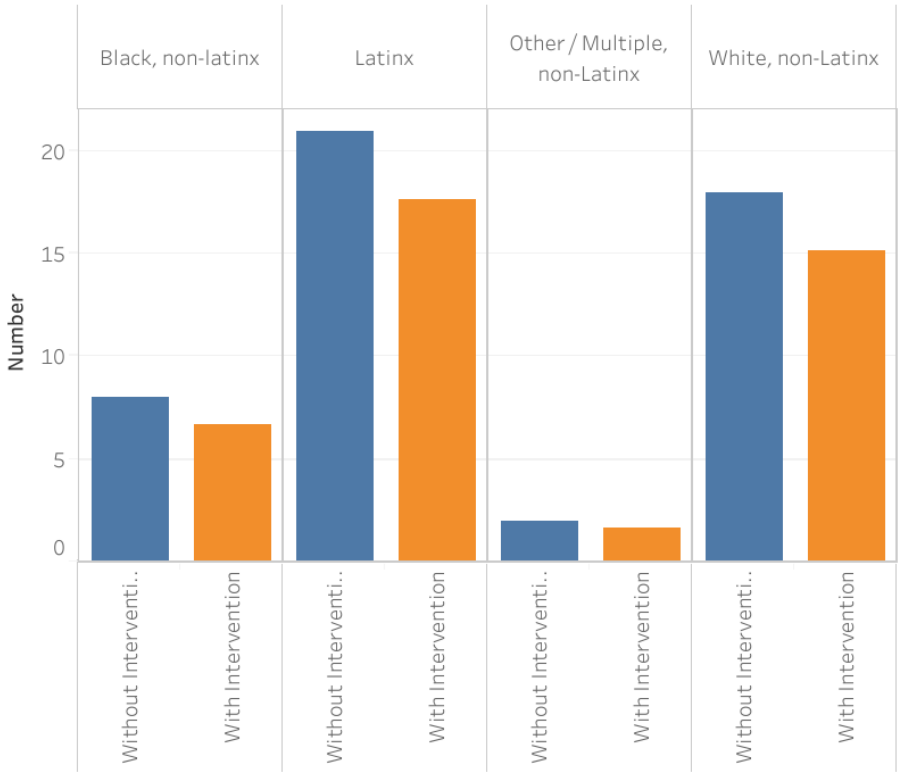



Figure 33 illustrates that Latinx folks have the largest reductions Fentanyl-related hospitalizations compared to the number of hospitalizations in the absence of the FTS program.

### *Decreased Emergency Department Visits*

Figure 34 and Figure 35 illustrate reductions Fentanyl-related Emergency Department Visits compared to without the FTS program by SPA and by race/ethnicity respectively.

Figure 34. Reductions in Fentanyl-related Emergency Department Visits with and without the FTS Intervention by Service Planning Areas

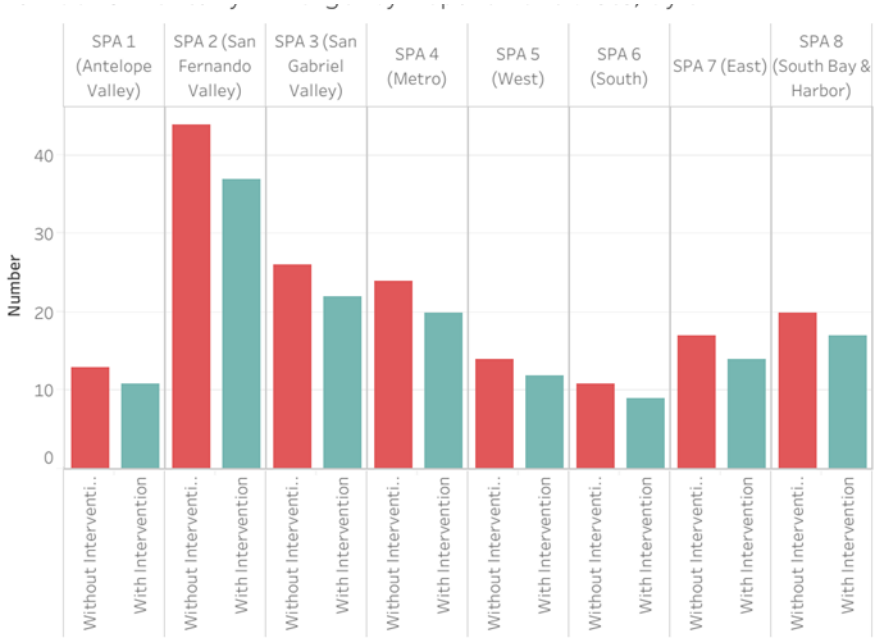



Figure 34 illustrates that SPA 2 and 3 have the largest reductions Fentanyl-related Emergency Department visits compared to without the FTS program.

Figure 35. Reductions in Fentanyl-related Emergency Department Visits with and without the FTS Intervention by Race/Ethnicity

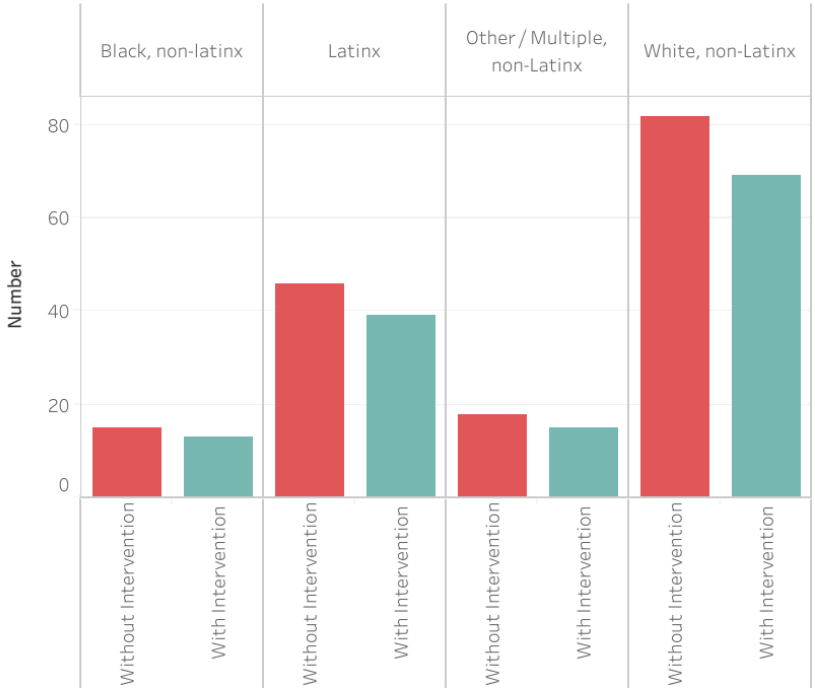



Figure 35 illustrates that Non-Latinx White population has the largest reductions Fentanyl-related Emergency Department visits compared to without the FTS program.

### *Decreased Fentanyl-related Deaths*

Figure 36 and Figure 37 illustrate reductions Fentanyl-related deaths compared to without the FTS program by SPA and by race/ethnicity respectively.

Figure 36. Reductions in Fentanyl-related Mortality with and without the FTS Intervention by Service Planning Areas

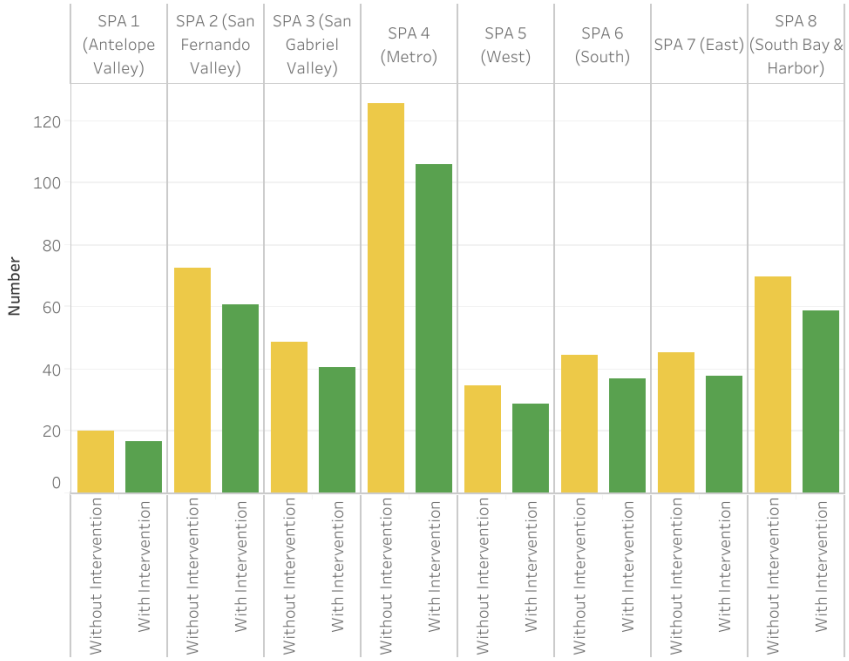



Figure 36 illustrates that SPA 5 is estimated to have the largest reduction in Fentanyl-related deaths compared to without the FTS program.

Figure 37. Reductions in Fentanyl-related Mortality with and without the FTS Intervention by Race/Ethnicity

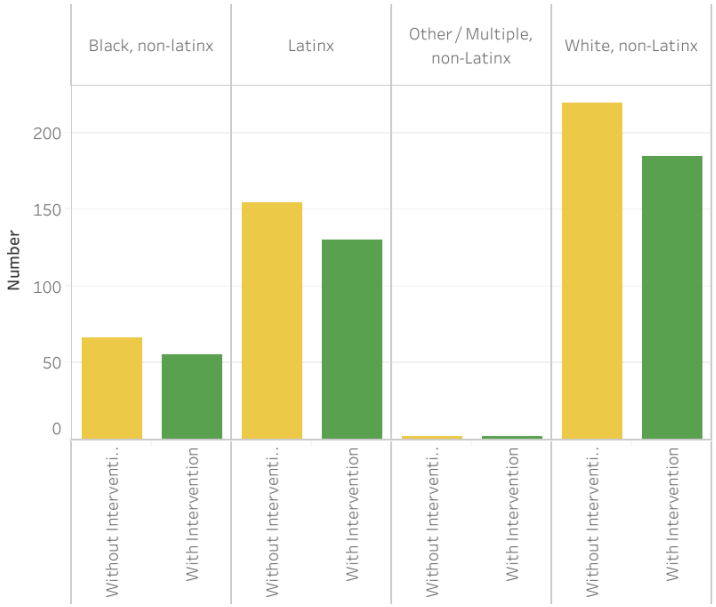


Figure 37 illustrates that non-Latinx white population is estimated to have the largest reduction in Fentanyl-related deaths compared to without the FTS program.

### Return-on-Investment

Please note that the results do not include a return-on-investment estimate for this intervention because the program's value is derived from mortalities averted.

# Overview

The following tables provide a comparison of the interventions by outcome and cost.

## Overview of Impact by Program

| Intervention | Participants | Cost | ROI | Mortality – All-Cause | Mortality – Overdose | Hospitalizations | ED Visits |
|---|---|---|---|---|---|---|---|
| **Buprenorphine** | 4,370 | $11.6 million | $1.23 | 57 fewer | 14 fewer | 23 fewer | 50 fewer |
| **Recovery Housing** | 1,977 | $9.2 million | $0.90 | 16 fewer | --- | 125 fewer | 292 fewer |
| **Fentanyl Test Strips** | | | | | | | |

| Intervention | Drug Use @ 6 mos. | Employment | Homelessness | Arrests | Depression | Infant/ Child Outcomes |
|---|---|---|---|---|---|---|
| **Buprenorphine** | 1,492 fewer (using) | --- | --- | 617 fewer | --- | 69 fewer NAS days |
| **Recovery Housing** | 445 fewer (abstinent) | 365 additional | 237 fewer | 162 fewer | 84 fewer | 2 fewer premature births<br>2 fewer child abuse cases |
| **Fentanyl Test Strips** | | | | | | |

# Conclusion

Opioid use disorder is recognized as a crisis that threatens the public's health. At both the federal and local level, public health officials have been tasked with the challenge of adopting mix of programs to combat this costly crisis to individuals and communities. Addressing this issue sufficiently will require a multi-pronged approach that is sensitive to the social determinants of health and other structural inequities that shape population health.

Using the best evidence available, as well as a clear set of consistent modeling assumptions, we have laid out the potential impact of three different programs that could make inroads in addressing opioid use disorder in Los Angeles County: Enhanced Buprenorphine Access, Recovery Bridge Housing, and Fentanyl Test Strip distribution. Overall, we find that the interventions have positive estimated impacts on health outcomes and healthcare utilization. They also have a range of costs and governmental return-on-investment. When comparing interventions, there is not typically a clear winner where an intervention is likely to work well in every jurisdiction. Instead, the Win-Win Project strives to provide accurate estimates of the program impact and cost effectiveness. This information helps to highlight the differences and similarities between interventions and helps decision-makers more clearly see the trade-offs between different solutions. Policy-makers are likely to choose different interventions based on community needs and priorities.

The Win-Win Project synthesizes the evaluation literature and estimates the health impact and cost-effectiveness for a specific jurisdiction. Our goal is for this information to lead to a more informed audience of advocates and leaders who use this knowledge to make evidence-based decisions to improve their community.

# Appendix: Methodology

The methodology used to develop Win-Win models is outlined below. We aim to use the same standards and assumptions in each model to provide easy comparison between interventions.

## I. Overview

The Win-Win team first conducts a review of the evaluation literature of the program or policy. We use search engines and review clearinghouse websites, such as The Community Guide, to find all of the high-quality studies that evaluate the intervention impact. We identify all of the outcomes that have been measured in these studies. Once we have an understanding of the primary outcomes that are affected by the intervention, we look through literature to identify additional, secondary outcomes that may be impacted by the intervention. For example, if evaluation literature demonstrates an increase of high school graduation, we will research other studies to determine what happens downstream from high school graduation, such as an increase in employment. Using the studies for primary and secondary outcomes, we collect all of the corresponding effect sizes.

Once we know the measured outcomes associated with an intervention, we collect all of the related baseline data for the specified geographic location. For example, if we are modeling an intervention for Los Angeles County, we will collect demographic data for the target population. We will collect other data such as crime and employment statistics. These data serve as the baseline data to represent the context before the intervention. We also collect other information specific to the location, such as tax, insurance or cost data. This information feeds into the Win-Win model to calculate the quantified impact the intervention is likely to have over a two-year period for the given location. In addition, we calculate the savings associated with this impact to determine the return-on-investment for the local and state government.

The model adopts a “comparative statics” approach – the baseline data we use does not take into account other changes in a complex system, whether it be demographics, underlying population health, or other public policy changes. For example, a modeled reduction in arrests does not adjust for other changes to the criminal justice system. If policies like substance use decriminalization and reducing levels of incarceration co-occur with a public health intervention, the direct effect of said intervention on arrests may be smaller than what we actually model.

## II. Methods for Estimating Effect Sizes of Intervention

Outcomes and the associated effect sizes are collected during the literature review for the intervention.

### a. Utilizing effect sizes

Utilization of effect sizes varies by intervention. In general, effect sizes are utilized in three ways. We begin with the most preferred method and proceed to alternative methods as dictated by the source in the literature or by the available baseline data for the eligible population. Ranked from most preferred to least preferred effect sizes, they

are: (1) Weighted Standardized Effect Sizes based on Cohen's d or the D-Cox transformation (2) Relative Risk Reductions utilized as a percentage decrease (3) Absolute Risk Reduction utilized as a change in outcome units.

We perform literature reviews for the intervention of interest to obtain the effect sizes associated with outcomes of interest. We use a modified approach similar to that developed by the Community Guide. Search terms are used to obtain as many relevant literature resources as possible, and then the studies are analyzed to determine whether they 1) evaluate a similar intervention, 2) use a strong study design, and 3) measure outcomes of interest to the model.

This process begins by analyzing the literature used by the clearinghouse that was responsible for our preliminary literature review finding the intervention. From those studies, we obtain a clearer picture of the landscape of the literature and use the meta-analytic methods to expand the literature base from which we draw to obtain the relative risk reductions.

Once the studies are cataloged, we extract the relevant information provided based on our conceptual map leading to outcomes of interest. We take the absolute difference in means, the group means for different study conditions, variance, standard deviation, 95% confidence interval, etc. This information is organized into a spreadsheet by the type of outcome monitored so that it can be combined to obtain one effect size for each portion of the model. The effects are combined across studies with the same outcome by inverse variance weighting the effects. The variance is either reported or calculated from the 95% confidence interval.

In the event that one outcome is measured across multiple time periods, we plot each measurement against time to monitor whether the effect increases or decreases with more time. This plays an important role in the distribution of effects over years. When the model runs and we distribute the cost offsets across future years, we use this information to distribute the savings.

When there are intermediate outcomes, such as hospitalizations, we can use additional effect sizes from the literature to connect those test scores to our outcomes of interest– in this case, high school graduation. However, in cases where that outcome is later measured directly, we opt for the directly measured outcome rather than attempting to model it out. Additionally, the extant literature concerning FTS is scant. There is evidence of willingness to use the strips and potential behavior modifications but little evidence on the direct changes in overdose risk.

Additionally, the effect on homelessness in studies is taken from a single study with a pre-post design (as opposed to the ideal of an RCT) conducted in Northern California. The effect modeled here is somewhat larger than that found for Housing First programs. If we apply the Housing First estimate in its place, the overall impact is about 70% that of

what we have modeled here. Based on this study, at 6 months, most of the population no longer experiencing homelessness are likely still accessing housing services. However, at 18 months, the effect on reduced homelessness is persistent, with much of this population moving into more stable housing.

### *i. Standardized Effect Sizes*

It is important to ascertain the baseline conditions for the population to be treated by the intervention. From that baseline, we apply the effects to determine the overall impacts of that program or policy. As described in the estimation of effect sizes, the form of the baseline data determines how the effect sizes are operationalized.

When the data provides information on dichotomous variables, proportional rates, or a continuous variable for which the distribution and standard deviation of the measure is available, we utilized the standardized effect size from Cohen's d or the D-Cox estimation. This application yields a relative risk reduction, but it is dependent on the baseline rates for the eligible population within the jurisdiction of interest. This means that if we have baseline rates, say for crime, by zip code, then the relative risk reduction will similarly vary by zip code. This is an advantage over utilizing one average relative risk reduction across the entire eligible population. This methodology also allows us to compare similar, but not identical outcomes to establish one effect size. In the case of Universal Pre-K, we were able to work in terms of these preferred effect sizes for all outcomes. When utilizing effect sizes, the equation to calculate monetary returns from the effects on crime, health, and education is:

*Continuous Measures*

cost offset = (standardized effect size) * (standard deviation of the baseline rate) * (take-up rate) * (eligible population) * (cost per unit)

averted units = (standardized effect size) * (standard deviation of the baseline rate) * (take-up rate) * (eligible population)

*Dichotomous Measures*

cost offset = *(take-up rate) * (eligible population) * (cost per unit)

averted units =  * (take-up rate) * (eligible population)

## II. Baseline Data

Once we have selected an intervention to model, we then select a jurisdiction. The Win-Win Project can model the intervention for almost all geographic areas if the data is available, but we

typically model at the city, county or state level. We provide results by sub-geographies within that area, either zip codes, school districts, service planning areas, or other small areas of interest. To model the intervention for a specific jurisdiction of interest, we must collect baseline demographic and other relevant data to apply the effect sizes to in order to estimate the impact of the intervention for that population.

In order to collect baseline data, we must first define the eligible population for the intervention so we can collect baseline data for this population.

### a. Defining the eligible population

One important factor in estimating the model is determining who will receive the intervention. The first portion of this determination is to understand who is eligible to receive the intervention under the defined scope. For eligibility requirements, we look to the literature and base the restrictions off of the programs evaluated in the evidence base.

It is important to match the eligible population to those programs evaluated in the literature. If the population to which the effect sizes are applied is wildly different than the population studied, the external validity of the estimates is called into question. A program may be very effective in a low-income, urban community, but may not have the same effect size in an affluent suburban community. If the model is intended to demonstrate the impact on a group outside of the population studied in the literature, the researchers will indicate the direction of the impact they expect to see on the effect sizes.

We also further broke the population for the overall jurisdiction down into the following race/ethnicity groups to examine the programs effect on health equity: white, non-Latinx; black, non-Latinx; Latinx; and other/multiple race, non-Latinx.

### b. Collecting data

Baseline data are collected from various sources at the geographic level of interest. For most models, the target level is the zip code or other small area of interest. When data is unavailable for the smaller geographic areas, we look to larger jurisdictions to obtain the data: neighborhood, city, county, state, region, nation. Many of the demographic data come from the US Census bureau, and the more localized data come from local health, education or criminal justice departments.

As is the case for the population, it is beneficial to match the baseline data to the population, but not always possible. For example, recovery housing typically targets the population experiencing homelessness, but much of the data for outcomes like arrests, employment, and drug use is not available for this group at the population level. In these instances, we either use estimates provided in the original studies, or use data for the jurisdiction's overall population, with the acknowledgement that either approach will be subject to measurement error.

### c. Process of re-examining baseline data and collecting appropriate measures to fit with the effect sizes

After collecting all baseline data, we re-examine the data and confirm that the measures fit with the available effect sizes that have been identified from the literature review. We aim to search for measures at the smallest geographic level that we plan to model, whether it is zip code, school district or other sub-geography. However, if data at the smaller area is unavailable, we look to collect data at the city, county or state level to use as proxy measures.

### d. Calculating take-up rate

The take-up rate is important in calculating the overall effect of an intervention. It will not impact the overall percentage return on investment, but it will affect the amount required to invest in the treated population and the amount of total savings. The take-up rate is estimated from a variety of sources. In some cases, we are able to work directly with the end consumers to utilize a take-up rate that they feel most appropriately represents their community. Another option is to analyze the literature to determine the take-up rate among similar programs that have been studied. Additionally, there is sometimes evidence within a community that quantifies the demonstrated up-take rate for a given program.

In the case of opioid use disorder, it is highly likely that take-up exceeds county capacity to provide intervention resources. Therefore, we used our best estimate of county capacity, based on conversations with staff from LA County Department of Public Health.

### e. Imputation of data points and distributions

***f.*** With the exception of high school graduation and arrest measures, the different baseline rates for each grouping of race/ethnicity and income level were imputed by collecting related data for each of these dimensions individually and then using the “Goal Seek” function in Microsoft Excel to ensure risk ratios for the groups lined up properly.

## III. Development of the model

### a. Organization

Models are organized into the following sections – 1) General Baseline data (with a cell for users to select their geography of preference ; 2) Directly Modeled Outcomes (including monetization for a standard year, if applicable) ;  and 3) Indirectly Modeled Outcomes (including monetization for a standard year, if applicable). Within direct and indirect outcomes, they are generally sorted by health, education, or crime.

b. Monetization

*i. Standardized measures*

1. Inflation – Monetized measures are adjusted for general inflation to the year the model was constructed in. In the case of medical costs, we use an inflation index specific to Medical expenditures provided by the Bureau of Labor and Statistics.
2. Jurisdiction – Oftentimes cost estimates are not available for the local jurisdiction being modeled. In these cases, monetized measures are adjusted for jurisdiction using an adjustment factor taken from CMS called the Global Adjustment Factor (GAF).

*ii. Costs*

Costs are taken from the literature and converted to a per participant amount. This number is later multiplied by the modeled number of beneficiaries.

*iii. Local and State Savings*

Savings to state and local government per reduced felony and misdemeanor arrest are calculated using estimated arrest costs from the city or county. Marginal costs for incarceration were taken from a previous analysis on the subject.

Costs for treatment of opioid use disorder were extracted from an analysis of Healthcare Cost and Utilization Project (HCUP) data.

Costs for treatment of depression are taken from an analysis of National Health and Wellness Survey.

Costs for social services of the homeless population are taken from a report by the LA County government.

Buprenorphine-specific cost savings are estimated separately for time during treatment and the 6 month period following the program.

There is a small effect on child abuse and neglect for recovery housing that we use in cost savings estimation. Associated costs are taken from a report on the economic impact of child abuse and neglect.

c. Returns tab calculations

i. Medical inflation – We do not account for general inflation for estimates of returns in the future. However, since growth in medical expenditures typically outpaces inflation, we do estimate the difference between the medical inflation rate and the general inflation rate and apply it to all

sources of returns via reduced medical expenditures. This difference is 0.4%.

ii. Discount rate – Typical of this type of economic modeling, we apply a discount rate of 3.00% to future years of costs and returns.

iii. Timing of Outcomes – Outcomes are sequenced such that the impact of a program matches what is observed in the literature. Out of concern for relapse among participants, we restrict savings to the year after they were involved in the program – this may make impact estimates more conservative than what would actually be observed.

iv. Return on Investment (ROI) – This is calculated by summing the costs of the program over the two-year period for the eligible population that participates, as well as the individual benefits detailed above. The total benefits to local and state governments are divided by the costs of the program. The measure is constructed in such a way that a value of $1.00 corresponds to the program breaking even over two years, although as mentioned above most of the savings occur within one or two years. Reductions in child abuse and neglect is the notable exception.