

Economic analysis of options for helping people experiencing homelessness in Sacramento

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Abstract

The research question for this analysis was, “What are the costs and outcomes of different options for helping a hypothetical cohort of 2,000 persistently homeless people in Sacramento?” The Markov model for the economic analysis had a one-month cycle and captured a variety of costs and outcomes over a five-year time horizon. Under the base case assumptions, an integrated care option incurs \$70 million more in building and \$77 million more in staff costs relative to the current status option. However, the analysis predicts that the integrated care option will reduce ED costs by \$20 million, inpatient costs by \$45 million, victimization and criminalization costs by \$17 million, and other costs by \$14 million. Overall, the results suggest an integrated care option will cost \$51 million more than the current status option over a five-year time horizon, while incurring over 25,000 less emergency department visits, 16,000 fewer inpatient days, and 38 fewer deaths. Thus, the results suggest there is a potential win/win option for helping people experiencing persistent homelessness in Sacramento. Nichols and Taylor (2018) argue that a properly governed, collaborative approach to financing could enable self-interested health stakeholders to earn a financial return on sustainable social determinants investments. For example, our results suggest that the savings outweigh the variable staff costs; consequently, repayment from the surplus over time could be used to pay down debt of building/fixed costs. Based on Nichols and Taylor’s collaborative approach to financing and our analysis, there is an economic argument supporting options for helping people experiencing homelessness in Sacramento.

Main messages

- Over the 5-year time horizon for the economic analysis, an integrated care option (ICO) or a hub and spoke option (HSO) would require nearly \$150 million more in building and staff costs relative to the current status option (CSO). These investments allow for substantial reductions in other costs including reduced ED costs (by \$20 million), inpatient costs (by \$45 million), victimization and criminalization costs (by \$17 million), and other costs (by \$14 million). Overall, the results suggest ICO will cost \$51 million more than CSO over a five-year time horizon. HSO, with higher building costs because of multiple sites, features similar tradeoffs.
- Over the 5-year time horizon, ICO and HSO also show potential for gains in key outcomes. The economic analysis suggests that for a hypothetical cohort of 2,000 persistently homeless people in Sacramento, ICO could lead to reductions in emergency department visits (25,000 fewer), inpatient days (16,000 fewer), and deaths (38 fewer). HSO, with lower effectiveness (because of greater distance to services), features similar outcomes.
- Nichols and Taylor (2018) argue that the benefits from investments like ICO or HSO cannot be easily limited to only those who pay for them. Consequently, there is a tendency to underinvest in these options from a societal perspective because the benefits can accrue to many after the costs are borne by a few. Nichols and Taylor (2018) suggest a properly governed, collaborative approach to financing could enable all health stakeholders to enjoy benefits from on sustainable social determinants investments (e.g., like an ICO or HSO). A key next step would be to begin a collaborative approach to financing so that all stakeholders may benefit from supporting options for helping people experiencing homelessness in Sacramento.

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1 Background

During 2019, an estimated 10,000 people in Sacramento County experienced homelessness, and the 2019 Sacramento Point-In-Time Count found that on any given night, 5,570 people are homeless—a 19% increase since 2017 (Melnikow et al., 2020). Of those, about 1,600 are classified as chronically homeless, defined as being without shelter for 12+ months and having a disabling condition such as a physical health condition, mental health condition, and/or substance use disorder (SUD); nearly 4,000 are unsheltered (Melnikow et al., 2020).

Almost 2,000 (53%) individuals enrolled in the county’s Homeless Management Information System report two or more health-related conditions (Melnikow et al., 2020). These conditions are exacerbated by the lack of housing where continued exposure to the elements and unsafe environments prevent proper healing (Melnikow et al., 2020). The approximately 800 emergency shelter beds in Sacramento are insufficient to meet the demand for shelter. Supportive housing is in short supply; numbers of inpatient psychiatric and residential drug treatment beds are insufficient (Melnikow et al., 2020).

Melnikow et al. (2020) confirmed these findings with Sacramento stakeholders (35 representatives from health systems, social service providers, people with lived experience, community clinics, and local government) who described the primary challenges as: 1) Insufficient capacity in multiple intervention domains; and 2) Limited communication or coordination between siloed services. Their recent report “Integrating Care for People Experiencing Homelessness: A Focus on Sacramento County” made the following recommendations for Sacramento:

- Expand capacity for shelters, supportive housing, and Board and Care facilities;
- Expand capacity for inpatient, residential, and intensive outpatient care of serious mental illness (SMI) and residential substance use treatment for people experiencing homelessness;
- Coordinate care and housing services for individuals with SMI and/or SUD being diverted or released from jail;
- Increase evidence-based residential treatment programs for people with methamphetamine use disorders;
- Co-locate integrated services linked to expanded housing capacity on site or elsewhere in the Sacramento community to improve care and support transition into long-term housing; and
- Rigorously evaluate integrated care programs to assess their effectiveness and cost-effectiveness.

2 Introduction

This report summarizes preliminary results from the economic analysis of three options for helping 2,000 people experiencing persistent homelessness in Sacramento:

1. the current status option (CSO);
2. an integrated care option (ICO); and
3. a hub and spoke option (HSO).

The CSO denotes “usual care” or “standard practice”. In contrast, both ICO and HSO include building a Federally Qualified Health Center (FQHC), Residential Treatment Facilities and an Administrative center in one location. However, they differ in that ICO has Emergency Shelter and Supportive Housing on-site while HSO has these features off-site at other locations in the community. The economic analysis uses Sacramento data from the Homeless Management Information System (HMIS) as well as the report “Using Pay for Success to improve outcomes for the persistently homeless in Sacramento” by Segal and colleagues (2018). In addition, the building cost estimates come from a detailed analysis by Stantec. The cost and outcome estimates convey the potential value of targeted investments in housing, services and healthcare.

3 Methods

The economic analysis of options to help a hypothetical cohort of 2,000 individuals experiencing persistent homelessness considers three options:

1. Current Status Option (CSO)
2. Integrated Care Option (ICO)
3. Hub and Spoke Option (HSO)

The ICO and HSO invest in increased capacity through more treatment facilities and housing. The construction estimate for both options includes:

- **Supportive Housing:** 300 beds consisting of small studios and a few 1- & 2-bedroom units
- **Emergency Shelter:** 100 beds in bunk type rooms; 25 Camp spots; and 25 Parking spaces
- **FQHC Outpatient Clinical Services:** A Crisis Stabilization Unit, Primary Care with Integrated Behavioral Health, and Outpatient Clinical Services for SMI and Substance Use Disorder/Medication-Assisted Treatment (SUD/MAT)
- **Residential Treatment:** 64 Beds for Mental Health; 30 Beds for SUD
- **An Administrative Hub**

Analysis by Stantec, an engineering and architectural firm, estimated that the cost of building the ICO between \$194 million and \$255 million and (see Table 1).

Table 1. General Costs

Types of cost	Upper End Estimate	Lower End Estimate
<i>Included</i>		
Construction	\$128 million	\$97 million
Other Project	\$84 million	\$64 million
Contingency	\$42 million	\$32 million
<i>Not included in this estimate</i>		
25-acres of Real Estate	\$0*	\$0*
800 Offsite Beds	\$0*	\$0*
Operating costs	\$0*	\$0*
Approximate Total**	\$255 million	\$194 million

*Note: Actual values may differ from \$0, which is used as a placeholder. ** Totals are approximate due to rounding.

In addition, operating the ICO requires staff, including case managers, counselors, therapists, psychiatrists, medical assistants, pharmacists, physicians, and security personnel, amongst others.

3.1 Model structure, costs, and outcomes.

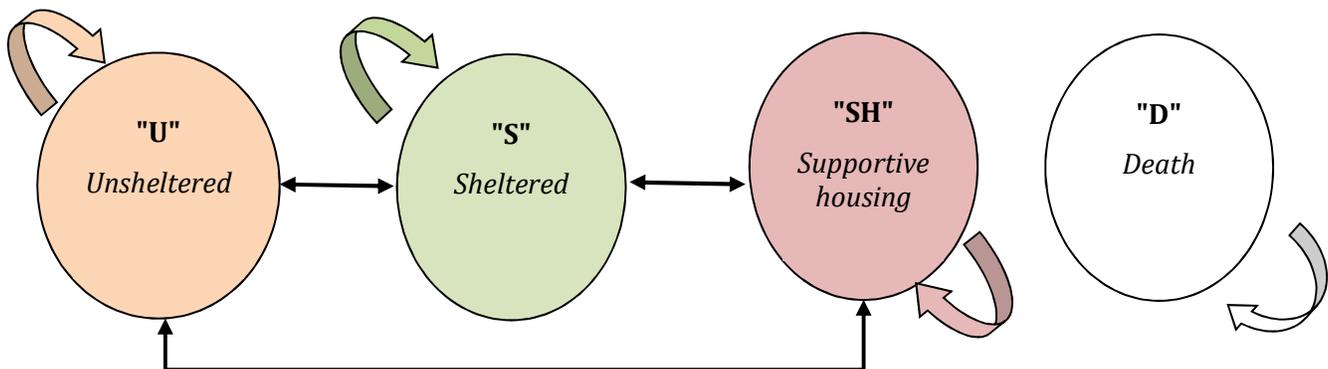
To explore the potential costs and outcomes of the different options, an economic model was designed to produce estimates (See the Appendix for more details). The model evaluates the costs and outcomes of the three options (i.e., CSO, ICO and HSO) over a five-year period, and evaluates costs and outcomes for each month. The economic analysis model consists of five mutually exclusive states (see Figure 1).

1. Unsheltered (U)
2. Shelter (S)
3. Supportive housing – low cost (L)
4. Supportive housing – moderate cost (M)
5. Death (D)

The decision to distinguish between low cost (L) and moderate cost (M) supportive housing allows the economic analysis to recognize important heterogeneity. The Stantec analysis suggested that the square footage requirements (and thus building costs) differ for these two types of housing. For example, 100 beds of M housing account for nearly 60,000 square feet in the overall design, compared to approximately 90,000 square feet for 200 beds of L housing. Secondly, quarterly data analyzed in-house by Sacramento Steps Forward (a non-profit organization committed to ending homelessness) provided evidence suggesting that the probability of transitioning from L or M to other states differs between the options (as does the probability of transitioning from other states into L or M). Thus, the costs and the transition probabilities differ by L or M. The economic analysis acknowledges the different cost data and different transition probability estimates with separate supportive housing states.

Over time, individuals transition between states (indicated by O's in Figure 1). For example, individuals in the unsheltered state (i.e., U) may continue to be unsheltered, or transition to shelter (S), supportive housing (SH composed of L and M), or death (D). The arrows in Figure 1 outline the possible transitions. It is important to note that the structure shown in Figure 1 does *not* require individuals to move sequentially. For simplicity, Figure 1 does not include arrows from each of the U, S, L, and M states to D. Each state is associated with a different probability of transitioning and a unique profile of costs and outcomes. For example, individuals in M are less likely than those in U to die. In addition, individuals in U have more inpatient days, ED visits, and associated costs than those in supportive housing.

Figure 1. Model structure¹



Importantly, the economic analysis accounts for the “bed capacity” of each state; this capacity varies depending upon the option being evaluated (e.g., CSO vs. ICO). When beds fill in one state, “excess” individuals go to a different state with available capacity. For example, if M becomes full (i.e., reaches capacity), individuals are allocated to L until it reaches capacity; subsequently, individuals are allocated to emergency shelter until S reaches capacity. Once the M, L, and S states are completely full, the remaining individuals are allocated to the U state which has unlimited capacity. Capacities for each of the housing states and options appear in Table 2. Additional S, L, and M capacity inputs for the ICO came from the specifications provided for the Stantec analysis. The sensitivity analysis described later explores the impact of increasing bed capacity.

¹ It is possible for people to transition to State D from any State in Figure 1.

Table 2. Base case capacity by state and option

State	CSO	ICO
U	Unlimited	Unlimited
S	500	744
T	0	200
P	0	100
D	Unlimited	Unlimited

The economic analysis spreads the building costs for the ICO and HSO over 50 years (i.e., the costs are amortized using a 5% discount rate). For the base case analysis, the ICO cost was assumed to be \$255 million (the upper end estimate), and the HSO was assumed to cost an additional 10%. Both assumptions were varied in detailed sensitivity and scenario analyses. The base case analysis uses five years' worth of the \$255 million costs for the economic model's five-year time horizon. The analysis attributes all costs over this five-year period to a study cohort of 2,000 individuals. This reflects an assumption that this cohort would use all available *capital* capacity.

The number and roles of staff required to operate the ICO were estimated using other comparable community models of care. Salaries for each role were estimated from the May 2019 Metropolitan and Nonmetropolitan Area Occupational Employment and Wage Estimates for Sacramento--Roseville--Arden-Arcade, CA with benefits added at a rate of 30% (See the Appendix for more details). It was assumed that two thirds (i.e., 67%) of staff costs were attributed to the study cohort which reflects an assumption that the ICO and HSO would be able to provide health and social services to more than the 2,000 individuals in this analysis.

3.2 Population

The economic analysis considers a hypothetical cohort of 2,000 persistently homeless individuals (individuals that have long-term challenges with homeless, are frequent utilizers of the County and City's services, and are highly vulnerable with at least two chronic conditions) in the Sacramento area, consisting of both high (n=250) and low (n=1,750) service utilizers. The analysis assumes this population consists of 70% unsheltered and 30% sheltered individuals based on data from the 2019 Point in Time Survey in Sacramento (Baiocchi et al., 2019). The cost profiles of high and low utilizers in the U and S states come from 2015/16 data estimating the annual cost of persistently homeless to Sacramento County and City public systems (Segal et al., 2018). Costs and outcomes for individuals in L and M come from several sources, including estimates from Sacramento data sources (Segal et al., 2018) and from the broader literature (Economic Roundtable, 2013).

3.3 Sensitivity analysis

Besides the base case analysis, we conducted nine additional analyses, representing different scenarios. Some scenarios only affect one option, but some affect both.

Table 3. Definition of alternate scenarios

Scenario	Description	Modification of the base case assumptions
Base Case	Default settings for the analysis	None
Reduced Effectiveness	50% less cost savings from investment	Housing and treatment is 50% as effective
Reduced Staff Costs	50% less staff costs	Staffing costs are only 33% (not 67%) for the study cohort

Scenario	Description	Modification of the base case assumptions
Increased Capacity	100 more beds	No-cost expansion from 100 to 200 beds
Improved S Death Rate	Death rate in S equals the L and M death rate	The sheltered (S) death rate no longer equals that of unsheltered (U). Instead, the death rate for S is comparable to that for L or M (supportive housing)
Lower End Building Cost	Lower end estimate for Building Cost	Assumes a \$194 Million building cost (lower end estimate)
Effectiveness S and U state @ 50%	50% less effectiveness for the S and U states for the ICO	Assumes that those in the U and S states have receive 50% less reductions in costs compared to the base case.
HSO building 20% premium	20% premium to build HSO compared to ICO	Base case assumes the HSO costs 10% more than the ICO to build – this scenario assumes that it costs 20% more.
HSO effectiveness 90%	Assumes effectiveness of HSO is 90% of the ICO	Base case assumes that the HSO is 95% as effective as the ICO – this scenario assumes it is 90% as effective as the ICO.

4 Results

The base case analysis results for the ICO and HSO appear in the sections below. As described above, all analyses consider a five-year time horizon in a cohort of 2,000 individuals experiencing persistent homelessness in Sacramento.

4.1 Integrated Care Option (ICO)

The results for the ICO are summarized in Table 4. The ICO is estimated to incur \$70 million more in building and \$77 million more in staff costs relative to the CSO. However, the ICO is estimated to reduce ED costs by \$20 million, inpatient costs by \$44 million, victimization and criminalization costs by \$17 million, and other costs by \$14 million. Overall, the analysis estimates the ICO will cost \$51 million more than the CSO over a five-year time horizon.

Table 4. Base case analysis of cost for CSO vs. ICO over a five-year time horizon

	CSO	ICO	Difference
Building	\$-	\$ 69,840,338	\$69,840,338
Staff	\$-	\$76,666,667	\$76,666,667
ED	\$57,254,592	\$ 36,968,079	\$(20,286,513)
Inpatient	\$229,018,369	\$184,274,247	\$(44,744,123)
Victimization and Criminalization	\$88,880,779	\$72,338,378	\$(16,542,401)
Other	\$120,281,808	\$105,871,715	\$(14,410,092)
Total	\$495,435,548	\$545,959,423	\$50,523,875

Over the five-year period under the CSO, the economic model estimates that the study cohort incurs over 80,000 ED visits, 81,000 inpatient days, and 316 deaths. The ICO investment results in over 25,000 fewer ED visits, nearly 16,000 fewer inpatient days, and 38 fewer deaths (see Table 5).

Table 5. Base case analysis of selected outcomes for CSO vs. ICO over a five-year time horizon²

	CSO	ICO	Difference
ED Visits	80,834	55,354	(25,480)
Inpatient Days	81,875	65,894	(15,982)
Deaths	316	279	(38)

4.2 Hub and Spoke Option (HSO)

The results for the HSO are summarized in Table 6. The HSO is estimated to incur \$77 million more in building and \$77 million more in staff costs relative to the CSO. However, the HSO is estimated to reduce ED costs by \$20 million, inpatient costs by \$43 million, victimization and criminalization costs by \$16 million, and other costs by \$13 million. Overall, the analysis estimates the HSO will cost \$63 million more than the CSO over a five-year time horizon.

Table 6. Base case analysis of cost for CSO vs. HSO over a five-year time horizon

	CSO	HSO	Difference
Building	\$-	\$76,824,372	\$76,824,372
Staff	\$-	\$76,666,667	\$76,666,667
ED	\$57,254,592	\$37,967,826	\$(19,286,766)
Inpatient	\$229,018,369	\$186,453,139	\$(42,565,230)
Victimization and Criminalization	\$88,880,779	\$73,207,344	\$(15,673,435)
Other	\$120,281,808	\$106,856,326	\$(13,425,481)
Total	\$495,435,548	\$557,975,674	\$62,540,126

Over the five-year period under the HSO, the economic model estimates that the ICO investment results in nearly 24,000 fewer ED visits, over 15,000 fewer inpatient days, and 38 fewer deaths (see Table 7).

Table 7. Base case analysis of selected outcomes for CSO vs. HSO over a five-year time horizon

	CSO	HSO	Difference
ED Visits	80,834	56,855	(23,979)
Inpatient Days	81,875	66,674	(15,201)
Deaths	316	279	(38)

4.3 Sensitivity analysis

Table 8 summarizes results of the scenario analyses for the ICO. Briefly:

² These estimates should be viewed in light of the following circumstances. Currently, the site is unknown. No design has been completed; therefore, this analysis is only for conceptual level review for generalized budgeting for a hypothetical low risk site. Also, actual design and full incorporation of actual site conditions and local/state/federal requirements will need to be evaluated during the Due Diligence phase to establish Onsite and Offsite infrastructure cost and capacities. In addition, reliance on these generalized hypothetical budgetary cost values are at the user's discretion and risk. There is no guarantee as to the accuracy of these, or any, budgetary numbers without completing final design and formal estimation. Lastly, these numbers do not include demolition, earthwork, or unknown subsurface conditions, including geotechnical and environmental considerations.

Economic analysis of options for helping people experiencing homelessness:

- *Reduced Effectiveness:* When housing and treatment are half as effective as the base case, the ICO would cost an additional \$50 million relative to CSO (a \$100 million difference vs. a \$50 million difference). The reduced effectiveness means a smaller reduction in ED visits (10,000 instead of 25,000) and a smaller reduction in Inpatient days (8,000 instead of 16,000).
- *Reduced Staff Costs.* Attributing a third of staff costs to the study cohort (as opposed to two thirds) decreased the ICO's incremental costs to \$12 million (vs. \$50 million in the base case).
- *Increased Moderate Cost Housing Capacity.* A no-cost increase of M capacity from 100 to 200 decreased the incremental costs of the ICO to \$45 million (vs. \$50 million in the base case) and resulted in larger reductions in ED visits (27,000 instead of 25,000) and hospitalizations (16,500 instead of 16,000) relative to CSO.
- *Improved death rate in S state.* Assuming those in Shelter (i.e., state S) had a death rate like those in L and M states resulted in 51 fewer deaths for ICO relative to CSO (compared to 38 in the base case).
- *Lower End Building Cost.* If ICO building costs were \$194 million, rather than \$255 million (as in the base case) resulted in an incremental cost estimate of \$24 million for ICO relative to the CSO (vs. \$50 million in the base case).
- *Effectiveness S and U state @ 50%.* When the S and U states were assumed to be half as effective at reducing costs compared to the base case, the ICO would cost about \$40 million more relative to the CSO (a \$90 million difference vs. a \$50 million difference).

Table 8. Sensitivity analysis with alternate scenarios for the ICO

Scenario	Cost Category	CSO	ICO	Difference
<i>Base Case</i>	Costs	\$495,435,548	\$545,959,423	\$50,523,875
	ED Visits	80,834	55,354	(25,480)
	Inpatient Days	81,875	65,894	(15,982)
	Deaths	316	279	(38)
<i>Reduced effectiveness</i>	Costs	\$495,435,548	\$596,281,596	\$100,846,048
	ED Visits	80,834	70,364	(10,470)
	Inpatient Days	81,875	73,702	(8,174)
	Deaths	316	279	(38)
<i>Reduced staff costs</i>	Costs	\$495,435,548	\$507,626,089	\$12,190,542
	ED Visits	80,834	55,354	(25,480)
	Inpatient Days	81,875	65,894	(15,982)
	Deaths	316	279	(38)
<i>Increased M capacity</i>	Costs	\$495,435,548	\$540,031,737	\$44,596,189
	ED Visits	80,834	53,410	(27,424)
	Inpatient Days	81,875	65,285	(16,590)
	Deaths	316	266	(50)
<i>Improved Death Rate in S State</i>	Costs	\$503,489,564	\$554,401,773	\$50,912,209
	ED Visits	82,313	56,646	(25,667)
	Inpatient Days	83,373	67,305	(16,068)
	Deaths	254	202	(51)
<i>Lower building cost estimate</i>	Costs	\$495,435,548	\$529,252,518	\$33,816,971
	ED Visits	80,834	55,354	(25,480)
	Inpatient Days	81,875	65,894	(15,982)
	Deaths	316	279	(38)
<i>Effectiveness S and U state @ 50%</i>	Costs	\$495,435,548	\$585,919,322	\$90,483,775
	ED Visits	80,834	66,819	(14,015)
	Inpatient Days	81,875	71,857	(10,018)
	Deaths	316	279	(38)

Table 9 summarizes results of two scenario analyses for the HSO. Briefly:

- *HSO building 20% premium.* When the premium to build the HSO is assumed to be 20% (compared to 10% in the base case), the HSO would cost about \$7 million more (a \$70 million difference vs. a \$63 million difference).
- *HSO effectiveness 90%.* When the HSO is assumed to have 90% effectiveness relative to the ICO (compared to 95% in the base case), the HSO's incremental costs increase to \$68 million (vs. \$63 million in the base case).

Table 9. Sensitivity analysis with alternate scenarios for the HSO

Scenario	Cost Category	CSO	HSO	Difference
<i>Base Case</i>	Costs	\$495,435,548	\$557,975,674	\$62,540,126
	ED Visits	80,834	56,855	(23,979)
	Inpatient Days	81,875	66,674	(15,201)
	Deaths	316	279	(38)
<i>HSO building 20% premium</i>	Costs	\$495,435,548	\$564,959,708	\$69,524,160
	ED Visits	80,834	56,855	(23,979)
	Inpatient Days	81,875	66,674	(15,201)
	Deaths	316	279	(38)
<i>HSO effectiveness 90%</i>	Costs	\$495,435,548	\$563,007,891	\$67,572,343
	ED Visits	80,834	58,356	(22,478)
	Inpatient Days	81,875	67,455	(14,420)
	Deaths	316	279	(38)

5 Discussion

The economic analysis modeled three options for helping a hypothetical cohort of 2,000 people who are persistently homeless. The five-year results for the base case suggest that the cost increase is driven by the building and staff costs. These two cost categories generate increased costs of approximately \$146 million, comparing ICO to CSO. However, this cost increase is offset by more than \$96 million in cost reductions associated with ED visits, inpatient days, criminal justice, victimization, and other costs. As a result, the base case analysis estimates an overall *net* cost increase of nearly \$50 million for ICO vs. CSO (and \$63 million for HSO vs. CSO).

An important outcome that was not “monetarized” was the estimated 38 lives saved. Viewing the mortality outcome as part of a cost-effectiveness analysis, the extra \$50 million for the ICO is associated with 38 lives saved. This equates to approximately \$1.3 million per life saved. This is a “good deal” compared to estimates of the value of a human life used by the Environmental Protection Agency, Food and Drug Administration, or the Department of Transportation.

Many parameters influence the results of the economic analysis. We investigated several scenarios to determine the impact of varying key parameters. The results appeared sensitive to assumptions about the staff costs and housing availability. Assumptions about the effectiveness of treatment also affected the results. However, results seemed less sensitive to the assumption about the mortality rate in the sheltered state (i.e., S). Reducing the building costs from \$255 million to \$194 million reduced the cost increase from \$50 million to \$34 million.

There are limitations that accompany the results from this preliminary economic analysis. For example, the building cost estimate does not include expenditures related to real estate (25-acres in the case of ICO) or operating costs (e.g., gas, electric, sewage, maintenance, etc.). Also, the analysis did not investigate an “increased effectiveness” scenario. The base case results may be conservative, given the criminal justice cost and inpatient costs reductions. For the target population, having primary care on site can be very consequential, and the economic analysis may not reflect fully all this benefit. Furthermore, financial consideration for technological or data sharing infrastructure were not included. Additional limitations related to the building cost estimates (as noted in the Stantec analysis) are in Table 5.

6 Conclusion

This analysis suggests that housing and treating people who are persistently homeless and chronically ill might be a good investment. While there are substantial increases in building and staff costs, there are important cost offsets associated with reductions in ED visits, inpatient days, criminal justice, victimization, and other costs. The cost and outcome estimates convey the potential value from targeted investments in housing, services and healthcare.

Nichols and Taylor (2018) argue that underinvestment in social determinants of health reflects that such investments are “public goods”, and thus benefits cannot be efficiently limited to those who pay for them; this makes it more difficult to capture return on investment. They show how a properly governed, collaborative approach to financing could enable self-interested health stakeholders to earn a financial return on sustainable social determinants investments (e.g., like an ICO or HSO). Based on their collaborative approach to financing and our analysis, there is an economic argument supporting options for helping people experiencing homelessness in Sacramento.

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8 Appendix – Methods

This appendix provides details on the methods used in the economic analysis. This work explored the economic implications of two different housing and treatment facilities in Sacramento. These included the 1) integrated care option (ICO), which included all services in one centralized location, and 2) hub and spoke option (HSO) which included health services in one location, with housing set in various locations in the community.

8.1 Study population

This analysis focuses on the economic impacts in a cohort of 2,000 individuals experiencing persistent homelessness in Sacramento. Data for this cohort come in large part from a 2018 report published by Social Finance Inc. which sought to understand the costs of persistent homelessness in Sacramento. This work, conducted with the support from County and City partners, focused on a cohort of 250 of the highest utilizers of public services in the Sacramento area. The analysis in this report considered a broader cohort consisting of an additional 1,750 individuals experiencing persistent homelessness.

8.2 Markov model

8.2.1 Model structure

A Markov model was used to estimate the economic impacts of the ICO and HSO. A Markov model consists of several discrete and mutually exclusive states. The current analysis used a five state Markov model, which included the states: unsheltered, sheltered, supportive housing (both low and moderate cost), and death. High and low utilizers were costed separately. At baseline, 70% of each were assumed to be unsheltered, with the remaining 30% of the cohort being sheltered, based on data from the 2019 PIT survey from Sacramento.

8.2.2 Transition Probabilities

The hypothetical cohort in the Markov model transitions monthly between the five different states. Arrows in Figure 1 delineate how individuals may transition over time; however, the probability of transition between states varies. For example, the probability of someone in supportive housing dying is considerably lower than their probability of dying if unsheltered.

The probability of transitioning between the U, S, L, and M states was estimated from Sacramento HMIS data. Raw transition numbers from a three-month period in late 2019 were converted into monthly probabilities. In the economic analysis, the probability of transitioning was assumed to be the same over time and did not vary between the three policy options (CRO, HSO and ICO). This reflects the assumption that uptake of housing services is influenced primarily by available capacity (see following subsection). The probability of dying was derived from the Sacramento County Homeless Deaths Report which included death rates for the homeless and general population. These rates were converted to monthly probabilities. In the base case it was assumed that those in the U and S states would experience a probability of dying equivalent to the homeless population while those in the L and M states would experience a probability equivalent to the general population.

8.2.3 Capacity

Without accounting for the capacity available for housing in the ICO, HSO, and CSO, the Markov model may allocate more individuals to housing than is available. To address this, capacity limits were set for each of the states, which varied based on the model under investigation. Capacities by state are described below.

- Unsheltered: This state was assumed to have unlimited capacity in all models.

- Sheltered: This state was assumed to have a capacity of 500 spaces in the CSO. It was assumed that the ICO and HSO would increase capacity by approximately 244 each, resulting in a total capacity of 744 as stipulated per the Stantec analysis.
- Low cost housing: This state was assumed to have 0 capacity in the CSO. The ICO and HSO would assumed have capacity of 200 as stipulated per the Stantec analysis.
- Moderate cost housing: This state was assumed to have 0 capacity in the CSO. The ICO and HSO were assumed to have a capacity of 100 as stipulated per the Stantec analysis.

When the number of individuals allocated to a health state exceeded the available capacity, the excess individuals were reallocated to alternative states in the following order: P, T, S, U. Given that separate Markov models were used for high and low utilizers, the capacity was measured across both and allocated between high and low utilizers in a weighted fashion.

Costing

Unique monthly costs were estimated for each of the Markov states, models, and high and low utilizers. Estimates of CSO costs for high utilizers were derived from the Social Finance Inc. *Using Pay For Success To Improve Outcomes For The Persistently Homeless In Sacramento* report. This report estimated mean costs for the top 250 individuals experiencing persistent homelessness across several different cost categories, including: Shelter; Criminal justice; Victimization; Behavioral health; EMS transports; Other city/county. The mean cost estimate for high utilizers for 2016 was \$45,416. Study authors were contacted and provided an estimate of the mean costs the subsequent 1,750 persistently homeless individuals (i.e., the 251st to 2,000th most costly individuals in Sacramento). This group was termed low utilizers. The mean estimate for low utilizers for 2016 was \$20,360. There were two main limitations of these data for the current analysis. First, these figures do not include inpatient and emergency department (ED) costs. Secondly, the data used to provide these estimates consist of both sheltered and unsheltered individuals.

To address the first limitation, inpatient and ED costs were estimated. It is estimated that inpatient and ED costs account for approximately 57% of the total costs of persistently homeless individuals (Flaming et al., 2015) and that 80% of these costs are attributable to inpatient care, with the remaining 20% attributable to ED care (Economic Roundtable, 2013). Mean inpatient and emergency department costs for high and low utilizers were estimated based on these figures. This assumed that the proportions of a) inpatient/ED costs to overall costs, and b) inpatient costs to ED costs were the same between high and low utilizers.

To address the second limitation, the estimate costs for high and low utilizers were disaggregated for the unsheltered and sheltered states.

Effectiveness on costs

For the Moderate cost housing and Low cost housing state, the costs were estimated by multiplying the costs of the S state for the CSO (described above) by effectiveness estimates from the Social Finance Inc. *Using Pay For Success To Improve Outcomes For The Persistently Homeless In Sacramento* report. This report describes cost reductions for the following categories: Shelter (70%); Criminal justice (43%); Victimization (43%); Behavioral health (25%); EMS transports (25%); Other city/county (20%). Reductions for inpatient (43%) and ED (79%) costs were estimated from the Getting Home report (Economic Roundtable, 2013). The HSO was assumed to be 95% as effective as the ICO, and Table 3 and Figure A1 explore this assumption's impact on the results.

The ICO and HSO were assumed to result in reduced costs for those in shelter relative to those in the CSO due to increased access to health and social services. In the ICO, the shelter state was assumed to be 50% as effective as the supportive housing state, with cost reductions of: Shelter (35%); Criminal justice (22%); Victimization (22%); Behavioral health (13%); EMS transports (13%); Other city/county (10%). The HSO was

assumed to be 95% as effective as the ICO. The ICO and HSO were assumed to result in reduced costs for unsheltered individuals relative to those in the CSO due to increased access to health and social services. In the ICO, the shelter state was assumed to be 50% as effective as the shelter state, with cost reductions of: Shelter (17%); Criminal justice (10%); Victimization (10%); Behavioral health (6%); EMS transports (6%); Other city/county (5%). The HSO was assumed to be 95% as effective as the ICO.

Building costs

Building costs for the ICO were based on estimates from Stantec. Building costs were amortized over 50 years and discounted at 5% annually. The annual cost for the first five years was included in the model. Over this five-year period, all building costs were attributed to the sample of 2,000 individuals. This was a conservative assumption as ICO (e.g., space to administer health and social services) would invariably be used by those outside the cohort.

Staff costs

Staffing costs were estimated based on similar community facilities and standard provider ratios for the number of staff and roles required to operate the entire campus (health and housing). Annual wages were determined from the May 2019 Metropolitan and Nonmetropolitan Area Occupational Employment and Wage Estimates for Sacramento--Roseville--Arden-Arcade, CA. These estimates are calculated with data collected from employers in all industry sectors in Sacramento--Roseville--Arden-Arcade, CA, a California metropolitan statistical area. The data are available from the U.S. Bureau of Labor Statistics. Benefits were assumed to be 30% of annual wages. Staff salaries (wages + benefits) were aggregated, and two-thirds of staff costs were included in the model (i.e., were assumed to be used by the 2,000 individuals in the model).

Figure A1. Two-way sensitivity analysis exploring the impact of building costs and effectiveness on incremental costs of ICO compared to CSO

