

The Economics of Proactive Smoking Cessation Treatment for Individuals with Serious Mental Illness and/or Substance Use Disorder in the Medicaid Population

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Abstract

Purpose

Smoking cessation programs have the potential to improve individual health and productivity as well as reduce future healthcare spending. Improving health and reducing costs are key priorities as the most recent estimates suggest life expectancy is declining for younger Americans, and state governments are recovering from their worst financial crises since the Great Recession. The purpose of this analysis is to estimate the economic impact of proactively providing smoking cessation treatment through Kansas Medicaid for a population of adults with particularly high smoking rates and expected healthcare expenditures—those with severe mental illness and/or a substance use disorder.

Method

Direct program costs are calculated based on treatment costs adjusted for the probability of successful smoking cessation and the characteristics and size of the target population. Reductions in expected profits for local retailers and state tax revenue from cigarette sales are also included as direct program costs. Estimated direct benefits of proactive smoking cessation treatment include reduced healthcare spending, increased worker productivity, and longer life expectancy for the former smoker as well as reductions in secondhand smoke exposure for others. The net 2015 direct economic impact from proactive smoking cessation treatment is calculated as the difference between economic benefits and costs. Direct effects are run through a state-specific economic impact model to assess the indirect and induced effects on the Kansas economy and generate total annual net economic impacts (direct plus indirect and induced effects in 2015 dollars).

Results

It would cost an estimated \$51 million to provide proactive smoking cessation treatment to all adult Kansas Medicaid beneficiaries with severe mental illness and/or substance use disorder. This estimated program cost is less than the estimated \$66 million lost to the state economy due to smoking in the target population, resulting in a net direct economic benefit of \$15 million. This direct economic impact generates an additional \$14 million in indirect and induced economic activity for a total economic gain of \$29 million or \$1.57 for every \$1.00 spent.

Conclusions

Proactive smoking cessation treatment for adult Medicaid beneficiaries with severe mental illness and/or substance use disorder generates gains for the state economy in addition to improving health for individuals who successfully quit smoking.

The health benefits of smoking cessation are well established¹ and there is a growing literature that details the potential for net economic gain when treatment leads to reductions in the number of smokers^{2,4}. The combined possibility of health benefits, reduced healthcare expenditures, and net economic gain is particularly appealing in light of recent estimates that suggest declining life expectancy⁵ and ongoing fiscal shortfalls in state government⁶. This analysis assesses the net economic effects of proactively providing smoking cessation services to the Kansas adult Medicaid beneficiaries with severe mental illness and/or substance use disorder (SMI/SUD). This focus is particularly timely given the continued projected increases in Medicaid spending⁶, higher medical expenses for smokers covered by Medicaid^{5,7} and higher smoking rates and intensity⁸ for the target population.

Medicaid accounts for a large and growing share of state spending; in fiscal year 2015 Medicaid accounted for about one-quarter of state spending nationwide⁹ and 21% of state spending in Kansas¹⁰. Medicaid provisions for smoking cessation coverage for non-expansion populations are determined at the state level and not subject to the preventive care requirements for private insurance plans in the Affordable Care Act (ACA). ACA provisions require that compliant plans offer treatment including counseling and medications for at least two quit attempts per year at no additional cost to the patient¹¹. Coverage for smoking cessation in the Kansas Medicaid program, KanCare, includes one quit attempt per year with counseling only available to pregnant women¹². The evidence suggests that smokers are most likely to quit when counseling is combined with medication⁷ and that multiple attempts are needed to successfully quit smoking¹³.

The evidence is sufficient to conclude that tobacco cessation treatments are effective across a wide population of smokers, including those with significant mental and physical comorbidity.

Research from other states suggests a net savings from covering smoking cessation for adult Medicaid beneficiaries^{14,15}. This analysis builds on existing work by addressing a particularly vulnerable population within Medicaid, adults with severe mental illness and/or substance use disorder, and by assessing the economic impacts of proactively treating the target population. The baseline for the analysis is the status quo estimated loss to the Kansas economy (including healthcare expenditures, productivity losses, and the effects of secondhand smoke) attributable to smokers with SMI/SUD enrolled in Medicaid. The baseline is compared to a simulated intervention that includes comprehensive cessation treatment, repeated as needed for smoking cessation^{i,2,16}.

The economic impacts of the intervention are first calculated assuming that all cessation costs are paid using state dollars (i.e. no federal dollars in the form of Federal Medical Assistance Percentages (FMAP)). We relax this assumption in calculating an estimate of multiple treatment rounds with a federal matching rate of 54.75%. It should be noted that making multiple rounds of treatment available to all Medicaid enrollees and meeting adult vaccination requirements would result in a 1 percentage point increase in the matching rate for smoking cessation spending, but we do not include this enhanced match as our analysis is targeted to the SMI/SUD population.

Methods

This section provides a discussion of calculations, key assumptions, and data sources. Additional details and formulas can be found in the technical appendix. The analysis is conducted in several steps. First the target population is determined by first estimating the size of the adult Kansas

ⁱ Note that approximately 10% of participants will successfully quit after each successive round of treatment. The analysis is based on repeated treatment until successful cessation. Alternatively, one might limit the number of attempts so that maximum cessation spending equals the expected increase in medical spending for smokers vs. non-smokers, on average 4.32 attempts. The expected economic effects under this assumption range from \$15 million (no FMAP) to 42 million (FMAP on state spending).

SMI/SUD population and then determining what portion of these individuals are covered by Medicaid. The baseline, or no intervention, economic effects of smoking are estimated. Next the cost for proactively providing one round of treatment to the target population is assessed based on counseling plus the observed distribution of medication-based treatments for a 12-week round of treatment. Estimated treatment costs account for the probability of smoking cessation in any given round and we assume that multiple rounds of treatment are provided as needed. Direct economic savings from proactive treatment are calculated as the difference between the baseline cost of smoking and the expected costs of treatment. The economic impact software IMPLAN is used to estimate the indirect/induced economic effects (i.e. the “multiplier”) from proactive treatment to arrive at total economic impact, jobs created, and tax revenue. Estimates are adjusted for inflation as necessary so that all results are in 2015 dollars.ⁱⁱ Key parameters for each step are outlined below.

Target Population

The size of the target population is estimated using estimates of size of the Kansas SMI plus SUD population, adjusting for double counting due to co-occurring conditions, and applying a smoking rate based on estimates in the literature. The estimated Kansas SMI/SUD smoking population is divided by gender in order to establish the estimated number of men and pregnant and non-pregnant women. Estimates of pregnant women are adjusted for lower estimated pregnancy prevalence in the SMI/SUD population.

Target population estimates are further refined to establish the estimated number of Medicaid enrollees. National estimates of Medicaid coverage in the SMI/SUD population are adjusted for lower adult Medicaid coverage in KS. Estimates for pregnant women covered by Medicaid are

ⁱⁱ Inflation adjustments based on the Consumer Price Index Research Series.

calculated using estimates of the percent of KS births covered by Medicaid. An alternative method for estimating the affected population yields similar estimations and is described in the technical appendix..

Baseline Economic Effects

Baseline calculations are used to establish the effects of smoking in the SMI/SUD population on the Kansas economy compared to a scenario where each individual in the target population successfully quits smoking. Note that costs are calculated on differences between current and former smokers (not never smokers). Economic losses associated with smoking include medical expenditures, reduced worker productivity, and losses due to premature death. The economic benefits attributable to smoking include profits from retail sales that accrue to Kansas business owners and state tax revenue from the sale of cigarettes. Baseline estimates represent the net cost of smoking for the adult Medicaid SMI/SUD to the Kansas economy.

Economic Impact of Proactive Smoking Cessation Treatment in Kansas Medicaid

Costs of Treatment

Intervention costs for providing proactive treatment to all individuals in the adult Medicaid SMI/SUD population are based on a 12-week course of medication with 4 counseling sessions. We use the frequency of single treatment use reported in the literature to simulate expected treatment¹⁷, but note that actual treatment patterns will be determined jointly by providers and patients. Cost estimates are based on a single medication, and likely represent the highest possible cost to Medicaid as the additional cost of combining medications for treatment is more than offset by increases in the probability of successfully quitting.⁷ Prescription costs are based on generic brand pricing and over-the-counter medications are assigned the Walmart price. Estimates account for the expectation that

a small minority of participants will quit smoking after one round of treatment and that expected quit rates vary by treatment type.

Reduction in State Economic Losses Due to Smoking

As smokers become non-smokers we estimate the reduction in losses to the state economy. These returns include lower expected medical spending in Medicaid, higher worker productivity (adjusted for labor force participation rates^{18,19}), and reductions in smoking-related mortality. The net effect of the intervention is calculated as the increase in economic activity from smoking cessation minus the costs of providing the cessation treatment. .

Indirect and Induced Economic Impacts

Indirect and induced economic effects were estimated using the Kansas IMPLAN²⁰ (Impact Analysis for Planning) model. IMPLAN is widely used to estimate the economic impact of programs and policy changes. The model uses an input-output framework in which researchers can estimate how increases (or decreases) in an industry, such Medicaid savings that can be spent on other health care needs or increases in general household consumption from enhanced worker productivity, affect outputs in that industry and all other industries. The indirect and induced effects, which are often called multipliers, account for secondary economic impacts related smoking cessation²¹. *Indirect effects* represent changes in non-wage inputs within the same industry, such as additional Medicaid purchases from local medical suppliers who in turn rent more business space and purchase more office supplies and equipment. *Induced effects* represent the economic impact of changes in household income attributable to lower mortality and enhanced productivity. As household income rises, spending increases on goods (e.g., groceries) and services (e.g., daycare).

Results

Table 1 includes values for key parameters and population estimates (also see Appendix Figure 1).

The total estimated population for adult Kansas Medicaid SMI/SUD smokers is 16,102 people. The foundation for the population estimate is the Substance Abuse and Mental Health Services Administration (SAMHSA) estimate of 316,000 adults with SMI and/or SUD in Kansas.¹⁹ To avoid double counting, this number is adjusted for co-occurring conditions (the portion of individuals with both SMI and SUD) to arrive at 291,773 people. Using a mid-point from the literature, a smoking rate of 40% is used to arrive at 116,709 smokers in the target population. The total population is divided into groups of men (43,766 people) and women (72,943 people)ⁱⁱⁱ. Women are further divided into groups of non-pregnant (69,275) and pregnant (3,668) as expected smoking-related medical costs differ by gender and pregnancy status.^{iv}

The bottom portion of table 1 includes key parameters for estimating the number of individuals in the target population (116,709) who are covered by Medicaid (16,102). Estimated Medicaid enrollees include 14,451 men and non-pregnant women and 1,651 pregnant women.^v

Key estimation parameters and baseline economic effects of smoking in the Kansas adult Medicaid SMI/SUD population are presented in Table 2. After accounting for medical costs, productivity

ⁱⁱⁱ We also calculated impacts for 50% male 50% female given that the SUD population has a higher percent of males that would offset the higher female percent in the SMI population. This resulted in higher overall economic impact estimates, but we opted to focus on the more conservative estimates with higher female percent given that adult Medicaid recipients in Kansas are 62.5% women according to Kaiser Family Foundation Estimates: <https://www.kff.org/medicaid/state-indicator/distribution-by-gender-4/?currentTimeframe=0&sortModel=%7B%22colId%22:%22Location%22,%22sort%22:%22asc%22%7D>.

^{iv} The analysis likely underestimates total benefits as older children, who might be impacted by smoking, are not included in the analysis.

^v An alternative method for calculating the number of pregnant women from vital statistics data (adjusted for the share of SMI/SUD among adult women in Kansas, underreporting of smoking in birth certificate data, and higher smoking rates in the SMI/SUD population) yields a similar estimate of pregnant women (1,503 women).

losses (including secondhand smoke productivity losses²² and adjusting for lower labor force participation rates in the SMI/SUD population^{18,19}), losses from premature death, and neonatal medical costs for pregnant women, the estimated economic loss in the target population is \$4,730.58 per person or a total of about \$76 million.^{vi} This represents the economic losses associated with smoking that could be recouped by moving all current smokers in the target population to former smokers. Smoking in the target population leads to an estimated economic gain of about \$10 million in retail profits and state tax revenue. Thus, the net economic loss from smoking in the target population is just over \$66 million or about \$4,105 per smoker.

Results for the estimated costs of proactive smoking cessation treatment are presented in Table 3. Cost estimates are based on common prescription treatments (column 1). Weekly medication costs (column 2) are aggregated for a 12-week course of treatment (column 2). Four counseling sessions at \$20 per session (Medicaid reimbursement rate). Pregnant women receive only counseling sessions. Total treatment costs (medication + counseling) are included in column 5. Treatment costs per smoker (column 7) are adjusted for the expected quit rate (column 6) for each course of treatment. That is, treatment costs (average \$303.36 for men and non-pregnant women) are divided by expected quit rates for each type of treatment in order to estimate the cost of cessation (i.e. providing multiple rounds of treatment as needed). After adjusting for the frequency of use for each medication, the final column includes the weighed cost per smoker attributable to each cessation treatment. Thus, the economic impact estimates account for the use of higher cost treatment regimens at typical rates. Overall, the average cost of proactive treatment is estimated to be \$3,067.10 for men and non-pregnant women and \$4,000 per pregnant woman. The total estimated

^{vi} Note that child-related effects are likely underestimated as we include only neonatal costs, not avoided future costs including health care and educational services.

cost of proactive treatment is about \$51 million or \$3,162 per smoker. Note that this cost is significantly higher than the average 12-week treatment cost (about \$350 across all methods and participants and including both medication and counseling) because it is adjusted for expected quit rates. That is, treatment costs account for the expectation that only a fraction of those receiving treatment will successfully quit after each round.

Providing proactive smoking cessation treatment to each individual in the target population (16,102 Kansans) would yield a net economic gain of about \$15 million (\$66 million in potential economic gains from smoking cessation – treatment costs of \$51 million = \$15 in direct economic gains) or \$943 per former smoker. Table 4 includes estimates of the total economic impact of proactive smoking cessation treatment for the target population. The net gain in economic output of \$15.2 million generates an additional impact of \$13.8 million (\$867 per smoker) for a total economic impact of \$29 million (multiplier of 1.91 on direct impacts) or \$1,810 per smoker in the target population. Based on these estimates, each dollar spent on cessation treatment (\$51 million) generates an additional \$0.57 in economic activity. This additional economic activity is projected to lead to an additional 189 jobs in the Kansas economy and result in increased state tax revenues (e.g. state income tax on additional wage earnings) of about \$816,000.

Including federal matching dollars for cessation spending generates an economic impact of \$64 million. In general, the net benefit to the state of Kansas increases with the number of rounds of treatment provided and the amount of federal matching dollars that represent new funds available to the state of Kansas. Unrestricted rounds of treatment are cost effective in this model because the expected cost of treatment per person is less than the expected savings from smoking even using the maximum number of quit attempts estimated from published quit rates by treatment type.

Discussion

Rising healthcare costs and reductions in key indicators of health including life expectancy create an environment where the most promising policy initiative meet the dual objective of reducing costs and improving health outcomes. Previous research suggests that smoking cessation programs have the potential to be a cost effective way to improve health outcomes, increase worker productivity and reduce the utilization of healthcare services.^{1,14,15,23-26} Smoking rates are particularly high among individuals with SMI/SUD, many of whom receive health insurance through state and federally funded Medicaid programs. This analysis assesses whether providing smoking cessation services to adult Kansas Medicaid beneficiaries with SMI/SUD increases economic activity in Kansas. Results from the analysis demonstrate a net economic benefit from proactive smoking cessation treatment even with conservative estimates of the economic gains from smoking cessation and the inclusion of higher cost treatment alternatives.

Limitations

Estimates presented in this analysis are driven by assumptions about the target population, economic gains from smoking cessation, and the cost of treatment. A detailed outline of assumptions, calculations, and data sources can be found in the appendix. Additionally, the analysis is focused on a particular population and might not apply more generally to non-Medicaid eligible smokers with SMI/SUD or smokers in general. It should also be noted that the state of Kansas would be eligible for an enhanced Medicaid match on smoking cessation spending if smoking cessation services we aligned with requirements in the Affordable Care Act (ACA) and provided to

the standard Medicaid population. This enhanced match is not included in the analysis as the target population is more narrow than what is needed to qualify for the higher match.

Smoking cessation is likely to affect individuals and their families/friends in ways that are difficult to quantify. This study considers only the effects on medical spending, productivity, and reduced risk of premature death. Other benefits of smoking cessation might include improved quality of life and relationships, and improved health, educational, and economic outcomes for children born to women in target population.

As noted above, we assume that treatment consists of one medication and counseling. Evidence suggests that the combined use of more than one medication is more cost-effective⁷, but we did not have a reliable method for allocating patients across combined treatment types. Thus, our estimates likely reflect higher net treatment costs because the higher cost of combined treatments is more than offset by the increase in expected quit rates.

Conclusions

Proactively providing smoking cessation services to adult Kansas Medicaid enrollees with SMI/SUD leads to net increases in the Kansas economy in addition to health and quality of life benefits that accrue to former smokers. These economic gains are measured as net increases in economic output (\$29 million), increases in the number of jobs (189), and additional state tax revenue (\$816,000).

These gains account for smoking-related losses to retailers and probabilities of smoking cessation that range from 2.0 to 18.5 percent depending on treatment method.

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Table 1

Key Parameters for Estimating the Size of the adult Kansas SMI/SUD Medicaid population

Patient type	Percentage	Number
KS SMI/SUD Population^a		316,000
Adjust for co-occurring conditions	7.67% ^b	291,773
Number of smokers	40.00% ^c	116,709
Number of men	37.50% ^d	43,766
Number of women	62.50% ^d	72,943
Number of pregnant women	5.03% ^e	3,668
Number of non-pregnant women		69,275
Medicaid Coverage		
<i>Calculations for men and non-pregnant women</i>		113,041
National Medicaid coverage percent	19.00% ^f	21,478
Adjust for higher smoking rates in Kansas Medicaid	132.38% ^g	28,432
Adjust for lower adult enrollment in Kansas Medicaid	50.83% ^h	14,451
<i>Calculations for pregnant women</i>		3,668
Percent of births covered by Medicaid	34.00% ⁱ	1,247
Adjust for higher smoking rates in Kansas Medicaid	132.38% ^g	1,651
Total SMI/SUD Medicaid population^j		16,102

^a Number of individuals with SMI + number of individuals with SUD.¹⁹

^b Percent based on national estimates of 9.8 million individuals with SMI, 20.2 million individuals with SUD, and 2.3 million with SMI and SUD. Note that this differs from co-occurrence of SUD (20.2 million) and any mental illness (43.6 million), which is 12.4% or 7.9 million.²⁷

^c Estimates of the smoking rate for individuals with SMI range from 32.6% to 50%.²⁸⁻³⁰

^d NIMH estimates for the gender breakdown of individuals with SMI (implicit assumption that breakdown is similar for SUD).³¹ We also calculated impacts for 50% male 50% female given that the SUD population has a higher percent of males that would offset the higher female percent in the SMI population. This resulted in higher overall economic impact estimates, but we opted to focus on the more conservative estimates with higher female percent given that adult Medicaid recipients in Kansas are 62.5% women according to Kaiser Family Foundation Estimates: <https://www.kff.org/medicaid/state-indicator/distribution-by-gender-4/?currentTimeframe=0&sortModel=%7B%22colId%22:%22Location%22,%22sort%22:%22asc%22%7D>.

^e Please see technical appendix for detailed calculations.

^f National estimate for the percent of the SMI population covered by Medicaid.³²

^g Multiplier estimated by dividing the state average by the national average (times 100).³³

^h As noted above, national estimates suggest that about 19% of the SMI population is covered by Medicaid. However, adults generally comprise a much smaller percent of overall enrollment in KS (13.9% compared to 27.4%). Although it is possible that the SMI/SUD population is covered at rates closer to the national average, the adjustment is made to ensure conservative estimates of economic impacts.³⁴

ⁱ Estimated percent of Kansas births covered by Medicaid.³⁵

^j See Tables 1 and 2 in the Technical Appendix for a visual representation of population calculations.

Table 2

Net Economic Losses from Smoking in the SMI/SUD Medicaid Population for Kansas^a

Component	Percentage	Per person cost
Economic Losses per Smoker		
a. Per person additional medical cost for smokers in 2015 dollars ^b		\$2,926.95
b. Expected additional costs in medical spending for current vs former smokers ^c	19.00%	\$556.12
c. Adjust for higher per person spending in Medicaid ^d	236%	\$1,310.33
d. Estimated per person productivity cost of smoking ^e		\$612.58
e. Adjust for lower labor force participation rates in the SMI/SUD population ^f	50.00%	\$306.29
f. Estimated loss from ETS (as a % of estimated productivity losses) ^g	3.59%	\$21.99
g. Weighted average cost due to premature death (weighted by gender) ^h		\$2,858.87
h. Additional estimated neonatal cost per pregnant woman ⁱ		\$2,274.62
i. Average Economic Loss per Medicaid SMI/SUD Smoker [(c+e+f+g)+h*(% pregnant women)]		\$4,730.58
Total Economic Losses from Smoking in the Target Population [i x 16,102]		\$76,172,910
Economic Gains from Smoking in the Target Population: Retail Sales and State Tax Revenue^j		\$10,067,066
Net Economic Loss Due to Smoking in the KS Medicaid SMI/SUD Population		\$66,105,844

^a All dollar amounts in 2015 dollars. Adjusted using the CPI research series.

^b State-specific estimates of medical expenditures adjusted to 2015 dollars.²²

^c Ratio of former smoker medical spending to current smoker medical spending.³⁶

^d Medicaid accounts for about 45% of smoking-related medical spending and 19.1% of smokers.⁷

^e Difference in productivity costs for current and former smokers.²²

^f Adjust for the ratio of employment percent for the target population to the general adult employment rate.^{18,19}

^g Workplace loss in productivity due to secondhand smoke exposure.²²

^h Estimated costs for premature death by gender are adjusted for the distribution of gender in the target population to arrive at an overall average.²²

ⁱ Kansas-specific estimates of neonatal costs calculated in 2015 dollars using the Consumer Price Index, research series.³⁷

^j Kansas-specific estimates of retail sales mark-ups and state tax revenue.²²

Table 3: Estimated Smoking Cessation Treatment Costs for the Kansas Medicaid SMI/SUD Population

Medication	Cost per Week ^a	12 weeks	Counseling (4 sessions at \$20 per session) ^b	Total Treatment Cost	Effectiveness (successful quit percent) ^c	Cost per Smoker of Repeated Rounds of Treatment	Probability of Use ^d	Weighted Cost per Smoker of Repeated Rounds of Treatment ^e
Patch	13.00	156.00	80.00	236.00	0.080	2,950.00	0.40	1,180.00
Gum	10.90	130.80	80.00	210.80	0.080	2,635.00	0.15	395.25
Lozenge	17.10	205.20	80.00	285.20	0.080	3,565.00	0.15	534.75
Varenicline	36.80	441.60	80.00	521.60	0.185	2,819.46	0.19	535.70
Bupropion (gen only)	10.64	127.68	80.00	207.68	0.093	2,233.12	0.06	133.99
Spray	15.52	186.24	80.00	266.24	0.080	3,328.00	0.03	99.84
Inhaler	55.86	670.32	80.00	750.32	0.080	9,379.00	0.02	187.58
Weighted average cost (Men & Non-Pregnant Women)								3,067.10
Average cost (Pregnant Women)			80.00	80.00	0.020	4,000.00	1.00	4,000.00

^aCost per week of medication from Walmart (over-the-counter) and the CheapO medications link at PharmacyChecker.com (prescription drugs). Prices for generic drugs used where possible.

^b Counseling costs are based on the Kansas Medicaid reimbursement rate of \$20 per session.

^c Probability of quitting with counseling by Medication type.²²

^d Probability of use based on percentage of individuals who use cessation treatment with medication.¹⁷ Actual treatment to be jointly determined by patients and providers based on patient need.

^e Cost estimates are based on a single medication, and likely represent the highest possible cost to Medicaid as the additional cost of combining medications for treatment is more than offset by increases in the probability of successfully quitting.

Table 4: Estimated Economic Impacts in 2015 Dollars^a

Impact type	Direct effects ^b		Indirect/ induced effects ^c		Total impact	
	State Dollars Only	Federal Match	State Dollars Only	Federal Match	State Dollars Only	Federal Match
Output (\$ millions)	15.2	33.2	13.8	30.5	29.0	63.7
Job creation (number)	89	195	100	219	189	414
Employee compensation for jobs created (\$ millions)	6.9	12.1	3.7	11.1	10.6	23.3
State tax revenue (\$ thousands)					815.9	1,784
Per-Smoker Economic Impact (dollars)	943	2,062	867	1,897	1,810	3,958

^a Estimates represent the effects of providing proactive smoking cessation treatment for the adult SMI/SUD population in Kansa Medicaid. Both columns of estimates are based on repeated rounds of treatment. The first column of estimates assumes all cessation services are paid with state dollars (i.e. no additional money flows into the state because of the cessation spending). The second column estimates for each category include federal matching at the standard rate and assumes that the matching dollars represent new funds in the Kansas economy. Entries are rounded to the nearest million (output, employee compensation), number (job creation), thousand dollars (state tax revenue) or dollar (per-smoker impact). Row totals might differ due to rounding.

^b Direct effects based on authors' calculations of the net economic losses due to smoking minus the costs of providing smoking cessation treatment to the target population.

^c Indirect and induced effects calculated in IMPLAN using Kansas economic data.^{20,21}

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Technical Appendix

The Economics of Proactive Smoking Cessation Treatment for Individuals with Serious Mental Illness and/or Substance Use Disorder in the Medicaid Population

A Report Prepared for the National Alliance on Mental Illness- NAMI Kansas

Tami Gurley-Calvez, MA, PhD, and Christiadi, MA, PhD
2018

Population

1. The Kansas SMI and SUD Population

- a. Kansas residents with serious mental illness and/or substance use disorder. Kansas estimates from SAMHSA ¹⁹:

$$SMI + Alcohol Use Disorder + Other SUD = 87,000 + 174,000 + 55,000 = 316,000$$

- b. Adjust for co-occurring conditions using the calculated overlap from national SAMHSA estimates ²⁷:

Calculate adjustment factor: $(SMI \& SUD)/(SMI + SUD) = (2.3 \text{ million})/(9.8 \text{ million} + 20.2 \text{ million}) = 0.0767 = 7.67 \text{ percent}$

$$\text{Adjust Kansas SMI + SUD: } 316,000 * (1 - 0.0767) = 291,773$$

2. Estimate number of smokers

- a. Compile data sources to get a reasonable estimate of smoking prevalence in the SMI/SUD population:
JAMA²⁸, 41 percent; CDC, 32.6 percent ²⁹; SAMHSA, 50 percent³⁰. Use 40 percent.
- b. Calculate number of smokers:

$$SMISUD \text{ Population} * \text{Smoking Prevalence} = 291,773 * 0.40 = 116,709$$

3. Divide SMISUD smoking population by gender using NIMH estimates³¹ (SMI higher for females – implicit assumption that breakdown is similar for SMISUD)^{vii}:

^{vii} We also calculated impacts for 50% male 50% female given that the SUD population has a higher percent of males that would offset the higher female percent in the SMI population. This resulted in higher overall economic impact estimates, but we opted to focus on the more conservative estimates with higher female percent given that adult Medicaid recipients in Kansas are 62.5% women according to Kaiser Family Foundation Estimates:

- a. $\frac{\text{Prevalence for Females}}{\text{Prevalance for females} + \text{Prevalence for Males}} = \frac{8}{5} = 0.625 = 62.5 \text{ percent} = \text{Female percent}$
- b. $1 - \text{Female percent} = (1 - .625) = 0.375 = 37.5 \text{ percent} = \text{Male percent}$
- c. $116,709 * 0.625 = 72,943 \text{ females}$
- d. $116,709 * 0.375 = 43,766 \text{ males}$
4. Estimate number of pregnant women in the relevant population^{viii}:
- a. Begin with uniform distribution across ages for female population age 18+; adjust for number of years in each category (columns 1-3) and for proportion of SMI population by age (column 4) to get a weighted percent of female smoking population in each age category (column 5). Apply weights to the SMISUD female smoking population to get an estimated number of individuals in each by age group (column 6). Calculate expected number of pregnant women using pregnancy percent adjusted for age³⁸ and lower estimated pregnancy prevalence for women with SMI³⁹ (columns 7 and 8). A maximum age of 60 was used for calculations based on life expectancy calculations for neighboring Missouri⁴⁰.

1	2	3	4	5	6	7	8
Age Categories	Number of Years	Percent Years	Adjust for Percent SMI Population < Age 50 & 50+	Total Weight for Age Group	Female SMISUD Smoking Population	Adjusted Pregnancy Percent	Number of Pregnant Smokers
20-34	17	0.405	0.703	0.469	34,234	0.094	3,202
35-49	15	0.357	0.703	0.414	30,206	0.015	466
50+	10	0.238	0.297	0.117	8,503	0.000	0
Total	42	1.000		1.000	72,943		3,668

Table 1: Calculations for pregnant women.

- b. Non-pregnant women:
 $34,234 + 10,069 + 10,069 - 3,668 = 50,704$ Childbearing age
 $8,502 + 10,069 = 18,571$ Not childbearing age

<https://www.kff.org/medicaid/state-indicator/distribution-by-gender-4/?currentTimeframe=0&sortModel=%7B%22colId%22:%22Location%22,%22sort%22:%22asc%22%7D>.

^{viii} An alternative method for calculating the number of pregnant women from vital statistics data (adjusted for the share of SMI/SUD among adult women in Kansas, underreporting of smoking in birth certificate data, and higher smoking rates in the SMI/SUD population) yields a similar estimate of pregnant women (1,503 women).

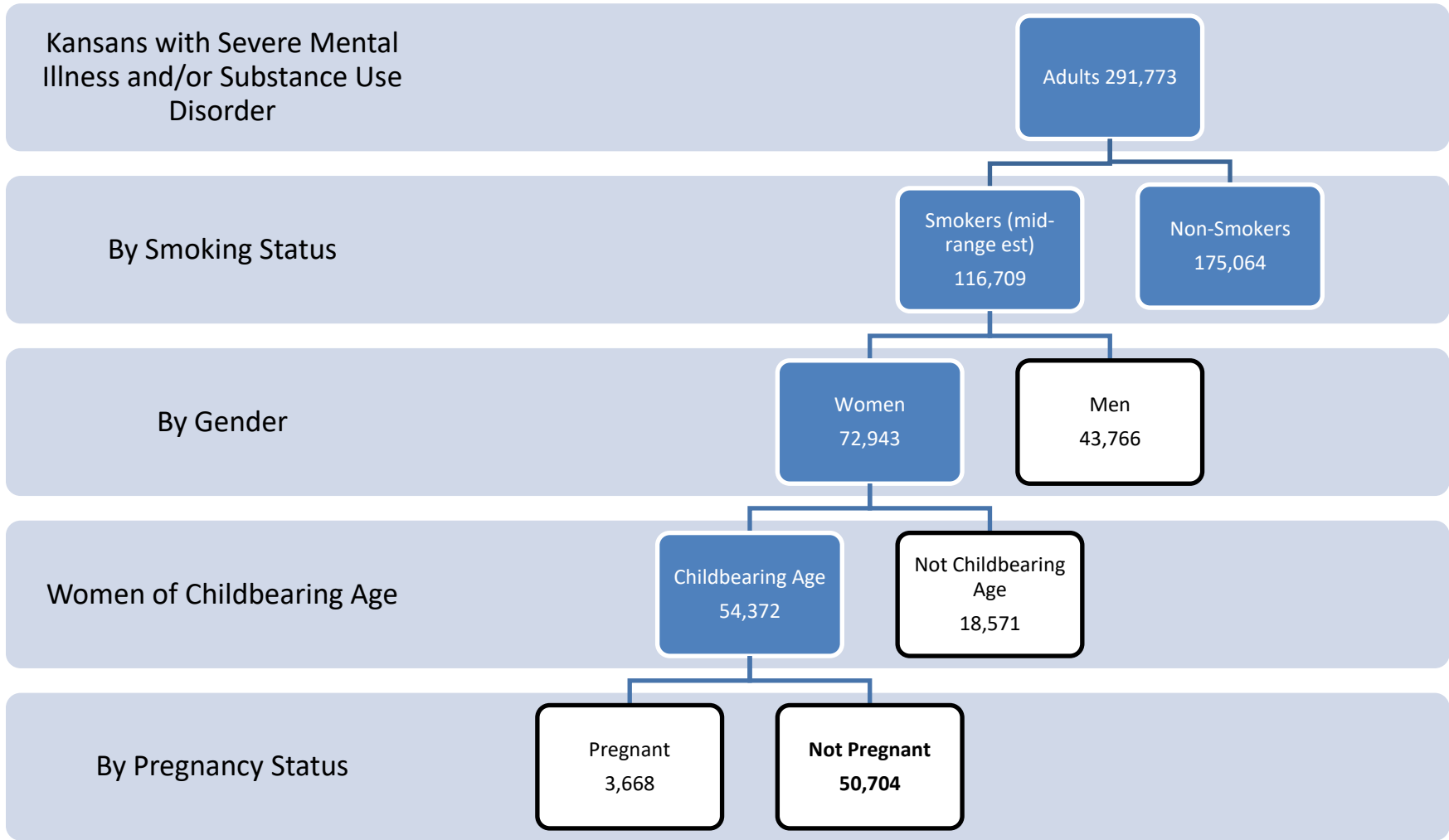


Figure 1: Estimated Population Numbers for Kansans with SMI and/or SUD

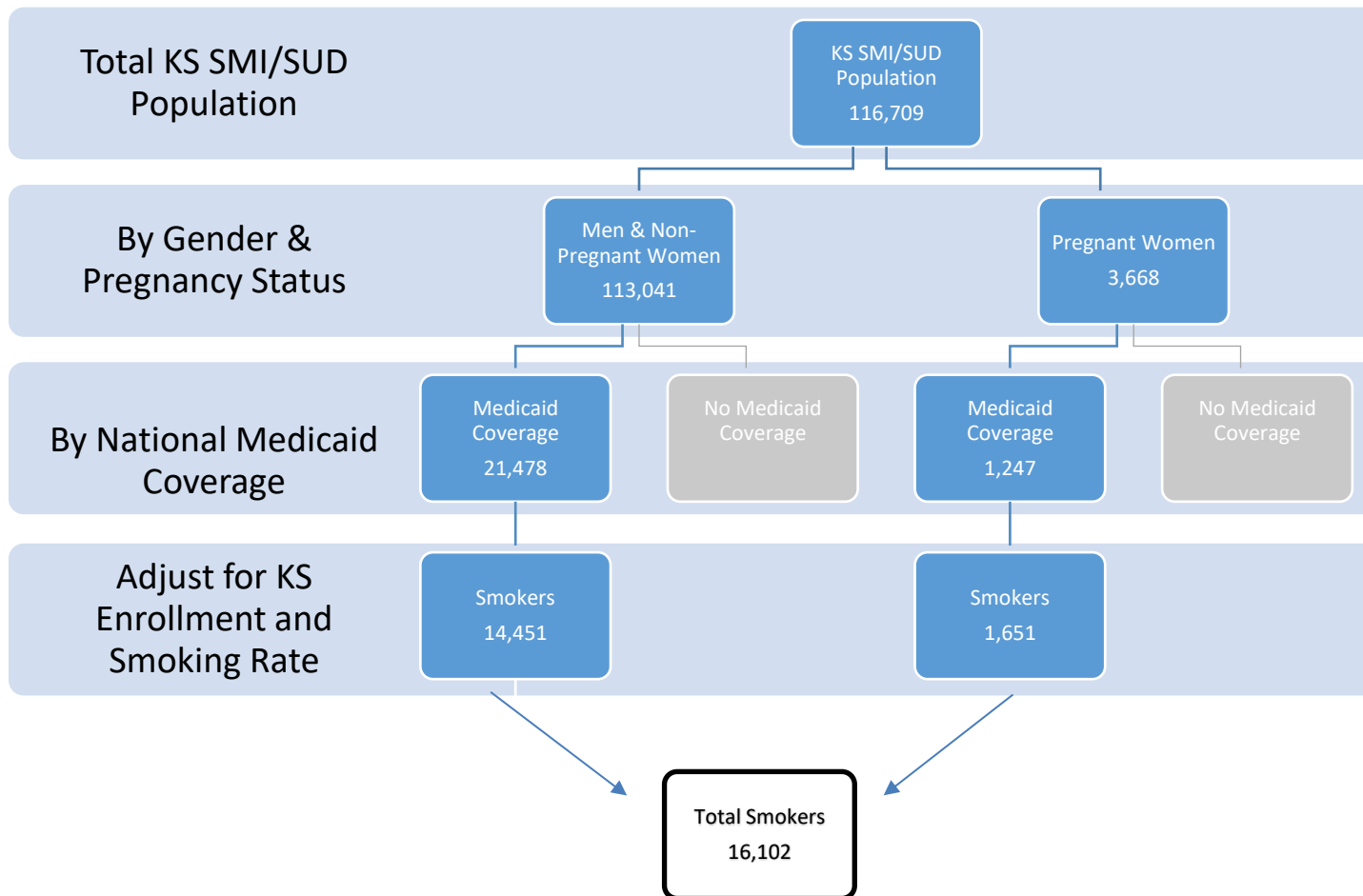


Figure 2: Estimated Adult Medicaid Beneficiaries who Smoke with SMI and/or SUD

Medicaid Coverage

1. Calculation for men and non-pregnant women using DHHS estimates of Medicaid adult coverage percent and prevalence calculated from KFF and Census data. Number of smokers adjusted for higher smoking rates in Kansas Medicaid relative to the national average.³³ Estimates for pregnant women adjusted for KFF estimates for percent of Kansas births covered by Medicaid:

- a. For men:

*Estimated Population * Medicaid Coverage Percent *
Adjustment for Higher Adult Medicaid Smoking Rates in Kansas *
Adjustment for Lower Adult Medicaid Enrollment in Kansas =
43,766*0.19*1.324*0.508=5,595*

- b. For non-pregnant women:

*Estimated Population * Medicaid Coverage Percent *
Adjustment for Higher Adult Medicaid Smoking Rates in Kansas *
Adjustment for Lower Adult Medicaid Enrollment in Kansas =
69,275*0.19*1.324*0.508=8,856*

- c. For pregnant women:

*Estimated Population * Percent Births Covered by Medicaid * Adjustment for Lower
Adult Medicaid Enrollment in Kansas = 3,668*0.34*0.19=1,651*

- d. *Total Estimated SMISUD Smokers Covered by Medicaid = 5,595 + 8,856 + 1,651 =
16,102*

2. Alternative method for calculating Medicaid coverage beginning with DAI estimates for SMI among the ABD population⁴¹, adding the estimated number of Medicaid-covered non-ABD adults with SMISUD^{8,19,34,35}, adding the estimated number of ABD enrollees with a SUD (SAMHSA, national prevalence estimates), and applying a 40 percent smoking rate^{28,29}:
 $[36,503 + (0.10 * 54,900) + (0.079 * 77,400)] * 0.40 = 19,243$
3. Alternative method yielded similar estimates of the Medicaid covered population. The more conservative estimate of 16,102 from the first method was used for all subsequent calculations.

Economic Costs and Benefits (2015 dollars^{ix})

1. **Economic Costs of Smoking:** Costs of smoking for SMISUD individuals covered by Medicaid. Estimates for medical spending, productivity gains, and gains from increased life expectancy taken from the literature²². The multiplier for higher medical spending for smokers in Medicaid was calculated based on DHHS and Surgeon General Report estimates (Medicaid represents about 45 percent of smoking-related medical costs, but only 19.1 percent of individual smokers)⁷, plus the difference in annual productivity between current smokers and former smokers (estimate from the literature adjusted to account for lower work participation in the SMISUD population – 50 percent)^{18,19}, plus productivity gains from reduced secondhand smoke²², plus gains from increased life expectancy²².
 - a. Men and non-pregnant women:
$$[(\text{Per person medical cost} * \text{multiplier for higher spending medical spending in Medicaid}) + ((\text{annual productivity for former smokers} - \text{current smokers}) * \text{adjustment for lower labor force participation}) + \text{productivity gains from reduced second hand smoke} + \text{estimated gains from increased life expectancy}] * \text{number of SMISUD smokers covered by Medicaid}$$
 - b. Pregnant women:
$$[(\text{Per person medical cost} * \text{multiplier for higher spending medical spending in Medicaid}) + ((\text{annual productivity for former smokers} - \text{current smokers}) * \text{adjustment for lower labor force participation}) + \text{productivity gains from reduced second hand smoke} + \text{estimated gains from increased life expectancy} + (\text{neonatal medical cost per smoking mother})] * \text{number of pregnant SMISUD smokers covered by Medicaid}$$
 - c. Total Economic Cost for SMISUD Medicaid population = \$76,172,910
2. **Economic Benefits from Taxation and Retail Sales:** State and retail benefits calculated using state tax per pack, an 8 percent estimated mark-up per pack²² and the estimated number of packs sold annually (adjusted for higher smoking intensity among the SMISUD population⁸ times the proportion of smokers represented by the SMISUD Medicaid population:
 - a.
$$[(\text{Tax revenue per pack} + \text{Estimated retail markup}) * (\text{Estimated annual number of packs} * \text{multiplier for higher smoking intensity in the SMISUD population})] * \text{proportion of smokers represented by the SMISUD Medicaid population}$$
 - b. Total Economic Benefit for SMISUD Medicaid population = \$10,067,066
3. **Net Economic Cost:** Difference between costs and benefit:

^{ix} Adjusted using annual estimates from the CPI research series.

- a. *Economic Cost of Smoking – Economic Benefit from Cigarette Sales = 66,105,844*
- b. *Cost per person = \$4,105*

Costs of Proactive Smoking Cessation Treatment

1. Treatment cost is calculated as a weighted average of medication and counseling (only counseling for pregnant women). Costs are based on 12 weeks of treatment and four counseling sessions at a reimbursement rate of \$20 per session. Costs are adjusted for effectiveness (percent of treated individuals who quit smoking) and the probability of using a given medication (j).^{7,22}

a. *Average Treatment Cost for men and nonpregnant women =*

$$\sum_{j=1}^J \frac{(Cost\ of\ medication_j * 12\ weeks) + (Cost\ of\ counseling * 4)}{Expected\ Effectiveness_j} * Probability\ of\ use_j$$

b. *Treatment Costs for pregnant women =*

$$\sum_{j=1}^J \frac{(Cost\ of\ counseling * 4)}{Expected\ Effectiveness_j} * Probability\ of\ use_j$$

Medication	Cost per Week	12 weeks	Counseling (4 sessions at \$20 per session)	Total Treatment Cost	Effectiveness (successful quit percent)	Cost per Smoker	Probability of Use	Weighted Cost per Smoker
Patch	13.00	156.00	80.00	236.00	0.080	2,950.00	0.40	1,180.00
Gum	10.90	130.80	80.00	210.80	0.080	2,635.00	0.15	395.25
Lozenge	17.10	205.20	80.00	285.20	0.080	3,565.00	0.15	534.75
Varenicline	36.80	441.60	80.00	521.60	0.185	2,819.46	0.19	535.70
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Spray	15.52	186.24	80.00	266.24	0.080	3,328.00	0.03	99.84
Inhaler	55.86	670.32	80.00	750.32	0.080	9,379.00	0.02	187.58
Weighted average cost								3,067.10
Pregnant Women			80.00	80.00	0.020	4,000.00	1.00	4,000.00

Table 2: Calculations for the Cost of Proactive Smoking Cessation Treatment

c. *Treatment cost per person =*

$$\frac{[(weighted\ average\ cost * number\ of\ men\ and\ nonpregnant\ women) + (cost\ for\ a\ pregnant\ woman * number\ of\ pregnant\ women)]}{number\ of\ individuals\ in\ the\ SMISUD\ Medicaid\ smoking\ population} =$$

\$3,163

d. *Total treatment cost* = $\$3,163 * 16,102 = \$50,927,325$

Economic Savings from Proactive Treatment

1. *Net savings per person* = $\$4,105 - \$3,163 = \$943$
- 2.

Confidence Interval

1. Bootstrapping methods can be used to generate confidence intervals for economic impact studies. We use estimates from a bootstrap simulation that suggests a 10.7% range (normal distribution, 90% confidence interval) for IMPLAN estimates to calculate upper and lower bounds for our direct effects⁴².
 - a. Upper bound: \$16,802,621
 - b. Lower bound: \$13,554,417

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