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RESEARCH ARTICLE

Medicaid Incentives for Preventing Chronic Disease: Effects of Financial Incentives for Smoking Cessation

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Objective. To test the effectiveness of financial incentives for smoking cessation in the Medicaid population.

Data Sources. Secondary data from the Medicaid Incentives for Prevention of Chronic Disease (MIPCD) program and Medicaid claims/encounter data from 2010 to 2015 for five states.

Study Design. Beneficiaries were randomized into receipt or no receipt of financial incentives. We ran multivariate regression models testing the impact of financial incentives on the use of counseling services, smoking behavior, and Medicaid expenditures and utilization.

Data Extraction. Participating states provided Medicaid eligibility, claims and encounters, program enrollment, and incentivized service use data.

Principal Findings. Participants who received incentives were more likely to call the Quitline and complete counseling sessions. Incentive receipt was positively associated with self-reported quit attempts, self-reported quits, or passing cotinine tests of smoking cessation in most programs, although results were only statistically significant in a subset. There was no systematic evidence that incentives affected health care use or spending.

Conclusions. Financial incentives are a promising policy lever to motivate behavioral change in the Medicaid population, but more evidence is needed regarding optimal incentive size, effectiveness of process-versus outcome-based incentives, targeting of incentives, and long-run cost-effectiveness.

Key Words. Smoking, Medicaid, incentive payments, contingency management

Despite substantial reductions in tobacco use over time, smoking remains a leading cause of chronic disease and preventable death in the United States. Smoking accounts for one in five deaths and policies aimed at reducing smoking continue to be tested (U.S. Department of Health and Human Services

2014). The burden of tobacco use is even higher in the Medicaid population, whose beneficiaries smoke at a rate of 29 percent compared to 13 percent of privately insured individuals (Jamal et al. 2015). Tobacco use imposes a large health and financial burden on beneficiaries and the Medicaid program, with smoking-related diseases accounting for approximately 15 percent of Medicaid spending (Xu et al. 2014).

There is growing interest in the use of financial incentives, also called contingency management, to motivate behavior changes such as smoking (Volpp et al. 2009; Kim et al. 2011; Troxel and Volpp 2012; Volpp and Galvin 2014; Cahill, Hartmann-Boyce, and Perera 2015; Halpern et al. 2015; Ierfino et al. 2015), weight loss (Finkelstein et al. 2007; Volpp et al. 2008a; John et al. 2011), substance abuse (Petry et al. 2000, 2005; Lussier et al. 2006; Peirce et al. 2006; Higgins, Sigmon, and Heil 2011; Davis et al. 2016), and medication adherence (Volpp et al. 2008b; Keller et al. 2011; DeFulio and Silverman 2012; Kimmel et al. 2012, 2016). Despite the literature on financial incentives for behavior change, little is known about the efficacy of financial incentives administered within the Medicaid program. To that end, in 2011 the Affordable Care Act authorized the Medicaid Incentives for Prevention of Chronic Disease (MIPCD) program with the aim of testing the impact of financial incentives on motivating behavioral change among Medicaid beneficiaries (RTI International 2016). California, Connecticut, New Hampshire, New York, and Wisconsin were awarded Center for Medicare and Medicaid Innovation (CMMI) demonstration grants to implement chronic disease prevention programs for their Medicaid enrollees to test the use of incentives to encourage smoking cessation (MIPCD programs in five other states focused on other chronic diseases). We evaluated the effectiveness of MIPCD programs at increasing the use of smoking cessation counseling, quit attempts, smoking cessation, and health care expenditures and utilization.

The MIPCD programs were designed to allow for a rigorous assessment of program impacts and incorporate lessons learned from previous Medicaid incentive programs. To that end, CMMI encouraged MIPCD-participating states to implement randomized designs, allowing for a high degree of confidence in the impact estimates financial incentives. Although several Medicaid

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programs have introduced incentives for beneficiaries in various forms such as vouchers, gift cards, points redeemable for health-related items, reduced premiums, or cost-sharing (Barth and Greene 2007; Greene 2007; Kenney et al. 2011; Blumenthal et al. 2013; Nyman, Abraham, and Riley 2013; Hand et al. 2014; MACPAC 2016). Blumenthal et al.'s (2013) review finds little evidence of effectiveness. The authors note that limited effectiveness is potentially due to limitations such as lack of program awareness among beneficiaries, incentive design, reliance on health care providers, and administrative complexities. Redmond, Solomon, and Lin (2007) take a pessimistic view of Medicaid incentive programs in general, noting that "rewards are especially unlikely to reduce the human and economic costs of smoking and obesity—the two areas where states are focusing their efforts and where solutions are most needed" (p. 6). The MIPCD program represents the best opportunity to date for evaluating the effectiveness of incentives for smoking cessation among Medicaid beneficiaries.

Incentives for smoking cessation can be successful in the low-income and special populations represented in Medicaid, including substance abusers, patients with chronic obstructive pulmonary disease, the homeless, the mentally ill, and pregnant women (Sigmon and Patrick 2012; Hertzberg et al. 2013; Businelle et al. 2014; Drummond et al. 2014; Secades-Villa et al. 2014; Cahill, Hartmann-Boyce, and Perera 2015; Kendzor et al. 2015; Etter and Schmid 2016). The broader literature on smoking cessation incentives has shown that incentives can reduce smoking in the short term (Volpp et al. 2009; Kim et al. 2011; Troxel and Volpp 2012; Volpp and Galvin 2014; Cahill, Hartmann-Boyce, and Perera 2015; Halpern et al. 2015; Ierfino et al. 2015; Higgins and Solomon 2016); however, detection of long-term smoking reductions is rare and may be partially due to underpowered studies rather than null effects (Troxel and Volpp 2012; Cahill, Hartmann-Boyce, and Perera 2015).

MIPCD Smoking Cessation Programs

California, Connecticut, New Hampshire, New York, and Wisconsin implemented smoking cessation programs. Each state designed and implemented its own program, resulting in a variety of incentive structures and program designs. All states included multiple incentive arms to test the efficacy of various incentive structures or target specific subpopulations. Across the five states, there were 12 incentive groups.

Table 1 summarizes each state's programs and incentive structure. MIPCD participants were randomized into incentive groups that received financial incentives and control groups that did not. In California, Quitline callers were randomized into receiving nicotine replacement therapies (NRT), NRT plus incentive payments for successive Quitline calls, or a control group that did not receive NRT or incentives. California's NRT-only arm did not receive incentives but was created to separate the impact of free NRT from the impact of incentive payments. Connecticut had three incentive arms that paid participants for receiving in-person or telephone counseling, passing tobacco-free cotinine tests, or a combination of both. Connecticut's program was designed to test whether incentives given for process measures (counseling sessions) are more or less effective than incentives given for outcome measures (cotinine tests). Like Connecticut, New York's program was designed to test for differences between process and outcome measures, with one program arm receiving incentive payments for completing smoking cessation counseling and another for passing cotinine tests. New Hampshire's participants were individuals who agreed to enter smoking cessation treatment after receiving \$10 for completing a web-based tool designed to encourage them to seek treatment. All of New Hampshire's participants were paid for obtaining an NRT prescription and passing cotinine tests, but they were randomized into a group that received a prescriber referral to smoking cessation treatment, prescriber referral plus Quitline sessions, or prescriber referral plus in-person cognitive behavioral therapy (CBT). Wisconsin had two programs with their own control group; one targeting nonpregnant smokers and another targeting pregnant smokers.

METHODS

To test the impact of incentive receipt on MIPCD program service use, smoking behavior, and health care expenditures and use, we ran multivariate models using data from two sources. First, MIPCD-participating states provided program participation data containing incentive payments, incentivized services used, and smoking outcomes. These data are referred to as the MIPCD Minimum Data Set (MIPCD MDS). Second, we obtained Medicaid enrollment, fee-for-service claims, and managed care encounter data for incentive and control group participants from MIPCD states.

Table 1: MIPCD Program Descriptions

<i>State</i>	<i>Description</i>	<i>Program</i>	<i>Incentive Payments</i>	<i>Implementation Date</i>
CA	Medicaid patients who called the California Smokers' Helpline were randomized into three groups: (1) usual care (control), (2) usual care plus free NRTs, and (3) usual care plus free NRTs plus financial incentives.	Counseling + NRT Counseling + NRT + Incentive	None \$20 for first call \$10 for up to 4 follow-up calls	July 2012 July 2012
CT	Participating mental health clinics, Federally Qualified Health Centers (FQHCs), patient-centered medical homes, and other primary care sites recruited participants and provided individual and group counseling. Participants could also call the smoking Quitline.	Original High Process High Outcome	\$5 per counseling session/quitline call up to 10 times \$15 bonus after 5 counseling sessions/quitline calls \$15 per tobacco-free CO test up to 12 \$10 for 3 consecutive tobacco-free CO tests \$10 per counseling session/quitline call up to 10 times \$30 bonus after 5 counseling sessions/quitline calls \$22 per tobacco-free CO test up to 12 \$22 for 3 consecutive tobacco-free CO tests	March 2013 November 2014 November 2014

continued

Table 1. Continued

State	Description	Program	Incentive Payments	Implementation Date
NH	Participants in the NH MIPCD weight management program could choose to participate in the smoking program. The smoking cessation program had three smoking cessation incentive programs, each with its own control group that did not receive incentives: (1) referral for NRT, (2) referral for NRT plus quitline sessions, and (3) a referral for NRT plus telephonic CBT.	NRT Referral	\$30 for signed prescriber letter \$50 per passed CO and cotinine test up to 6 in weeks 1 and 2 \$75 for passed CO and cotinine test in week 3 \$75 for passed CO and cotinine test in week 4	May 2012
		NRT + Quitline	\$15 for signed prescriber letter \$20 per session up to 3 \$50 per passed CO and cotinine test up to 6 in weeks 1 and 2 \$75 for passed CO and cotinine test in week 3 \$75 for passed CO and cotinine test in week 4	May 2012
		NRT+ Telephonic CBT	\$15 for signed prescriber letter \$5 per session up to 12 \$50 per passed CO and cotinine test up to 6 in weeks 1 and 2 \$75 for passed CO and cotinine test in week 3 \$75 for passed CO and cotinine test in week 4	May 2012

continued

Table 1. Continued

State	Description	Program	Incentive Payments	Implementation Date
NY	Participants were incentivized for attending smoking cessation program sessions, making smoking Quitline calls, filling smoking cessation prescriptions, and smoking cessation confirmed through a saliva cotinine test.	NY Process	\$50 at enrollment \$25 for class or prescription fill up to 5 times	March 2015
		NY Outcome	\$50 at enrollment \$50 for passing cotinine test within 3 months \$75 for passing cotinine test 3 months after initial test	March 2015
WI	Wisconsin's MIPCD program aimed to provide smoking cessation services to adult smokers enrolled in one of two programs, each with a randomized control group: (1) a general program for all smokers, who enrolled through the Wisconsin Tobacco Quit Line (WTQL), or (2) First Breath, an evidence-based program for pregnant smokers.	WI Striving to Quit	\$30 per quitline call up to 5 \$40 per CO or cotinine test taken up to 3 \$40 per CO or cotinine test passed up to 2	April 2013
		WI First Breath	\$50 at enrollment \$20 for first 4 counseling sessions \$40 for 5th and 6th counseling session \$40 per CO test taken up to 3 \$40 per CO test passed up to 3	September 2012

Notes: CBT, cognitive behavioral therapy; CO, carbon monoxide; NRT, nicotine replacement therapy.

MIPCD MDS Data

The analysis of Quitline calls, counseling sessions, and smoking behavior used to program data from each state's MIPCD MDS. The MIPCD MDS includes program enrollment, demographics, incentivized service utilization, incentive amounts received, and behavior outcomes for incentive and control group participants starting at the time of enrollment in the program and for a period after enrollment. The MIPCD MDS data contain information on smoking cessation program services used, including Quitline calls and counseling sessions. Smoking outcomes available in the MIPCD MDS depend on the state and include self-reported quit attempts, self-reported quitting, and results of cotinine biochemical tests for smoking cessation.

Smoking outcomes were available for a subset of participants. For the analyses of cotinine tests, the sample includes participants who took at least two tests to examine the change over time. Self-reported smoking behavior was not provided by all participants. To the degree that participants willing to take cotinine tests and report data are more likely to have reduced smoking than those who did not report outcome data, the results can be viewed as a "best-case scenario" in examining how successful the use of incentives was in reducing smoking.

Medicaid Claims, Encounter, and Enrollment Data

States provided Medicaid fee-for-service claims and managed care encounters data for incentive and control group participants for 2 years before entry into the MIPCD program and 1 to 3 years after entry into the program. Not every enrollee had a claims history spanning the full 2 years before entry in the MIPCD program, and not every participant had the same number of quarters of post-entry in MIPCD due to changes in their eligibility status and rolling enrollment. In each state, incentive and control group participants had similar pre- and post-entry quarters of Medicaid data and we controlled for the duration of Medicaid enrollment in the regressions.

We examined the following claims and encounter outcomes: total per-member-per-month (PMPM) expenditures, inpatient PMPM expenditures, ED PMPM expenditures, a binary indicator of whether an enrollee had an inpatient stay, and a binary indicator of whether an enrollee had an ED visit.

Study Sample

Appendix Table A1 presents sociodemographic, enrollment, and pre-period total Medicaid expenditures for the incentive and control groups from the 12 incentive programs conducted across five states. We assessed states' success at randomizing participants using t-tests for equality of means between incentive and control arms. States were largely successful in implementing the randomization: incentive and control group participants were comparable on almost all characteristics we examined. We corrected for remaining differences between incentive and control groups after randomization using multivariate regression.

Regression Analyses

Each state's design, incentive structure, and outcomes were unique; therefore, we conducted a separate regression analysis for each state. Following an intent-to-treat approach, we included all participants in analyses, regardless of whether the participant had completed the program or used incentivized services.

We tested for changes in smoking cessation service use and smoking behavior using the MIPCD MDS. For the analysis of smoking cessation service use, we fit negative binomial models for counts of Quitline calls, individual counseling sessions, and group counseling sessions. For self-reported quit attempts, smoking quits, or passing a biochemical test for smoking cessation, we fit logit models. Unlike the claims data, the MIPCD MDS does not provide information on MIPCD participants before their enrollment in the MIPCD program. Thus, regressions compared outcomes between the incentive and control groups after enrollment. Models controlled for sex, age, race, ethnicity, education, and program time. In many states, outcome measures were taken repeatedly, but success in capturing this information over time varied widely across measures and states. For simplicity and consistency across states, we collapsed repeated measures into the difference in the outcome from the baseline measure and the last measure for a participant to create a single measure of change over time. We controlled for program time and completion because time enrolled in the MIPCD program influenced engagement in program activities. When relevant, models also included a control for program completion.

For the claims-based analysis, we employed a difference-in-difference regression framework to test for the effect of receiving incentives on the outcomes of interest. For Medicaid expenditures, we fit a linear difference-in-

difference model. For inpatient stays and ED visits, we dichotomized the outcome variable to indicate that the patient had any inpatient stays or ED visits and fit a logit difference-in-difference model. For the logit results, we present coefficients representing the difference in the predicted probability of using services between the incentive and control groups calculated using the Puhani method (Puhani 2012). The coefficients from difference-in-difference models reflect how the outcomes changed between the pre- and post-intervention periods for the incentive group relative to the control group. In the claims-based multivariate analyses, we adjusted for age, sex, race, ethnicity, reason for Medicaid eligibility in the year before enrolling in the MIPCD program, total months enrolled in Medicaid (defined as number of months the enrollee was in the Medicaid claims data file), whether the beneficiary was continuously enrolled in Medicaid (defined as whether a beneficiary is enrolled in Medicaid for every month starting when the beneficiary first enters the study period through exit from the dataset), and whether the beneficiary was also enrolled in Medicare (dually eligible).

For all regression models, we made cluster adjustments to the standard errors because the evaluation design is characterized by repeated outcomes on the same enrollee over time. Compared with an independent sample, samples that adjust for clustering take a larger intervention effect or data from additional demonstration quarters to reject the null hypothesis of no effect of the incentive on outcomes.

RESULTS

Smoking Cessation Services

Table 2 presents the results for use of smoking cessation services. In 6 of the 11 programs for which smoking cessation service use was reported, individuals who received incentives were more likely to use program services than those who did not. In California's counseling + NRT + incentives arm, participants made an average of 5 Quitline relative to 4 calls in the control group. Similarly, participants in Wisconsin's incentive arms made 4 Quitline calls relative to 3 in the Wisconsin control groups. In New Hampshire and New York, service use was not significantly different between incentive and control groups.

Smoking Cessation

MIPCD programs showed varied success at reducing smoking (Figure 1). MIPCD-participating states collected up to three measures of smoking

Table 2: Incentive Payments and Utilization of Smoking Cessation Services

<i>Program</i>	<i>Incentive/ Control: Sample Size</i>	<i>Quitline Calls: IRR (95% Confidence Interval)</i>	<i>Individual Counseling Sessions: IRR (95% Confidence Interval)</i>	<i>Group Counseling Sessions: IRR (95% Confidence Interval)</i>
CA Counseling + NRT	1,416/1,012	1.00 (0.93–1.09)	—	—
CA Counseling + NRT + Incent	1,419/1,012	1.35 (1.24–1.47)	—	—
CT Original	2,273/1,558	1.82 (1.38–2.39)	2.14 (1.94–2.36)	1.85 (1.55–2.22)
CT High Process	150/1,558	1.54 (1.10–2.18)	1.14 (0.91–1.42)	1.16 (0.78–1.71)
CT High Outcome	66/1,558	1.64 (1.03–2.58)	1.16 (0.79–1.70)	1.69 (1.16–2.46)
NH Quitline	154/151	1.22 (0.78–1.90)	—	—
NH Telephonic CBT	109/105	0.95 (0.78–1.16)	—	—
NY Process	614/612	1.02 (0.94–1.11)	—	—
NY Outcome	614/612	1.00 (0.92–1.09)	—	—
WI Striving to Quit	978/982	1.37 (1.31–1.44)	—	—
WI First Breath	516/516	1.43 (1.31–1.55) [Postnatal]	1.27 (1.07–1.52) [Prenatal] 1.26 (1.17–1.36) [Postnatal]	—

Notes: Table presents sample sizes, incentives, and results from regressions using MDS data. IRRs and confidence intervals from logit regressions are presented. Standard errors were clustered by individual. CI, confidence interval; IRR, incidence rate ratio; NRT, nicotine replacement therapy; SD, standard deviation. Bolded cells indicate statistically significant results with $p < .05$.

cessation: self-reported quit attempts, self-reported quits, and biochemical tests of smoking cessation. For biochemical tests, smoking cessation was defined as having a below threshold (<80 ng/ml) cotinine or negative carbon monoxide (CO) test after the baseline test.

Incentive recipients in all program arms except Connecticut’s program were more likely to exhibit behavioral change than the control group. Although the odds ratios indicate increased success among incentive recipients relative to the control group, differences between the two groups were only statistically significant in regression analyses for a subset of programs. In California, participants were significantly more likely to self-report a quit attempt. In Wisconsin’s First Breath program, pregnant women who received incentives were more likely to self-report quitting. In both of Wisconsin’s programs, incentive recipients were more likely to pass cotinine tests than the control group. On the whole, evidence is suggestive of modest gains in smoking cessation among recipients of financial incentives.

Figure 1: Impact of MIPCD Program Participation on Smoking Behavior

Note: Table presents odds ratios and 95% confidence intervals from logit regressions. Regressions include controls for sex, age, race, ethnicity, education, and program time. When relevant, models also included a control for program completion. Standard errors were clustered by individual. New York did not have enough people self-report smoking or complete cotinine tests to conduct a regression analysis.

Medicaid Expenditures and Utilization

Table 3 presents difference-in-difference estimates comparing the change in spending and utilization between incentive and control groups. There is little evidence that incentive payments for smoking cessation reduced total Medicaid expenditures, inpatient expenditures, ED expenditures, inpatient stays, or ED visits. Two programs generated a statistically significant reduction in ED expenditures: Connecticut's High Outcome program and Wisconsin's Striving to Quit program reduced expenditures by \$18 and \$12 per-patient per-month, respectively. The reduction in ED expenditures for Connecticut's

Table 3: Impact of MIPCD Program Participation on Medicaid Expenditures and Utilization

Program	Sample Size	Medicaid Expenditures Coefficient (95% Confidence Interval)	Inpatient Expenditures Coefficient (95% Confidence Interval)	ED Expenditures Coefficient (95% Confidence Interval)	Inpatient Stay Coefficient (95% Confidence Interval)	ED Visit Coefficient (95% Confidence Interval)
CA Counseling + NRT	3,276	-30 (-122, 61)	1.77 (-47, 51)	-13 (-53, 27)	-0.06 (-1.05, 0.93)	-13 (-54, 27)
CA Counseling	3,276	-28 (-117, 62)	-20 (-63, 23)	-19 (-58, 20)	0.16 (-0.81, 1.13)	-19 (-59, 21)
+ NRT + Incent						
CT Original	3,994	-4 (-135, 128)	-68 (-128, -15)	-3 (-10, 4)	-0.58 (-1.62, 0.46)	-1.20 (-3.00, 0.60)
CT High Process	3,994	-39 (-339, 262)	-99 (-281, 83)	-4 (-15, 7)	-0.26 (-2.83, 2.31)	-2.90 (-7.78, 1.98)
CT High Outcome	3,994	-424 (-157, 1,004)	102 (-132, 336)	-18 (-39, -4)	3.40 (-1.22, 8.03)	-3.81 (-12.57, 4.95)
CT Peer Coaching	3,994	344 (-90, 778)	20 (-147, 187)	-1 (-15, 13)	1.40 (-9.22, 8.03)	6.35 (0.33, 12.37)
NH Prescriber Referral	145	15 (-365, 395)	17 (-21, 55)	-9 (-30, 12)	—	-3.01 (-11.14, 5.12)
NH Quitline	304	173 (-39, 285)	-20 (-52, 11)	-1 (-13, 11)	-1.99 (-4.89, 0.91)	1.31 (-4.77, 7.34)
NH Telephonic	214	-16 (-266, 235)	-13 (-63, 37)	6 (-21, 32)	0.59 (-1.66, 2.84)	-3.65 (-11.06, 3.76)
NY Process	1,816	-154 (-432, 123)	-31 (-136, 73)	—	-1.04 (-3.31, 1.23)	—
NY Outcome	1,816	178 (-115, 471)	78 (-40, 196)	—	1.38 (-0.80, 3.56)	—
WI Striving to Quit	1,900	-108 (-234, 17)	-49 (-142, 43)	-12 (-21, -2)	-0.30 (-1.22, 0.62)	-0.72 (-2.66, 1.22)
WI First Breath	1,031	-10 (-60, 39)	-2 (-26, 23)	-4 (-10, 2)	-0.82 (-3.21, 1.57)	-2.19 (-5.07, 0.69)

Notes: Table presents coefficients and standard errors from difference-in-difference regressions. Regressions include controls for age, sex, race, ethnicity, reason for Medicaid eligibility in the year before enrolling in the MIPCD program, total months enrolled in Medicaid (defined as number of months the enrollee was in the Medicaid claims data file), whether the beneficiary was continuously enrolled in Medicaid (defined as whether a beneficiary is enrolled in Medicaid for every month starting when the beneficiary first enters the study period through his or her exit from the dataset), and whether the beneficiary was also enrolled in Medicare (dually eligible). Standard errors were clustered by individual. Expenditures regressions were estimated using ordinary least squares. Inpatient stay and ED visit regressions were estimated using logit models and coefficients were calculated using the Puhani method (Puhani 2012). Bolded cells indicate statistically significant results with $p < .05$.

High Outcome participants is unlikely to be caused by improvements in health generated through smoking cessation because no statistically significant reductions in smoking were detected for Connecticut. However, increased Quitline calls and group counseling sessions which provide health information and peer support that promotes healthy behavior could reduce ED expenditures. In contrast, the reduction in ED expenditures by participants of Wisconsin's Striving to Quit program could plausibly be obtained through reductions in smoking as participants were more likely to pass cotinine tests than nonparticipants. All other difference-in-difference estimates indicate no difference in expenditures or utilization between the incentive and control groups.

DISCUSSION

MIPCD programs are the most comprehensive test to date of the role that financial incentives could play in reducing smoking in the Medicaid population. We evaluated the effects of financial incentives across 12 programs in five states with the goal of reducing the burden of smoking-related chronic disease. In three states, incentives achieved their immediate goal of increasing use of incentivized preventive services (e.g., Quitline calls and counseling sessions). Evidence was less strong that incentives improved quit rates. Overall, regression estimates suggested that Medicaid incentives improved smoking behavior; however, these improvements were not always statistically significant. There were no systematic short-term impacts on health care expenditures or utilization.

Across states, program implementation and incentive structure varied widely and other factors besides incentive amounts likely played a role in cessation service use and quitting success. Additionally, the lack of impact of participation in a smoking cessation program on health care expenditures and utilization does not necessarily mean that the programs were not effective because changes in these outcomes are unlikely to be realized in the short run. Rather, the effect of reductions in smoking on patient health and eventually spending may be generated years after the patient quits or reduces cigarette use.

This study has several limitations. First, the number of participants may have been too small to detect statistically significant differences in outcomes. Enrollment was lower than projected for many states and the number of participants may have been too small to estimate statistically significant changes

in Medicaid expenditures. Second, self-reported quit attempts and smoking cessation are subject to bias because a beneficiary's response may have been related to receipt of financial incentives. For this reason, self-reported estimates of smoking cessation should be interpreted as a best-case-scenario.

This study has shown that financial incentives are a promising policy lever to motivate behavioral change in the Medicaid population. For the Medicaid population, future research should investigate the optimal magnitude of financial incentives, the effectiveness of process-versus outcome-based incentives, targeting of incentives to subpopulations of interest, and the cost-effectiveness of financial incentives in the long run. The answers to these questions will be important for designing effective interventions to reduce the burden of smoking and its related chronic diseases in the Medicaid population.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article:

Appendix SA1: Author Matrix.

Table A1: MIPCD Participant Characteristics.