

## Association between statewide financial incentive programs and COVID-19 vaccination rates

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## **Abstract**

To encourage COVID-19 vaccination, many states in the US have introduced financial incentives ranging from small, guaranteed rewards to lotteries that give vaccinated individuals a chance to win \$1 million or more. We compiled information on statewide incentive programs along with data on daily vaccine doses administered per 100,000 individuals in each state. Leveraging variation across states in the daily presence of incentives, we used difference-in-differences regressions to examine the association between these incentive program indicators and vaccination rates. Difference-in-differences analysis showed that 24 statewide incentive programs were associated with a non-significant relative decline in daily vaccination rates of 8.9 per 100,000 individuals (95% CI [-64.3,46.5];  $p=0.75$ ). Furthermore, there was no significant difference in vaccination trends between states with and without incentives in any of the 14 days before or after incentives were introduced. Lotteries and other incentives offered by 24 states were not associated with a significant change in COVID-19 vaccination rates. More substantial incentives or mandates may be necessary to raise vaccination rates.

**Introduction.** Despite widespread availability of COVID-19 vaccines, about half of Americans are not fully vaccinated and vaccination rates have declined in recent months. To encourage vaccination, many states have introduced financial incentives ranging from small, guaranteed rewards (e.g., free beverages, gift cards) to lotteries that give vaccinated individuals a chance to win \$1 million or more. However, it is unclear whether the various statewide incentive programs have been effective. Evaluations of the first vaccine lottery in Ohio have been inconclusive.<sup>1,2</sup> We examined the association between statewide incentive programs and COVID-19 vaccination rates.

**Methods.** We compiled information on statewide incentive programs from the National Governors' Association<sup>3</sup> and Google News. For each program, we recorded the start date (when vaccinations were first incentivized), end date, and incentive type (lottery or guaranteed). For states with multiple programs, we recorded dates for the program with the highest expected value. We calculated the number of vaccine doses administered daily per 100,000 individuals in each state with data from the US Centers for Disease Control and Prevention,<sup>4</sup> focusing on the period April 1, 2021 (before the first statewide incentive program) to July 29, 2021.

For each state-date combination, we defined an indicator variable reflecting an active incentive program and indicator variables for each of the 14 days before and after incentive programs were introduced. Leveraging variation across states in the daily presence of incentives, we used difference-in-differences regressions<sup>5</sup> to examine the association between these incentive program indicators and vaccination rates. This approach meant that states with incentive programs were also part of the comparison group during periods when incentives were not in effect. In addition, for the 14 days before and after incentive programs were introduced, we compared trends in vaccination rates between states with and without incentive programs. We included state and date fixed effects to adjust for time-invariant differences across states in vaccination rates and for national trends. We clustered standard errors at the state level. All analyses were conducted using Stata version 17.0 (StataCorp).

**Results.** Twenty-four states introduced vaccination incentive programs during the study period (**Table**). The median (interquartile range) percent of the population that was fully vaccinated when incentives began was 43.8% (39.3%-47.2%). Among the 24 states, daily vaccination rates declined in the 14 days post-incentives (351/100,000 individuals) compared to 14 days pre-incentives (486/100,000 individuals). During comparable 14-day periods, vaccination rates also declined in 26 states without statewide incentive programs (351/100,000 individuals pre-incentive, 272/100,000 individuals post-incentive). Difference-in-differences analysis showed that incentive programs were associated with a non-significant relative decline in daily vaccination rates of 8.9 per 100,000 individuals (95% CI [-64.3,46.5];  $p=0.75$ ). Furthermore, there was no significant difference in vaccination trends between states with and without incentives in any of the 14 days before or after incentives were introduced (**Figure**).

**Discussion.** Lotteries and other incentives offered by 24 states were not associated with a significant change in COVID-19 vaccination rates. Confidence intervals for our analyses indicated there was insufficient statistical power to detect small effects of incentives, but that increases of >10% in daily vaccination rates can be ruled out. Many factors likely explain our findings. With about 40% of individuals already fully vaccinated when incentives were introduced, small rewards (e.g., \$5-\$50) or low-probability lotteries may have been insufficiently

persuasive to unvaccinated individuals. Incentives have been effective in other contexts,<sup>6</sup> but their impact may be attenuated if misinformation or distrust is shaping vaccine intentions. Low awareness of incentive programs may also reduce effectiveness. A limitation of the study is that employer or local government incentive programs could have dampened the effects of statewide programs. More substantial incentives or mandates may be necessary to raise vaccination rates.

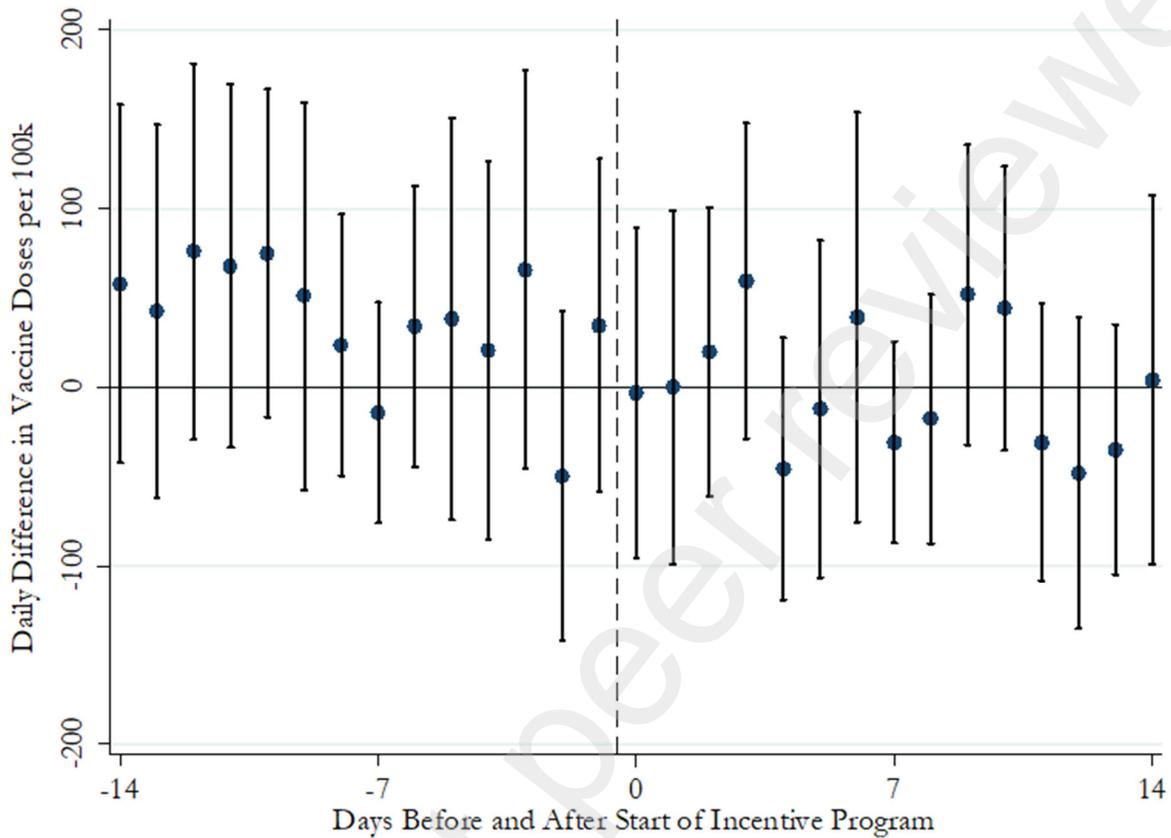
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**Figure. Difference-in-Differences Analysis of Daily Vaccination Rates in States With and Without Incentive Programs, 14 Days Before and After Start of Incentive Programs**



Coefficients and 95% confidence intervals shown from estimation of a difference-in-difference regression model with indicator variables for each of the 14 days before and after statewide incentive programs are introduced. For each day, the y-axis shows the difference in daily vaccine doses administered per 100,000 individuals between states with and without statewide incentive programs, after adjusting for time-invariant differences across states and for national trends with state and date fixed effects, respectively.

**Table. Summary of Analyzed Statewide Incentive Programs for COVID-19 Vaccination and Trends in Daily Vaccination Rates**

State	Start date	End date	Eligibility, Minimum age	Incentive type	Description of primary incentive programs	Daily vaccinations per 100k, mean		
						14 days before	14 days after	Difference
Connecticut	19-May	31-May	All, 12	Guaranteed	Free drink at restaurants	837	583	-254
New Jersey	19-May	4-Jul	All, 12	Guaranteed	Free annual state park pass	735	554	-181
Minnesota	27-May	30-Jun	New, 12	Guaranteed	\$25 Ticket/Pass	623	317	-306
Ohio	13-May	23-Jun	All, 12	Lottery	Five \$1 Million prizes	548	394	-154
Maryland	20-May	3-Jul	All, 18	Lottery	One \$400,000 prize + Daily drawings	819	549	-270
New York	20-May	11-Jun	New, 18	Lottery	One \$5 Million prize	696	556	-140
Oregon	21-May	27-Jun	All, 12	Lottery	One \$1 Million prize	840	622	-217
Colorado	25-May	30-Jun	All, 12	Lottery	Five \$1 Million prizes	637	382	-255
Delaware	25-May	29-Jun	All, 12	Lottery	One \$302,000 prize	538	438	-100
New Mexico	1-Jun	6-Aug	All, 18	Lottery	One \$5 Million prize	451	241	-210
Washington	3-Jun	11-Jul	All, 12	Lottery	One \$1 Million prize	675	446	-230
Hawaii	4-Jun	31-Aug	All, 18	Lottery	\$34,150 total prizes	422	274	-147
Kentucky	4-Jun	25-Aug	All, 12	Lottery	Three \$1 Million prizes	297	314	18
North Carolina	10-Jun	1-Aug	All, 12	Lottery	Four \$1 Million prizes	180	169	-12
Massachusetts	15-Jun	19-Aug	All, 12	Lottery	Five \$1 Million prizes	452	347	-105
Maine	16-Jun	3-Jul	All, 12	Lottery	One \$896,809 prize	431	218	-213
Illinois	17-Jun	19-Aug	All, 12	Lottery	Three \$1 Million prizes	346	360	14
Louisiana	17-Jun	31-Jul	All, 12	Lottery	One \$1 Million prize	218	157	-61
Nevada	17-Jun	26-Aug	All, 12	Lottery	One \$1 Million prize	305	293	-13
Michigan	1-Jul	30-Jul	All, 12	Lottery	One \$2 Million prize + Daily drawings	225	123	-102
Missouri	21-Jul	6-Oct	All, 12	Lottery	900 \$10,000 prizes	156	240	85
West Virginia	20-May	1-Aug	All, 12	Both	\$100 gift card/US treasury bond + One \$1.6 Million prize	289	233	-56
Arkansas	26-May		New, 12	Both	\$20 Game/Fish Certificate, One \$1 Million prize	290	201	-89
California	27-May	18-Jul	New, 12	Both	\$50 gift card + Ten \$1.5 Million prizes	662	413	-249
All 24 states with incentive programs	n/a	n/a	n/a	n/a	n/a	486	351	-135
All 26 states without incentive programs	n/a	n/a	n/a	n/a	n/a	351	272	-79

Eligibility indicates whether all vaccinated individuals or newly vaccinated were eligible for incentives. Minimum age indicates the lowest age of individuals who were eligible for incentives. Program descriptions focus on incentives that were typically offered for individuals aged  $\geq 18$  years, as individuals aged 12-17 years typically received other incentives such as scholarship funds. Among the 26 states without statewide incentive programs, the average daily vaccine doses administered per 100,000 individuals are calculated over the 14-day periods before (and after) the start dates of incentives in the 24 states with statewide incentive programs.