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Impact of Vax-a-Million Lottery on COVID-19 Vaccination Rates in Ohio

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ABSTRACT

BACKGROUND: A decrease in coronavirus disease 2019 (COVID-19) vaccination rates has led some states to consider various incentives to boost demand for vaccines. On May 13, 2021, Ohio announced a free weekly lottery for individuals who received at least 1 COVID-19 vaccination. This study seeks to rigorously quantify the impact of Ohio's vaccination lottery.

METHODS: A synthetic control consisting of a weighted combination of other states was used to approximate the demographic characteristics, new cases, and vaccination rates in Ohio prior to the lottery announcement. The difference in vaccination rates in Ohio and the synthetic control following the lottery announcement was then used to estimate the lottery's impact.

RESULTS: Prior to the lottery announcement, Ohio and synthetic Ohio had similar demographic characteristics and new case rates. Ohio and synthetic Ohio also had identical first vaccination rates. By the final lottery enrollment date of June 20, the percentage of the population with first vaccinations increased to 47.41% in Ohio and 46.43% in synthetic Ohio for a difference of 0.98% (95% confidence interval [CI] 0.42-1.54).

CONCLUSION: An additional 114,553 Ohioans received vaccinations as a result of the Vax-a-Million program (95% CI 49,094-180,012) at a cost of approximately \$49 per Ohioan vaccinated (95% CI \$31-\$114). However, a majority of Ohioans remained unvaccinated by the end of the lottery, indicating that additional efforts are needed to address barriers to vaccination. This synthetic control approach may also be useful to evaluate other COVID-19 incentive programs.

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INTRODUCTION

A decrease in coronavirus disease 2019 (COVID-19) vaccination rates has led some states to consider various incentives to boost demand for vaccines. On May 13, 2021, Ohio Governor Mike DeWine announced a free weekly lottery called Vax-a-Million to be held every Wednesday from May 26 through June 23 for Ohioans who received at least 1 COVID-19 vaccination. The weekly prizes were \$1 million for adults and college

scholarships for children aged 12-17 years, totaling about \$5.6 million over 5 weeks. By June 20, the end of the lottery enrollment period, nearly 3.5 million adults and 155,000 children had registered for the free lottery. Initial reports suggested that vaccinations increased substantially following DeWine's announcement, but later reports were more equivocal, and Ohio continues to trail the national average in vaccination rates.

This study seeks to rigorously quantify the impact of Ohio's vaccination lottery. Doing so is important for several reasons. First, Ohio's lottery received a great deal of national and international attention. Second, governors of several other states mentioned Ohio's program in considering or launching similar programs. Third, federal officials cited Vax-a-Million in encouraging other states to develop their own incentives. Fourth, Ohio's was the first dedicated vaccine lottery and the deadline to enter has passed, so

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enough time has elapsed to examine its effect (ie, 38 days from May 13 to June 20).

METHODS

A synthetic control was used to model vaccination rates in Ohio prior to the lottery announcement. This approach relies on the idea that a weighted combination of other states can better approximate the demographic characteristics, new cases, and vaccination rates in Ohio than any single state alone. Explanatory variables used to construct the synthetic control were selected based on past research identifying them as correlates of COVID-19 vaccination.^{1,2} These variables include age, gender, race/ethnicity, education, poverty, and new case rates. Changes in vaccination rates in Ohio and synthetic Ohio following the lottery announcement can then be used as an indicator of the lottery’s impact. As a result, the synthetic control approach combines elements of both matching and differences-in-differences techniques.

National and state demographic data were obtained from the Census Bureau and COVID-19 case and vaccination rates from the Centers for Disease Control and Prevention.³⁻⁵ To account for lack of data updates on weekends by some states, all case and vaccination values represent 7-day rolling averages. All 30 days of case and vaccine data prior to the lottery announcement (April 13 through May 12, 2021) were used to create the synthetic control. The potential control pool consists of the other 49 states and the District of Columbia. Thirteen states implemented other cash lottery incentives (such as a ticket to a preexisting state lottery or a dedicated vaccine lottery) before June 20 and were excluded from the pool.⁶ The weights chosen for states in the synthetic control minimize root mean square prediction error in the period before the lottery announcement.⁷ The impact of the lottery on vaccination rates was assessed for the period from the lottery announcement date of May 13 to the final lottery enrollment date of June 20.

Two sensitivity tests were performed to assess the robustness of the findings. First, an in-time placebo test reassigned the lottery announcement to the middle of the preannouncement period (April 28) with the final assessment occurring at the announcement date (May 13). Second, a leave-one-out test left out each of the selected control states one at a time.⁷ All analyses were conducted using the R package *microsynth*.⁸

RESULTS

The 11 states that contributed to the synthetic control and their weights are: Tennessee (0.211), North Dakota (0.161),

Oklahoma (0.146), Nebraska (0.116), Wisconsin (0.109), Missouri (0.103), Utah (0.056), Michigan (0.039), Vermont (0.034), Alaska (0.032), and New Hampshire (0.004). Prior to the lottery announcement, Ohio and synthetic Ohio had similar demographic characteristics and new case rates (Table). For example, the percentage of the population age 65 years or older was 17.5% in Ohio and 16.5% in synthetic

Ohio. Ohio and synthetic Ohio also had identical first vaccination rates. On the day before the lottery announcement, 34.4% of the population in both regions had received at least 1 dose of a COVID-19 vaccine.

After the lottery announcement, there were increases in vaccination rates in both regions (Figure). By June 20, the percentage of the population with first vaccinations increased to 47.41% in Ohio and 46.43% in synthetic Ohio for a difference of 0.98% (95% confidence interval [CI] 0.42-1.54). The in-time placebo sensitivity test did not suggest that factors other than the

lottery were responsible for changes in observed vaccination rates. The leave-one-out sensitivity test indicated that results were not driven by any single control state.

DISCUSSION

This analysis finds a statistically significant increase in first vaccinations in Ohio compared to a well-matched synthetic control. The difference is equivalent to 114,553 additional Ohioans getting vaccinated (95% CI 49,094-180,012) at a cost of approximately \$49 per Ohioan vaccinated (95% CI \$31-\$114). However, a majority of Ohioans remained unvaccinated by the end of the lottery, indicating that additional efforts are needed to address barriers to vaccination.

CLINICAL SIGNIFICANCE

- Various incentives have been proposed or implemented to increase coronavirus disease 2019 (COVID-19) vaccination.
- An additional 114,553 individuals received vaccinations as a result of Ohio’s vaccine lottery at a cost of approximately \$49 per Ohioan vaccinated.
- Health providers should continue to educate and encourage their patients to receive COVID-19 vaccinations.

Table Characteristics of Ohio and Synthetic Ohio Prior to Lottery Announcement

	Ohio	Synthetic Ohio
Age ≥ 65 years, %	17.5	16.5
Female, %	51.0	50.8
White non-Hispanic, %	78.4	77.2
College graduates, %	28.3	29.7
Population below poverty level, %	13.1	12.2
Daily new cases per 100,000 population		
30 days before lottery announcement	18.2	16.9
15 days before lottery announcement	12.9	13.5
1 day before lottery announcement	10.3	9.3
Received first vaccine dose, %		
30 days before lottery announcement	34.4	34.4
15 days before lottery announcement	39.3	39.3
1 day before lottery announcement	41.8	41.8

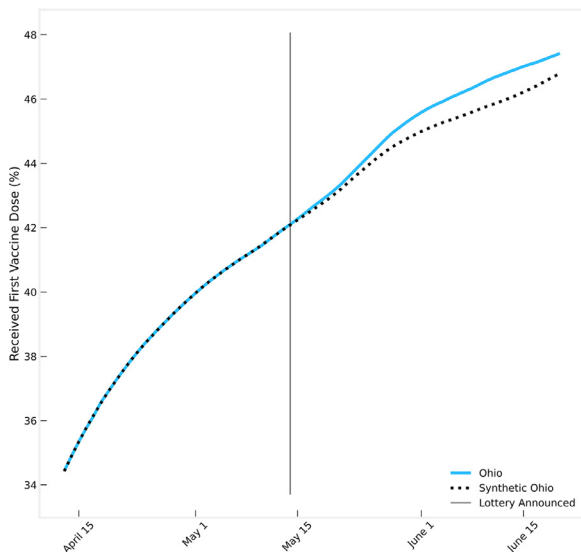


Figure Percentage of population that received first COVID-19 vaccine dose in Ohio and Synthetic Ohio from April 13, 2021 to June 20, 2021. COVID-19 = coronavirus disease 2019.

Limitations of this study include a focus on 1 state and adjustment for a small number of covariates. It is possible that lotteries or similar incentives in other regions may be more or less successful. The analyses do not account for smaller, nonlottery incentives adopted by some control states (such as free tickets to professional baseball games or amusement parks). As a result, the difference between Ohio and synthetic Ohio may be an underestimate. This study

does not address ethical concerns associated with paying people to get vaccinated, nor does it assess potential long-term negative effects of incentives, such as engendering distrust in the safety of vaccines.

These findings may be helpful to policy makers as they consider the merits and costs of similar lotteries. This synthetic control approach may also be useful to evaluate other COVID-19 incentive programs.

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