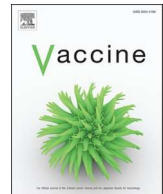




Contents lists available at ScienceDirect

Vaccine

journal homepage: www.elsevier.com/locate/vaccine

Short communication

Massachusetts companion program bolsters COVID-19 vaccine rates among seniors

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ARTICLE INFO

Keywords:

Vaccine uptake

Incentivization

COVID-19

Companion programs

Policy evaluation

Regression discontinuity designs

Generalized additive models

ABSTRACT

In parts of the United States, COVID-19 vaccination rates remained low until late in Fall 2021 owing to both limited vaccine access and hesitancy. With colliding epidemics of RSV, flu, and COVID-19 in the winter, the retrospective evaluation of vaccine incentive policies is needed to inform future routine immunization campaigns. The Massachusetts companion program is one example of a policy that could boost vaccine uptake among older populations. Our regression discontinuity analysis suggests that the program was associated with an increase of up to 22 percentage points in the proportion of individuals aged 75 and older who have been fully vaccinated. Going forward, similar intervention strategies could be invaluable in scenarios where household contacts pose the greatest risk of transmission or where social ties can strongly influence individual decision-making.

1. Introduction

Both limited vaccine access and vaccine hesitancy contributed to low COVID-19 vaccination rates in certain parts of the US until late in Fall 2021 [1–3]. With colliding epidemics of RSV, flu, and SARS-CoV-2 in Winter 2022–2023, the retrospective evaluation of vaccine incentive policies is warranted to prevent another “tripledemic” in subsequent winter seasons [4]. Such an assessment could inform the joint deployment of COVID-19 bivalent booster doses, flu, and RSV vaccines. The concurrent distribution of these vaccines is highly relevant, since the US Centers for Disease Control and Prevention (CDC) recently updated their recommendations for routine immunizations in children and adults to include COVID-19 vaccines and the Advisory Committee on Immunization Practices (ACIP) recently approved RSV vaccines in older adults, pregnant people, infants, and young children [5,6]. Incentive-based policies are particularly relevant in situations where immediate action is needed to counteract vaccine hesitancy [7–9]. Even within households, individuals may have differing opinions about vaccination and prophylactic measures more broadly [10]. In such scenarios, policies

that leverage social and intergenerational influence can improve uptake; those not yet eligible but eager to benefit from an intervention can boost uptake among their eligible but more hesitant social contacts.

The Massachusetts (MA) companion program is one example of such a policy. On February 10, 2021, the Governor's office announced that individuals who accompanied a senior citizen aged 75+ – the only age group eligible for vaccination at the time – could receive their own vaccine on the same day, prior to the eligibility of younger age groups [11]. Initially intended to boost vaccine uptake among older populations, the program also aimed to broaden access and simplify distribution logistics.

2. Methods

To determine whether the MA companion program yielded a boost in COVID-19 vaccination rates among seniors, we performed two regression discontinuity (RD) analyses to measure the increase in the percentage of state residents aged 75+ who (1) had received at least one dose or (2) had been fully vaccinated, proximal to the time of policy

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<https://doi.org/10.1016/j.vaccine.2023.12.048>

Received 7 October 2023; Received in revised form 13 December 2023; Accepted 17 December 2023

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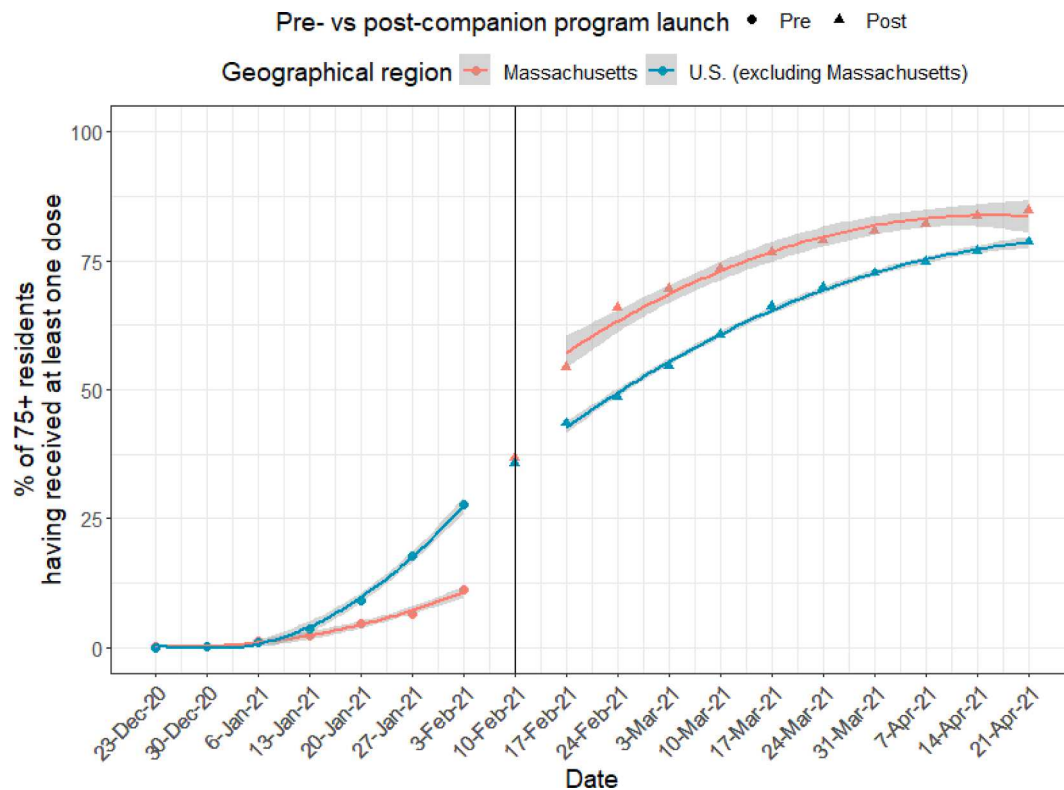


Fig. 1. Regression discontinuity in the percentage of residents aged 75 + having received at least one COVID-19 vaccine dose around the date of the Massachusetts companion program launch. The graph shows the temporal evolution of the percentage of residents aged 75 + who have received at least one COVID-19 vaccine dose, from December 23, 2020 (day 1) to April 21, 2021 (day 120). Data was made available on a weekly basis. Day 50 (February 10, 2021) corresponds the date on which the Massachusetts companion program was launched. The black vertical line marks the policy implementation date and splits the temporal horizon under consideration into two periods: pre (December 23, 2020 to February 3, 2021 or day 1 to 43) and post (February 17, 2021 to April 21, 2021 or day 57 to 120). The red curve is associated with the state of Massachusetts, while the blue curve represents the rest of the United States (i.e., all states but Massachusetts). Fits were obtained using 2-degree polynomial regression on each side of the vertical line, i.e., before and after deployment of the policy (day 50). A “donut” regression discontinuity analysis framework was selected, effectively removing the policy implementation date (day 50) from regression models to consider potential delays between the companion program’s official announcement and its application. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

implementation. We used weekly count data released by the MA Department of Public Health and characterized the evolution of vaccination outcomes in the considered age group. Both time series started on the first available reporting date (December 22, 2020; day 1) and were right-truncated after vaccination opened to the full MA population (April 20, 2021; day 120). A lag of 21 days — the average time between the first and second injection recommended with the Pfizer-BioNTech COVID-19 vaccine [12] — was applied to the second time series, as the potential effect of the companion program on two-dose vaccination could only be observed with a delay. A sensitivity analysis was also conducted using a delay of 28 days, as recommended by the CDC for Moderna vaccines. Additionally, the policy implementation date (day 50) was excluded from the statistical estimation to consider potential delays between the companion program’s official announcement and its application in practice. In addition to this “donut” RD approach, we performed a traditional regression analysis, wherein the policy enactment date was included when fitting the model (Supplemental Appendix). The point estimate of the intention-to-treat effect of the intervention likely lies between those obtained under the “donut” and traditional settings. Moreover, we fitted a generalized additive model (GAM) to each observed vaccination time series, which allowed us to account for varying supply. Of note, we did not account for changes in COVID-19 daily or weekly incidence rates during the study period. Although increased COVID-19 disease prevalence has been posited to associate with increased vaccination uptake, the period surrounding the implementation of the MA companion program coincided with low viral

activity and transmission in the state; therefore, we deemed such adjustment irrelevant in GAMs. Using logistic growth models, we also derived counterfactual uptake trajectories, which we forward-projected (in time) assuming vaccine rollout at a constant speed, to provide an alternative approach for estimating the intervention’s effect.

3. Results

Utilizing our statistical estimation framework, we found that the MA companion program was associated with an increase of up to 35.4 points (95 % CI: 29.4–41.4) in the percentage of state residents aged 75 + who received at least one dose and of up to 22.2 points (95 % CI: 15.9–28.6) in those who received two doses. For comparison, a similar analysis was conducted over the same time period in the rest of the US population aged 75+ (excluding MA); this US-wide analysis did not reveal any significant increases in vaccine uptake (Fig. 1). Sensitivity analyses to the program’s launch date, RD design, and underlying model structure (i.e., RD versus GAM) further confirmed the robustness of our findings (Supplemental Appendix). Although potential confounding in the relationship between the companion program’s launch and vaccination outcomes cannot be fully obviated, our sensitivity analysis using GAMs and explicitly accounting for changes in vaccine supply confirmed a notable effect of the intervention (Supplemental Appendix). Methodologically, our study presents a novel application of causal inference approaches based on regression discontinuity designs to evaluate the effect of incentive-based public health policies. While these methods are

well-established in economics and have been utilized in environmental epidemiology, their broader application in infectious disease epidemiology holds significant promise.

4. Discussion

Access and mobility constraints have been identified as a barrier to immunization among older adults [13–15]. Our retrospective analysis of a natural experiment in Massachusetts provides evidence that companion programs can effectively hasten the speed of vaccine distribution and help achieve desired levels of immunization faster among older age groups. Such incentive-based policies work best in situations where the eligible population is hesitant, while another “companion” population is not yet eligible but is eager to benefit from an early intervention (e.g., in Winter 2022–2023, 65 + individuals were eligible to receive Paxlovid, whereas younger people interested in it were ineligible [16]). Furthermore, the MA companion program may have alleviated logistical barriers owing to identification of a vaccine clinic, subsequent booking of an appointment through an online platform, and ultimately coordination of a transportation means to the corresponding site. Facilitated logistics, in combination with the willingness of companions to get vaccinated, likely contributed to increased vaccination rates among individuals aged 75+. The deployment of companion-like programs during subsequent winter seasons could similarly accelerate concurrent vaccination against respiratory viruses among high-risk priority groups, such as infants, pregnant people, and elderly populations (e.g., during forthcoming RSV vaccination campaigns). In the future, intervention strategies like the MA companion program could prove invaluable in scenarios where household contacts pose the greatest risk of transmission or where social ties can influence individual decision-making.

5. Funding statement

MSM was supported in part by grant SES2200228 from the National Science Foundation. MLC was supported in part by a doctoral fellowship from the MIT-Harvard Broad Institute Eric & Wendy Schmidt Center. The CompEpi Dispersed Volunteer Research Network is sponsored in part by grant R35GM146974 from the National Institute of General Medical Sciences, National Institutes of Health. The funding sources had no involvement in the study design; in the collection, analysis, and interpretation of data; in the writing of the report; or in the decision to submit the paper for publication.

CRedit authorship contribution statement

Marie Charpignon: Conceptualization, Methodology, Data curation, Formal analysis, Software, Visualization, Writing – original draft. **Shagun Gupta:** Visualization, Writing – review & editing. **Maimuna Shahnaz Majumder:** Supervision, Writing – review & editing.

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Maimuna S. Majumder reports financial support was provided by National Institute of General Medical Sciences. Marie-Laure Charpignon

reports financial support was provided by Eric and Wendy Schmidt Center at the MIT-Harvard Broad Institute.

Data availability

Data will be made available on request.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.vaccine.2023.12.048>.

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