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Monetary incentives increase COVID-19 vaccinations

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Stalling COVID-19 vaccination rates threaten public health. To increase vaccination rates, governments across the globe are considering using monetary incentives. We present evidence on the effect of guaranteed payments on COVID-19 vaccination uptake. We ran a large pre-registered randomized controlled trial (N = 8,286) in Sweden and linked the data to population-wide administrative vaccination records. We found that modest monetary payments of $24 (SEK 200) increased vaccination rates by 4.2 percentage points (p = 0.005), from a baseline rate of 71.6%. In contrast, behavioral nudges increased stated intentions to vaccinate but had only small and not statistically significant impacts on vaccination rates. The results highlight the potential of modest monetary incentives to increase vaccination rates.

COVID-19 and the emergence of new variants are a grave threat to public health. Effective vaccination deployment is essential to mitigate that risk (*1*–*3*). Yet, despite widespread awareness and availability of COVID-19 vaccines, many high-income countries struggle to push vaccination rates beyond 70%. At the core of an effective disease containment strategy lie policies that further increase vaccination rates among the hesitant and among people who intend to vaccinate but do not follow through (*4*–*6*).

Governments and organizations across the globe have started using incentives to encourage vaccination, ranging from payments of $5 in Vancouver and lotteries in Ohio to payments of €150 in Greece (*7*, *8*). Many others are now considering introducing payments for vaccinations. Notably, USA President Biden recently urged "[...] state, territorial, and local governments to provide $100 payments for every newly vaccinated American, as an extra incentive to boost vaccination rates, protect communities, and save lives" (*9*). Yet, governments and organizations are limited in their ability to properly assess the impact of monetary incentives because they lack control groups that are not exposed to incentives (*10*). Causal evidence examining the effectiveness of introducing payments for COVID-19 vaccinations is lacking.

Here we report findings from a randomized controlled trial (RCT) studying the impact of guaranteed monetary incentives on COVID-19 vaccination. We paid participants, drawn from a general sample of the Swedish population, SEK 200 (about $24) conditional on becoming vaccinated. The Swedish setting provides a unique opportunity to link individual-level survey data from the RCT to exhaustive population-wide Swedish administrative records for actual vaccinations collected by the public health authorities. We find that the monetary incentives increased vaccination rates by 4.2 percentage points. This is an increase from a 71.6% baseline rate, which is a similar rate to other countries in the EU, indicating that incentives can increase vaccine uptake even in countries with high vaccination rates.

Our findings are also important because it is controversial whether monetary incentives to encourage healthier behavior in general and for COVID-19 vaccination specifically lead to the desired result. While monetary incentives have been shown to sometimes encourage healthier behavior (*11*–*15*), incentives can often be ineffective or counterproductive (*16*–*20*). Based on this evidence, many argue that paying people for COVID-19 vaccinations may signal that vaccination is undesirable or even dangerous (*21*, *22*), or that it could crowd out peoples' motivation to vaccinate to protect others (*7*), leading to a decrease in vaccination uptake. In contrast, our results highlight that modest monetary incentives can increase vaccination rates. However, it is important to note that our findings do not imply that we ought to pay people; our paper does not speak to the normative question of whether paying for vaccination is ethically permissible (*23*, *24*).

We also studied the effect of three behavioral nudges on vaccination uptake. Nudges are subtle interventions that do not deny any options or change economic incentives (*25*). They have been used with varying success to alter behaviors (*4*, *26*–*28*). In the context of COVID-19 vaccinations, one study found that in the initial phase of the vaccination rollout, when vaccination rates were around 13%, reminders to book an appointment increased COVID-19 vaccination rates (*29*). However, at the high vaccination rates achieved in many high-income countries, some have argued that nudges might have reached their limit (*30*). In our trial, we found no statistically significantly impact of any of the nudges on vaccination rates.

We conducted the pre-registered RCT from May to July 2021 with 8,286 participants 18-49 years of age. Participants were recruited from a broadly representative online panel created by Norstat, a large survey company. We sent the survey to each participant as soon as the first Swedish regions opened vaccination for the participant's age group. In the online survey, we randomized participants into five different treatment conditions and one control condition. Immediately after the treatment we measured participants' intentions to get vaccinated against COVID-19. Except for the participants in one of the conditions (the no-reminders condition), all participants, even in the control group, received two reminders to vaccinate two and four weeks after taking the survey. In August 2021, the Swedish Public Health Agency linked the trial data of each participant to their COVID-19 vaccination records collected for all Swedish residents.

Our pre-registered main outcome variables are (i) participants' self-reported intention to get a first dose of a COVID-19 vaccine within 30 days after vaccines become available to them and (ii) whether participants vaccinated within 30 days according to the administrative records. All reported results in the text and figures come from ordinary least squares regressions (OLS) with heteroscedasticity-robust standard errors (see SM section 1.2.2 for details; all p-values come from two-sided *t* tests).

In the incentives condition, participants were offered a monetary incentive of SEK 200 (about $24) if they vaccinated within 30 days of the vaccine becoming available to them. We checked uptake using the administrative vaccination records.

The incentives condition increased both vaccination intention and actual uptake compared to the control condition (Fig. 1). The proportion of participants who intended to vaccinate within 30 days was 83.5% in the control condition and 87.2% in the incentives condition, a difference of 3.9 percentage points ($p = 0.001$). The proportion of participants who were vaccinated within 30 days was 71.6% in the control condition and 75.6% in the incentives condition, a difference of 4 percentage points ($p = 0.009$).

The effect sizes from our pre-registered main specification are shown in Fig. 2. We estimated that receiving monetary incentives for vaccinating increased intentions to vaccinate by 3.7 percentage points ($p = 0.002$) relative to the control condition. Corresponding to the higher intentions, actual vaccination rates increased by 4.2 percentage points ($p = 0.005$). These results are robust to a battery of robustness checks, such as considering secondary outcome variables, including different sets of control variables, using logistic regressions, correcting for multiple hypothesis testing, and including all participants who went through the experimental intervention but did not finish the survey (see SM sections 2.3 and 2.4). We observed similar effects for incentives for vaccination uptake within 10, 20, 30, 40, and 50 days after survey completion (see SM table S7). These results showed that monetary incentives not only accelerated immediate vaccination uptake but increased uptake for at least 50 days.

We collected detailed information on individual characteristics of the participants. We found large baseline differences in vaccination uptake across sociodemographic groups: People with a higher socio-economic status (college degree, higher income, employed) showed higher vaccination rates (see SM section 2.6). Strikingly, and despite the different baseline vaccination rates, we found that monetary incentives increased vaccination rates similarly across all subgroups (see SM section 2.5). This result indicates that monetary incentives have the potential to increase vaccination rates irrespective of people's background.

We also employed different types of behavioral nudges to persuade participants to vaccinate (*26*, *31*): We asked participants to make a list of four people who would benefit from the participant vaccinating (social impact condition) (*32*–*34*), to write down arguments that could best convince another person to vaccinate (arguments condition) (*27*), and to participate in a quiz with information on the safety and effectiveness of COVID-19 vaccines (information condition) (*29*). In contrast to the other conditions, a final condition (the no-reminders condition) did not include any nudge or reminder, allowing us to study the impact of reminders on vaccination uptake (*29*).

Some behavioral nudges did statistically significantly increase participants' intentions to vaccinate, but none increased actual vaccination uptake (Fig. 2). When we pooled the data from the three nudges conditions (social impact, argument, information condition), we found that nudging may increase vaccination intentions by 1.8 percentage points ($p = 0.056$). However, the increase in intentions only translates to a 1.2 percentage points ($p = 0.302$) increase in vaccination uptake, which is not statistically significantly different from zero. Of the nudges, the social impact and argument conditions had the highest impact on intentions (2.2 percentage points, $p = 0.072$; 2.7 percentage points, $p = 0.028$), but neither of them statistically significantly increased actual vaccination uptake (1.4 percentage points, $p = 0.360$; 1.3 percentage points, $p = 0.388$). The comparison of the no-reminder condition with the control condition indicated that reminders did not substantially affect vaccination rates ($p = 0.594$). Moreover, there is no statistically significant difference between the no-reminder condition and the three nudge conditions ($p = 0.243$). We did not find any statistically significant or economically meaningful differences across sociodemographic groups, such as immigrant status, income or gender (see SM table S21).

Hence, we found larger impacts of monetary incentives on vaccination uptake than of behavioral nudges. While the preregistered main analysis focused on the comparison between each of the experimental conditions and the control condition, we could also study the impact of the incentives condition relative to the three nudges. We found that the incentives condition had a larger impact on vaccination uptake than the three nudges pooled (3.1 percentage points difference, $p = 0.038$).

There is also a difference between giving monetary incentives and behavioral nudges in whether, at the end of the survey, participants clicked a link to a website with information to schedule a vaccine appointment (Fig. 3). In the incentives condition, participants were 4.9 percentage points ($p < 0.001$) more likely to click on the link, while participants in the nudge conditions did not click on the link more often than those in the control condition (−0.08 percentage points, $p = 0.889$). Thus, participants were more likely to click the appointments link in the incentives condition compared to the three behavioral nudge conditions (4.8 percentage points, $p < 0.001$).

In sum, our study reveals that even modest monetary incentives can increase COVID-19 vaccination rates. We found that payments of SEK 200 (≈$24) increased COVID-19 vaccination rates by 4 percentage points. Our trial shows that incentives can increase vaccination uptake even when baseline vaccination rates are high. In contrast, behavioral nudges had small and not statistically significant effects on vaccination rates.

A natural question is whether paying people to get vaccinated is cost effective for governments. In addition to the direct benefits of saving lives, increasing vaccination rates leads to indirect benefits such as higher population immunity, lower hospitalization rates and medical costs, and economic growth. It is beyond the scope of this report to provide an encompassing cost-effectiveness analysis, but SM section 2.9 offers some perspectives on why our intervention likely is cost-effective. A key consideration is that paying for vaccination carries much lower costs for society than the sum of all payments; since money is transferred from the government to the citizens, the money paid is not lost.

Our study has several limitations. First, we only tested one size of monetary incentive. Companies and governments around the world have proposed incentives that range from less than $1 in Philadelphia and €25 in Serbia, to $100 in New York. Our trial cannot shed light on whether smaller or larger incentives would be more effective. We also cannot assess the effectiveness of other ways of incentivizing people, such as increasing health insurance premiums for the unvaccinated. Second, while during summer 2021 Sweden had a vaccination rate in line with the EU average, countries greatly differ in the proportion of vaccinated population, and the effect of incentives may vary depending on vaccination rates. Relatedly, we offered incentives when the rollout was starting; results could differ if monetary incentives are offered later, for example because unvaccinated people could increase their reluctance over time. Third, monetary incentives could potentially crowd out the willingness to get vaccinated in the future (e.g., booster shots) without getting paid. Finally, people might react differently based on who provides monetary incentives and corresponding trust in receiving the promised payments. In our case, researchers provided incentives, but the effects could differ if incentives were offered by governments or companies.

Despite these limitations, our pre-registered trial yields a clear result: guaranteed incentives can increase COVID-19 vaccinations. As the COVID-19 pandemic continues, incentives could be an effective tool to reduce COVID-19 spread and fatalities.

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SUPPLEMENTARY MATERIALS
science.org/doi/10.1126/science.abm0475
Materials and Methods
Supplementary Text
Figs. S1 to S12
Tables S1 to S28
References (*36*–*43*)
MDAR Reproducibility Checklist

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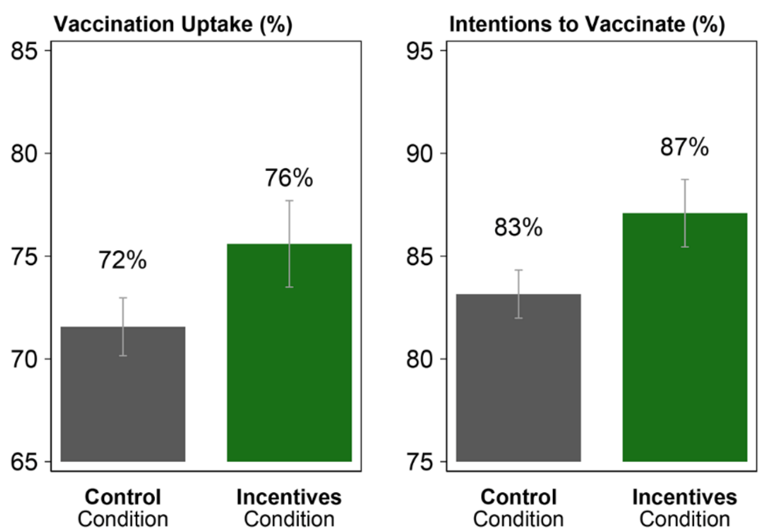

Fig. 1. Vaccination uptake and intentions to vaccinate, incentives condition relative to control condition. This figure displays the proportion of participants in the Incentives and Control Condition who got vaccinated or who intended to vaccinate. The figure is based on survey data from the trial linked to Swedish administrative records on vaccination. Vaccination Uptake indicates the proportion of participants getting vaccinated within 30 days of the trial according to vaccination records. Intentions to Vaccinate indicates the proportion of participants intending to vaccinate within 30 days of the trial according to experimental data. Error bars represent normal-based 90% confidence intervals (CI: mean ± 1.64 SE) from ordinary least squares regressions with heteroscedasticity robust standard errors. The number of participants is 1,131 in the Incentives Condition and 2,778 in the Control Condition.

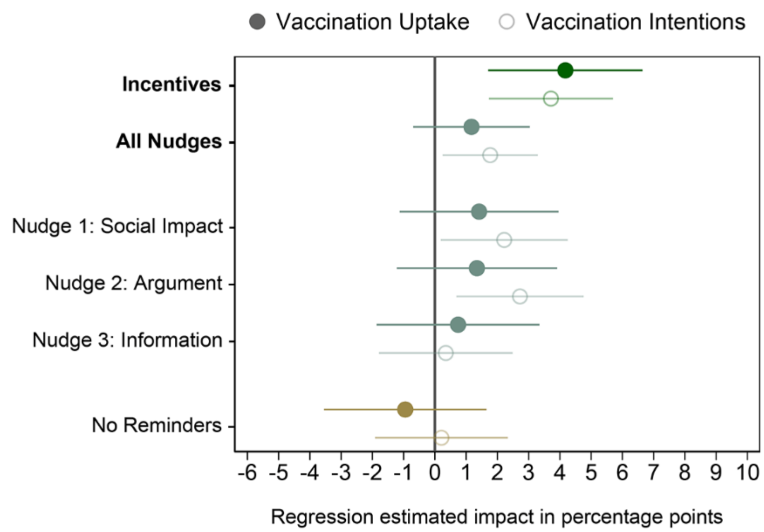

Fig. 2. Regression-estimated effects of experimental conditions on vaccination uptake and vaccination intentions vs. the control condition (N = 8,286). The figure shows regression-estimated effects (ordinary least squares regression) of the experimental conditions relative to the control condition, as pre-registered. In addition, the All Nudges shows the estimate when we pool the social impact condition, argument condition, and information condition. The filled circles indicate the estimated impact on vaccination uptake within 30 days after participation in the survey (100 if the participant got vaccinated, 0 otherwise). The non-filled circles indicate the estimated impact on intended vaccination uptake (100 if the participant intends to vaccinate, 0 otherwise) within 30 days. Error bars represent 90% normal-based confidence intervals (CI: coefficient ± 1.64 SE) from ordinary least squares regressions with heteroscedasticity robust standard errors.

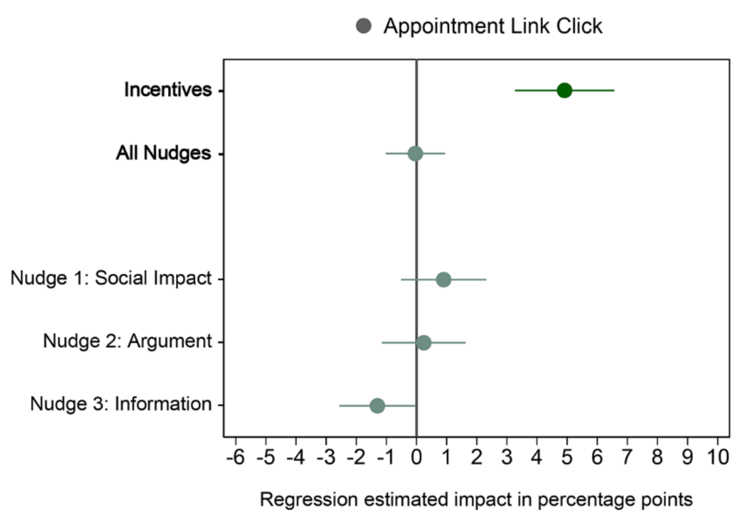

Fig. 3. Regression-estimated effects of experimental conditions on whether participants click a link to a website with the information to schedule an appointment (N = 7,288). The figure shows regression-estimated effects (ordinary least squares regression) of the experimental conditions relative to the control condition, as pre-registered. In addition, All Nudges shows the estimate when we pool the social impact condition, argument condition, and information condition. The circles indicate the estimated impact of each of the experimental conditions on the probability of clicking the appointment link (100 if the participant clicked the link, 0 otherwise). The no-reminders condition is not included because this condition did not include the link. Error bars represent 90% normal-based confidence intervals (CI: coefficient ± 1.64 SE) from ordinary least squares regressions with heteroscedasticity robust standard errors.

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