Vaccines at Work

Manuel Hoffmann[1] (Texas A&M University)

Roberto Mosquera[1] (Texas A&M University)

Adrian Chadi[2] (University of Konstanz)

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Abstract

Influenza imposes substantial costs worldwide in terms of human lives and productivity losses. Vaccination could be a cost-effective way to reduce these costs for firms and public health institutions, but low take-up rates, particularly of working adults, and vaccination unintendingly causing moral hazard may decrease its benefits. We ran a natural field experiment in cooperation with a major bank in Ecuador where we modified a company-wide vaccination campaign. Experimentally manipulating incentives to participate in this health intervention allows us to study peer effects with organizational data and to determine the personal consequences of being randomly encouraged to take part in the campaign. We find that assigning employees to get vaccinated during the workweek increased take-up by 112% compared to employees assigned to the weekend, which indicates that reducing opportunity costs plays an important role to increase vaccination rates. Peer take-up also increased individual take-up significantly. Contrary to the company's expectations, we find that the effect of vaccination on health outcomes is a precise zero with no measurable health externalities from coworkers. Using a dataset of administrative records on sickness diagnoses and employee surveys, we find evidence consistent with vaccination causing moral hazard, which could decrease the effectiveness of vaccination.

JEL Classification: D90; I12; J01; N36

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[1] Economics Department, Texas A&M University, 4228 TAMU, College Station, TX 77843, Manuel Hoffmann, manuelhoffmann@tamu.edu; Roberto Mosquera, robmun12@tamu.edu.

[2] Department of Economics, University of Konstanz, PO Box 131, Universitätsstr. 10, 78457 Konstanz, E-Mail: Adrian.Chadi@uni-konstanz.de.

1. Introduction

Seasonal influenza causes substantial morbidity and mortality every year around the world. The World Health Organization (WHO, 2018) estimates that the flu is associated with three to five million cases of severe respiratory illnesses and between 290,000 to 600,000 deaths per year worldwide. Rothman (2017) estimates that the flu has an economic burden of approximately $34.7 billion in the United States, most of it due to lives lost and foregone work. Molinari et al. (2007) associate 16 million days of productivity lost due to influenza in the United States. For both public health institutions and firms, flu vaccination has the potential to be a cost-effective way to reduce the incidence of the disease and its costs. From an immunological perspective, the flu vaccine increases the level of individual immunity by generating antibodies (Gross et al., 1989, Cox et al., 2004), which promises to reduce the transmission rate of the disease.

However, individual behavior can counter the potential benefits of vaccination in two ways. First, according to the World Bank, the Center for Disease Control, and other public health institutions, vaccination rates in most countries of the world are substantially below recommended levels.[1] Therefore, it is essential to understand the factors that affect vaccination take-up, particularly of working adults who are the least likely to get the vaccine. Second, economic theory and empirical evidence suggest that the adoption of protective technologies may induce individuals to behave riskier.[2] Vaccinated individuals may overestimate the protection that the vaccine grants and engage in risky behaviors like waiting longer before going to the doctor when feeling sick and taking fewer protective measures to prevent illnesses. Thus, moral hazard could counter the benefits of adopting a preventive medical technology like the flu vaccine.

In this paper we study how economic factors affect working adults' decision to vaccinate, the effects of vaccination on health and whether flu vaccination can cause moral hazard. In cooperation with a major bank in Ecuador that provides annual vaccination campaigns to improve its

[1] Public health institutions recommend that everybody over six months should vaccinate against the flu. However, flu vaccination rates in European countries ranges from 2% to 70% (Mereckiene, 2015), and only 38.5% of adults 18 and older were immunized in the United States during the 2017-2018 flu season (Srivastav et al., 2018).

[2] There is a large literature that studies whether the adoption of any type of safety device leads individuals to adopt riskier practices. (Peltzman, 1975; Richens et al., 2000; Auld, 2003; Cohen and Einav, 2003; Klick and Stratmann, 2007; Peltzman, 2011; Prasad and Jena, 2014; and Talamàs et al., 2018). There is a larger literature that studies moral hazard in insurance. For studies on moral hazard in medical insurance see Einav et al. (2013) and Einav and Finkelstein (2018).

employees' health, we randomize incentives to get a flu shot. We follow the definition of a natural field experiment (Harrison and List, 2004) closely by studying individual behavior in an environment where subjects naturally make their decisions without knowing that they are participants in an experiment. Our design allows us to analyze how economic factors – price, opportunity costs, information, and peers – affect working adults' decision to vaccinate. In a second step, we use the exogenous variation on vaccination generated by the random incentives to study its impact on employees' health and their behavior. Thus, we use a random encouragement design (List et al., 2017) in a health-related context, which constitutes an ethical approach for evaluating the effects of adopting a medical technology that in our view is superior to existing empirical approaches.

Much of the medical research on vaccines relies on evidence from observational studies without randomization of the individual treatment. While reviews of the medical literature document the positive health effects of flu vaccination, many of the medical studies could be affected by selection and other biases, as pointed out by Jefferson et al. (2010), Osterholm et al. (2012), Demicheli et al. (2014), and Østerhus (2015). For instance, researchers describe the problem of a "healthy vaccine recipient effect," which implies that healthier individuals are more likely to get vaccinated. Such positive selection bias could lead to an overestimation of the health effects. Still, observational studies are often preferred because of ethical concerns regarding experimental interventions in the context of health. This concern is also true for randomized controlled trials on vaccines, which, if conducted, rarely make use of placebos for ethical reasons (Sanson-Fisher et al., 2007, Baxter et al., 2010), but instead manipulate the type of vaccine across treatment and control groups. Besides these identification issues, the medical research on vaccines focuses only on the medical effects, without considering changes in behavior that may affect health. By design, participants of a randomized controlled trial know that they are in an experiment but do not know if they received the vaccine or not, which rules out changes in behavior. Since public institutions and companies are interested in the total effect of health interventions, we believe that our random encouragement design is superior in the sense that it captures both behavioral and medical effects from getting vaccinated and it circumvents the ethical dilemma of withholding a potentially effective medical treatment as in placebo-controlled interventions.

We introduced three modifications to the bank's 2017 vaccination campaign to influence vaccination take-up: We changed the vaccine's price at an income threshold, assigned weekdays for on-site vaccinations randomly across employees, and varied the content of the emails used to invite employees to vaccinate. Regarding price, employees who earned less than $750 would receive a $2.48 price discount from the bank if they got vaccinated. To implement the other encouragements, we randomly assigned all employees into four groups. Employees assigned to the control group were informed of the campaign via email about their assigned day during the workweek, time, and the vaccine's price. The first treatment group received the same information as the control, but employees were assigned to get vaccinated on Saturday. Assigning employees for vaccination on Saturday increases the opportunity costs of vaccination compared to the workweek because these employees would need to incur additional transportation costs and arrange their weekend schedule to get vaccinated. In contrast, assigning employees to the workweek minimizes their opportunity costs because the bank allows them to take time off their duties to get vaccinated. The second and third treatment groups received the same email as the control, plus an information nudge in the form of a short message summarizing the altruistic and individual benefits of the vaccine, respectively.

To investigate the determinants and consequences of vaccination, we have access to administrative data from the bank that we merge with information on treatment assignment at the individual level. The firm's data includes detailed medical diagnoses for each employee, so we can precisely identify flu diagnoses and the resulting sick days. We check if getting vaccinated affects these measures of health. Also, being able to distinguish flu-related sickness from non-flu-related sickness allows us to study behavioral effects, assuming that flu vaccination has no direct effect on non-flu-related sickness. Also, our empirical setting helps us with the issue of health spill-overs, as in principle unvaccinated individuals could benefit from vaccinated peers. First, general population flu vaccination rates in Ecuador fluctuate around 2% (ENSANUT, 2012), which is far below the levels that grant herd-immunity effects. Second, we can empirically check whether peer effects in health are an issue by using the bank's organizational data. In our setup, the bank's units, which group the employees that work directly together every day, are the relevant social groups.[3] Given our intervention at the employee level, by chance, there are some units which have more employees encouraged to get the vaccine than in other units. We exploit this variation to study peer effects in take-up as well as potential health effects of having exogenously vaccinated peers. Finally, employee surveys before and after the vaccination campaign complement our dataset and allow inspection of possible mechanisms for the effects on employee health and behavior.

We find the following results on the factors that affect vaccination take-up. First, we assess how price and opportunity costs affect vaccination take-up on working adults. Economic theory identifies both monetary and opportunity costs as a relevant component in the decision to adopt medical technologies like vaccination (Brito et al., 1991; Geoffard and Philipson, 1997; Kremer and Miguel, 2007; Chen and Toxvaerd, 2014, Schaller et al., 2017)). We find that a $2.48 change in price did not affect take-up. Conversely, decreasing opportunity costs by assigning employees to get vaccinated during the workweek increased take-up by 14 percentage points, a 112 percent increase compared to Saturday. Thus, reducing opportunity costs has a significant effect on take-up for working adults. Other policy measures directed to increase vaccination rates of adults, such as advertising or commitment devices, have smaller effects than reducing these costs (Nowalk et al., 2010; Milkman et al., 2011).[4] Thus, public health institutions and firms can cost-effectively increase take-up by minimizing opportunity costs. Information on the altruistic or personal benefits of vaccination is another factor that could affect take-up, but we find no effect from providing this information. The coefficients are close to zero, negative and statistically insignificant, which is consistent with previous studies (Bronchetti et al., 2015; Godinho et al. 2016). Given that reducing opportunity costs has a substantial effect on take-up, it is plausible that supplying a sentence of additional information is not enough to further increase it.

Having found a significant determinant of vaccine take-up, we can use the random assignment to the workweek to identify both the effects of vaccination on health and potential peer effects within units. First, we study the causal effect of randomly vaccinated coworkers on individual take-up by exploiting exogenous variation in the proportion of peers who get vaccinated. While

[3] Previous studies on peer effects in the adoption of medical technology rely on distance measures or on self-reported (incentivized and non-incentivized) networks of friends (Kremer and Miguel, 2007; Sato and Takasaki, 2015b, Rao et al., 2017).

[4] Nowalk et al. (2010) find that increased advertising increases take-up by 29% in adults older than 50 years, with no effect on younger adults. Milkman et al. (2011) find that the use of commitment devices increases take-up by 13%.

previous empirical work has revealed mixed results of peer effects on the adoption of medical technologies, we find a positive effect of peers on take-up.[5] The estimates indicate that if the proportion of peers that get vaccinated increases by ten percentage points, take-up increases by 7.9 percentage points. We explore potential mechanisms and find that peers are not changing information and beliefs about vaccination. Instead, our evidence suggests that employees react to social norms.

Next, we study the consequences of vaccine take-up by examining if flu vaccination is effective to improve working adults' health. If flu vaccination decreases flu cases, we expect that offering employees the opportunity to get vaccinated during the workweek would reduce the number of flu cases and thereby the incidence of sickness as well as absence from work due to higher vaccine take-up. However, we find that assigning employees to the workweek did not affect the probability of having a sick day or the incidence of a sickness per se. Using detailed data on medical diagnoses, we find no evidence that exogenously triggered vaccination decreased the probability of getting sick due to the flu. In particular, we can rule out an effect of -2.4 percentage points that correspond to the CDC's estimate of the effectiveness of the 2017-2018 flu vaccine.[6] Also, we explore whether peer vaccination affects employees' health. We find that peer vaccination does not affect the probability of having a sick day due to the flu, which is consistent with low unit vaccination rates that do not grant herd immunity.

We continue analyzing the consequences of vaccination by exploring if getting vaccinated can unintendingly cause moral hazard. As mentioned above, medical studies usually do not consider if vaccination could induce risky behavior (Prasad et al., 2014), while the few papers in economics that quasi-experimentally study moral hazard in the context of medical interventions have mixed results (Margolis et al., 2014; Moghtaderi and Dor, 2016; Doleac and Mukjerjee, 2018). We find several pieces of evidence suggesting that getting vaccinated can indeed cause moral hazard. First,

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[5] Theoretically, peer vaccination can either increase (Kremer and Miguel, 2007) or decrease individual take-up (Geoffard and Philipson, 1997; Chen and Toxvaerd, 2014). For flu vaccination, Rao et al. (2017) estimate a positive peer effect on flu vaccination for college students in Harvard. Regarding other medical technologies, Kremer and Miguel (2007) find that increased deworming of peers reduces deworming take-up in Kenya. Conversely, Sato and Takasaki (2015b) find that having at least one friend who got vaccinated against tetanus increases the likelihood of tetanus vaccination of women in rural Nigeria.

[6] The CDC calculates the effectiveness of the vaccine by comparing hospitalization rates due to the flu of vaccinated and unvaccinated individuals. In the 2017-2018 flu season, the CDC estimates that getting vaccinated decreased the probability of being hospitalized due to the flu by 36 percentage points. Scaling up this effect by the estimate of the effect of being assigned for vaccination in the workweek on vaccination take-up (6.7 percentage points with the most conservative first stage) yields a reduced form effect of -2.4 percentage points.

we test if getting vaccinated leads to individuals to feel more protected and to react differently than the unvaccinated when flu-like symptoms arise. Non-flu respiratory diseases have symptoms similar to the flu, but the flu vaccine does not provide any immunity benefit to prevent them. Thus, flu vaccination should not affect the probability of being diagnosed with a non-flu disease, so any effect on this probability would imply a change in how employees react when sick with a respiratory disease. In particular, if vaccinated employees feel more protected, they might be less likely to go to the doctor when they feel flu-like symptoms, and the probability of being diagnosed with a non-flu disease would decrease. Consistent with this hypothesis, we find that assigning individuals to get vaccinated on the workweek decreased the likelihood of being diagnosed with a non-flu respiratory disease by 6.5 percentage points (20% of the baseline). Consistent with moral hazard, we find that assigning individuals to the workweek decreased the likelihood of going to the bank's on-site doctor for any reason.[7] Finally, we asked employees in the post-intervention survey about self-reported habits related to improving health. In line with the idea of riskier behavior among the vaccinated, we find that assigning employees for vaccination on the workweek decreased the frequency of people reporting to carry an umbrella by 18 percent of the baseline. As Ecuadorians and many other cultures around the world believe that carrying an umbrella could help prevent the flu and other respiratory diseases, this result suggests that vaccinated employees are less likely to engage in practices believed to prevent the flu. In summary, the results from our analyses suggest that getting vaccinated can create a moral hazard problem that could reduce the effectiveness of flu vaccination.

The factors that affect vaccination take-up and the causal impacts of flu vaccination on health have been of great interest to researchers in medicine and economics. In comparison to previous work, our intervention quantifies large effects of opportunity costs on vaccination of working adults and how peers affect take-up. Thus, we contribute to the ongoing research on the determinants of vaccine take-up, as an example of the adoption of preventive medical technology. According to previous studies, other factors that can affect vaccination take-up include information, education, age, health status, health behavior, and lifestyle (Maurer, 2009; Schmitz and Wuebker, 2011; Godinho et al., 2016; Chang, 2018). We also contribute to the research on peer effects, which has important implications on workplace productivity (Mas and Moretti, 2009;

[7] The on-site doctor is a convenient feature the bank offers its employees. Before the intervention 77 percent of all sick cases correspond to visits to these doctors.

Herbst and Mas, 2014) and has recently been recognized as an important aspect in human behavior concerning health. Our findings on the health effects of vaccine take-up add to an ongoing discussion that predominantly takes place in the medical literature, with few exceptions such as Ager et al. (2017) for smallpox vaccines as well as Ward (2014) and White (2018) for influenza vaccines. Vaccination campaigns are seen as a way to tackle sickness-related absence, which is a topic of high economic relevance (Ziebarth and Karlsson, 2010; Bütikofer and Skira, 2018). Finally, with our investigation of a company-wide vaccination campaign, we contribute to the literature of on-site health interventions (Just and Price, 2013; List and Samek, 2015; Belot and Nolen, 2016), whereas our findings may also inform the broader literature on public health interventions (Evers et al., 1998; Cawley, 2010; Bütikofer and Salvanes, forthcoming). By showing how preventive medical technologies can unintendingly cause moral hazard, we may offer a partial explanation why health interventions may not always be as successful as expected in improving people's health.

2. Experimental Design

We ran the field experiment in cooperation with a bank in Ecuador. This bank focuses on consumer credit and is one of the largest credit card issuers in the country. Its headquarters is in Quito, Ecuador's capital, and it has six branches across the country with over 1,300 employees, distributed in 31 divisions with 142 working units. The bank had run small vaccination campaigns in the past. These campaigns included only some employees in crowded areas and ran during the workweek in the bank's offices.[8] In 2017, the bank decided to extend its annual campaign to all its employees and allowed us to experimentally modify it to investigate how to increase take-up and the effects of vaccination. We implemented three interventions: we changed the vaccine's price for some employees using income-dependent subsidies, we randomized assignments for on-site vaccinations across weekdays, and we implemented information nudges by varying the content of the emails that were used to invite employees to vaccinate.

[8] These areas included the call center and the collections departments, which only have few employees. We exclude the call center from our analysis of the 2017 campaign, as we have evidence that the call center supervisors pushed their employees into taking the vaccine leading to a take-up of almost 100%.

The bank decided to give the vaccine for free to areas that participated in campaigns in previous years and to partially subsidize it for new participants. We used the employees' income to allocate this subsidy. Employees who earned less than $750 per month would pay $4.95 to get vaccinated, while those who earned more than $750 would pay $7.43. Note that the vaccine's full price is $9.99. The payment was directly deducted from the employees' paycheck if they opted to get vaccinated.

To examine the effects of opportunity costs and information, we randomly assigned all employees into one of four groups.[9] First, employees assigned to the control group (*Control*) received an email informing them about the campaign, their assigned day, time, and the price they would have to pay (see Figure A1). These employees were assigned to get vaccinated during the workweek (Wednesday, Thursday or Friday) and were allowed to take time off their duties to get vaccinated. The specific day was selected randomly for each employee.

The first treatment increased the opportunity costs of vaccination by assigning employees to get vaccinated on *Saturday*. The employees usually do not work during the weekend, so they would incur extra transportation costs and would have to arrange their schedule to go to the bank and get vaccinated.[10] Otherwise, this group received the same information as the Control (see Figure A2). This treatment was only applied in Quito because all the other branches are substantially smaller (82% of the employees work in Quito), and their employees could get vaccinated in a single day, which was not possible in Quito.[11]

We also implemented two information nudges. The first nudge highlights the social benefits of flu immunization (*Altruistic Treatment*). In addition to the information provided to the control group, the email included the phrase: "Getting vaccinated also protects people around you, including those who are more vulnerable to serious flu illness, like infants, young children, the elderly and people with serious health conditions that cannot get vaccinated" (see Figure A3). The second nudge highlights the individual benefits of flu immunization (*Selfish Treatment*). In addition to the information provided to the control group, the email included the phrase:

[9] The bank requested that we exclude the CEO and another high executive from the intervention. We also excluded our counterpart in Human Resources and four employees who work in the local branches and did not have a company email address to deliver the treatments.

[10] Based on data from the employees' magnetic cards swipes to enter the bank, only 0.4% of the employees work regularly on Saturdays.

[11] Branches in the coastlands were randomly assigned to get vaccinated on Wednesday, and branches in the highlands were assigned to Thursday.

"Vaccination can significantly reduce your risk of getting sick, according to both health officials from the World Health Organization and numerous scientific studies" (see Figure A4). Employees in these two treatments were assigned to get vaccinated during the workweek and the specific day was selected randomly.

Our intervention targeted the Ecuadorian flu season which usually covers the period from November to the end of February (Ropero, 2011). The bank ran a pre-intervention survey from October 25 to October 29, 2017. Human Resources sent the intervention emails on November 1, 2017, using its official email account. Employees were not aware that this study was taking place. For them, the campaign was just a regular activity organized by the Human Resources department. Employees are used to receiving emails from Human Resources and according to the Human Resources manager typically read these emails carefully. The bank sent out a reminder using the same email account a week later. The vaccination campaign ran from November 8 to November 11, 2017, at locations within the bank's offices in each branch. The bank hired an external medical team to supply and inject the vaccines. Finally, the bank conducted a post-survey during March and April 2018.[12]

3. Data

This section describes the data used in our analyses for assessing how economic factors can affect take-up and the effects of the flu vaccine on health. First, we have access to the firm's administrative records about its employees: gender, age, education level, and dependents; job and its position within the bank's organizational structure; tenure and income; and sickness diagnoses and sick days. Second, we collected vaccination take-up data from the bank's campaign records. Third, we use data from pre- and post-intervention surveys. These surveys asked employees about: previous illnesses and general health; knowledge and beliefs about vaccination and the flu vaccine; habits related to health; relations with coworkers; opinions about the campaign; motivation; organizational attachment and work satisfaction; and risk and time preferences.

[12] The geographic locations of the banks' branches are displayed in Figure A5 and a depiction of the timeline is shown in Figure A6. Figure A7 provides information about the flu vaccine used and Figure A8 shows an individual getting vaccinated during the campaign.

--- Table 1 about here ---

Table 1 presents the mean characteristics of the bank's employees (Column 1). On average, employees earn a total monthly income of $1,760. As a reference, in 2017 the average total income in Ecuador was $479, which implies that the bank's employees are in the three highest deciles of the Ecuadorian income distribution (ENEMDU, 2017). The average employee has been in the company for more than seven years and is around 36 years old. The company employs roughly the same number of men and women, and more than 90% of its employees have at least some college education, close to education levels in developed countries. Almost 50% of the employees completed the pre-intervention survey, a high completion rate compared to previous surveys from Human Resources. The completion rate decreased to 36% for the post-intervention survey.

The administrative data include two measures of health: medical diagnoses and sick days. These measures come from two sources: the onsite doctors and medical certificates from outside doctors. It is important to note that Ecuadorian law establishes that employees must present a medical certificate to get a sick day.[13] Consequently, the onsite doctors report every visit they receive to Human Resources. The doctors report the diagnosis (the type of disease), whether they granted a sick day or not, and the number of sick days granted. Also, by law, if an employee takes time off work to go to an outside doctor, then she has to present to Human Resources a medical certificate that indicates the diagnosis and number of sick days granted if any.[14] Hence, in addition to sick days, we can also observe employees being diagnosed sick with no sick days granted for cases where a doctor did not consider the illness severe enough. Thus, sick days are a measure of more severe illness. From January to early November 2017, before the intervention, 14% of the employees were sick from any disease, and 6% had at least one sick day.

Table 1 also shows evidence on the balance of treatment assignment. Columns 2 to 5 present the mean employee characteristics across the four groups. All variables have almost identical means across groups. For each characteristic, Column 6 shows the p-value of a joint significance test of differences of means. We cannot reject the null hypothesis that the means are the same across the four treatments, which suggests that our randomization was successful. The Kruskal-

[13] By law employees in Ecuador also have up to one year of paid leave due to sickness and employers are not allowed to terminate employment during sick leave.

[14] Doctors diagnose their patient using a combination of a physical examination, blood tests and culture tests. The specific procedure is part of individual medical records and we do not have access to that data.

Wallis rank test shows the same result. Finally, we test whether answering the pre and post surveys is different across treatments and find no statistically significant difference.

4. Analysis of Vaccination Take-up

In this section, we study how economic factors affect working adults' decision to vaccinate. Specifically, we consider the effect of opportunity costs, altruistic and individual information, and peers on take-up in detail. Regarding the income-dependent vaccine subsidy, we do not find any effect of the $2.48 price difference on vaccination take-up.[15] We conclude that such price change may be too small to induce changes in take-up behavior.

The last row in Table 1 presents the flu immunization take-up rates for the different treatments during the campaign. The *Control* group has a take-up rate of 22%, the *Altruistic* treatment has a take-up of 17%, and the *Selfish* treatment has a take-up of 19%. Comparing across the three groups suggests that the information treatments were not sufficient to increase take-up. In contrast, being assigned to get vaccinated during the workweek increases take-up by 14 percentage points in contrast to *Saturday* (112%).[16] We extend the analysis of these effects in the next section.

4.1 Effects of Opportunity Costs and Information on Individual Take-up

We model the effect of opportunity costs, altruistic information and selfish information on vaccination take-up for employee *i* in city *c* using the following equation:

$$Takeup_{ic} = \alpha + \gamma_c + \pi_1 Saturday_{ic} + \pi_2 Altruism_{ic} + \pi_3 Selfish_{ic} + u_{ic} \qquad (1)$$

where $Takeup_{ic}$ is an indicator of getting vaccinated. We include Quito fixed effects γ_c to account for differences in implementation of the vaccination day assignment across branches as discussed in Section 2. $Saturday_{ic}$, $Altruism_{ic}$, and $Selfish_{ic}$ are dummy variables that indicate

[15] Figure A9 shows no visible discontinuity across the threshold. Regression discontinuity estimates also do not indicate any significant change in take-up at the cutoff (see Table A1), which is robust to different bandwidths.
[16] In the post-intervention survey 59 employees report that they got vaccinated outside the campaign. Vaccination outside the campaign is not significantly different by treatment status. Also note that between November 2017 and February 2018, 20 treated employees quit the bank. Attrition is not correlated with assignment to the treatments.

treatment assignment. Thus, we estimate the effect of the different treatments relative to those individuals who were assigned to vaccination on the workweek and did not receive any information nudge.

Table 2 presents the effects of the different treatments on take-up. Column 1 shows baseline results of the effect of opportunity costs and information on vaccination take-up. The estimates indicate that assigning employees to *Saturday* decreased take-up by 7.9 percentage points compared to the *Control*. This effect is approximately 46% of the *Control's* take-up and is statistically significant at the 1% level. Hence, minimizing the opportunity costs associated with vaccination is a useful measure to increase take-up.

Conversely, we find that emphasizing either the altruistic or the selfish benefits of vaccination does not affect take-up. The coefficients are close to zero, negative and statistically insignificant. It is plausible that supplying a sentence of additional information is not enough to further increase take-up given that reducing opportunity costs has a substantial effect on it.[17] One interpretation of these results is that information would have to be very salient to accrue an effect on vaccine take-up in a company context such as this.

---- Table 2 about here ---

Columns 2-4 of Table 2 show the robustness of the results to the inclusion of controls, to the use of a restricted sample, and to controlling for non-compliance. Specifically, Column 2 shows that controlling for the vaccine's price, income, tenure, division in the company, gender, age, and education level does not affect the estimates. Column 3 addresses the fact that only employees who work in the bank's headquarters in Quito were assigned to vaccinate on *Saturday*. In this subsample, assigning employees to *Saturday* decreased take-up by almost nine percentage points (51% of the control group take-up), significant at the 1% level. This result is slightly larger than the main result, but we cannot reject that they are statistically the same. Both information treatments have small, negative and statistically insignificant effects. Column 4 shows the effect

[17] The post intervention survey asks if the employee recalls the altruistic and selfish information statements. Appendix Table A2 shows that neither employees assigned to the *Altruistic* treatment nor those assigned to the *Selfish* treatment remember their respective statements better than the control. Another issue could be spillovers of information, but this is unlikely given that our design provides information directly to the treated individuals via email.

of controlling for non-compliance.[18] In this subsample, assigning employees to *Saturday* decreased take-up by 6.7 percentage points, significant at the 5% level. We cannot reject that this estimate is statistically the same as the baseline result. The estimates of the effect of the information treatments are practically the same as the main estimates.

Lastly, in Column 5 we check whether assignment to different days in the week affects take-up differentially. We exploit the fact that vaccination days are randomly assigned, and we regress our indicator of vaccination take-up on dummies for the assigned day (*Wednesday*, *Thursday*, *Friday* or *Saturday*), using the Quito's subsample.[19] These estimates show that take-up on *Thursday* and *Friday* is not statistically different from take-up on *Wednesday*, while the effect of *Saturday* is substantially larger in magnitude and very close to the baseline estimate in Column 1.[20] These results do not support time-inconsistent preferences that would induce procrastination as the mechanism behind the *Saturday* effect and are consistent with increasing opportunity costs.[21]

4.2 Further Evidence on Opportunity Costs

We analyze heterogeneous treatment effects across different subgroups of our study population, which may yield further evidence that opportunity costs are driving the difference in take-up between being assigned to vaccinate on the workweek and Saturday.[22] We focus on differences across gender, distance to work, and employees with and without children.[23] Figure 1 shows that assignment to *Saturday* has larger effects for men than for women, although the difference is not statistically significant.

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[18] We identified in the campaign records 12 people assigned to the workweek who vaccinated on *Saturday*. The bank asked the medical team in charge of the vaccination campaign to enforce the day assigned to each employee, but they failed to enforce this requirement on Saturday and were unable to send employees back home if they showed up that day. In contrast, nobody of those assigned to *Saturday* got vaccinated during the workweek.

[19] Of the bank's employees in Quito, after excluding the call center, 23.4% where assigned to vaccination on *Wednesday*, 26.7% to *Thursday*, 26.5% to *Friday*, and 23.4% to *Saturday*.

[20] While the effect of assignment to *Friday* is not significant, it is 44% of the effect of *Saturday* and two orders of magnitude larger than the effect of *Thursday*. Being assigned to *Friday* can slightly increase the opportunity cost of vaccination because it is only a 6-hour workday if employees finish their tasks.

[21] Also, the *Control* includes people assigned to *Wednesday*, *Thursday* and *Friday*, so any effect of procrastination is included in the comparison made in the baseline estimates.

[22] We find that the information treatments have no differential effect across subgroups. These estimates are small and statistically insignificant. See Table A3.

[23] Distance to work was calculated with a geo-location service using employees' home addresses.

--- Figure 1 about here ---

Distance to work reflects the transportation costs that an individual regularly incurs. The median employee lives 6.5 km away from work. Figure 1 shows that those who live further away than the median are slightly less likely to get vaccinated when they were assigned to *Saturday* than those who live closer to the bank, but this difference is not statistically significant. This result is consistent with increasing travel costs, but the magnitude suggests that travel costs are not the main factor driving the difference in take-up between employees assigned to the workweek and *Saturday*.

Finally, we consider differences in the effect between employees with and without children. Having children may imply higher opportunity costs at the weekend by increased family obligations. Figure 1 shows that assignment to *Saturday* decreased take-up by 10.6 percentage points for employees with children, while the effect is smaller (5.3 percentage points) and insignificant for employees without children. Although the difference between these two effects is not significant, its magnitude is consistent with the idea that opportunity costs increase for people assigned to *Saturday*.

In conclusion, these results suggest that the difference in take-up between employees assigned to the workweek and *Saturday* correspond to a change in the opportunity costs of vaccination. We use only this variation in take-up created by lowering opportunity costs as an instrument in the rest of our analyses.

4.3 Peer Effects on Vaccination Take-up

Peer effects may play an important role in vaccination behavior by either increasing or decreasing take-up. When a person gets vaccinated, the prevalence of the disease may decrease, making it less likely for others to get sick. Thus, if getting vaccinated has costs, then it may be optimal for some people not to do so if their peers got vaccinated. Theoretically, this free-rider problem can result in a Nash equilibrium where nobody takes the vaccine (Chen and Toxvaerd, 2014). Conversely, peers may increase take-up by exchanging information that affects individual beliefs about the flu and the vaccine. Also, individuals may imitate the health care behavior of their peers to conform to social norms (Kremer and Miguel, 2007).

The exogenous variation in take-up created by assigning people to get vaccinated in the workweek allows us to estimate the effects of groups who work together every day on vaccination. The bank's units define the social groups of employees that work directly together. Thus, we can identify the effect of social groups with whom adults share a large portion of their daily time on vaccine take-up. We will also use this approach to analyze peer effects in health caused by vaccinated peers below (Section 5).

We model the effect of the proportion of peers in unit j who take the vaccine on employee i's decision as

$$Takeup_{ijc} = \gamma_c + \beta_1 Prop.Takeup_{jc} + \beta_2 X_{ic} + \beta_3 \bar{X}_{jc} + \pi_3 Workweek_{ic} + u_{ijc} \qquad (2)$$

where $Prop.Takeup_{jc}$ is the proportion of peers in unit j who get vaccinated and $\bar{X}_{jc}$ are the average observable characteristics of peers j. Manski (1993) shows that if we estimate equation (2) by OLS, self-selection, common environmental factors and reflection confound the true peer effects β_1 and β_3. However, in our design employees are randomly assigned to vaccination on the workweek independently of their unit. This creates an exogenous variation that affects the proportion of peers who get vaccinated independently of employee i's decision to get vaccinated because by chance some units have more employees assigned to the workweek than other units. We can average equation (2) across unit j to obtain the first stage equation:

$$Prop.Takeup_{jc} = \frac{\gamma_c}{1-\beta_1} + \frac{\beta_2+\beta_3}{1-\beta_1}\bar{X}_{jc} + \frac{\pi_3}{1-\beta_1}Prop.Workweek_{jc} + \frac{\bar{u}_{ijc}}{1-\beta_1} \qquad (3)$$

where the proportion of peers in unit j who get vaccinated is a function of the proportion of peers who were randomly assigned to the workweek ($Prop.Workweek_{jc}$). Random assignment implies that $Prop.Workweek_{jc}$ is uncorrelated with both $\bar{X}_{jc}$ and $\bar{u}_{ijc}$. Hence, the reduced form equation is

$$Takeup_{ijc} = \left(\frac{\gamma_c}{1-\beta_1}\right) + \left(\frac{\beta_1\beta_2+\beta_3}{1-\beta_1}\right)\bar{X}_{jc} + \beta_2 X_{ic} + \frac{\beta_1\pi_3}{1-\beta_1}Prop.Workweek_{jc} + \pi_3 Workweek_{ic} + \tilde{u}_{ijc} \quad (4)$$

In our design, the exclusion restriction holds because the proportion of peers that got vaccinated is the only channel through which the proportion of peers assigned to the workweek can affect the individual's vaccination decision. Hence, we can combine the estimates from equations (3) and (4) to obtain an IV estimate of the effect of the proportion vaccinated peers on the employee's take-up. The error term in equation (4) includes both the individual error from equation (2) and the average error from equation (3), so we cluster the standard errors at the unit level.

--- Table 3 about here ---

Panel A in Table 3 presents the main results. The first stage estimate in Column 1 indicates that a ten-percentage-point increase in the proportion of peers assigned to the workweek increased by 3.1 percentage points the proportion of peers that get vaccinated. The F-statistic is 16.48, so according to the results of Stock and Yogo (2002), the instrument is relevant. The estimates in columns 2-4 show that peer vaccination has a positive effect on individual take-up and that not accounting for endogeneity biases the effect downwards. The IV estimate in Column 4 indicates that a ten percentage points increase in the proportion of peers that get vaccinated increased take-up by 7.9 percentage points. The results are robust to controlling for the total number of people in the unit and for mean age and gender of the peers (Appendix Table A4).[24]

The positive peer effect on individual take-up suggests that peers might be changing personal beliefs about vaccination or that individuals follow behavior that they deem socially acceptable. To disentangle these potential channels, we first explore how individual take-up responds to peers of similar or different gender. There is evidence that individuals react more to peers of similar characteristics (Akerlof and Kranton, 2000; Hoffman et al., 1996; Perkins, 2002). Thus, if peers with similar characteristics have a larger effect on take-up than peers with different characteristics, this would suggest that following social norms may be the mechanism behind the positive peer effect on take-up. Panel B in Table 3 shows that ten percentage points increase in the proportion of peers of the same gender who get vaccinated increased take-up by 7.6 percentage points. This

[24] Mechanically, smaller units may have larger proportions. We also control for the proportion of peers in the unit who have some managerial position. The point estimates are not affected by including this control variable.

effect is almost identical to the main estimate and is driven by men. The effect of peers of a different gender is 37% smaller and is not significant.

--- Table 4 about here ---

To study if peers might be changing personal beliefs about vaccination more directly, we exploit the post-intervention survey questions on beliefs and knowledge of flu vaccines and interactions with coworkers related to vaccination. Even though answering the post-intervention survey is not correlated with treatment assignment (Table 1), the first stage loses precision due to the smaller sample size in the survey. We focus on reduced form analyses to prevent issues with finite sample bias in the IV estimate. Panel A in Table 4 shows the results on a set of 12 outcomes. The proportion of peers assigned to the workweek only had a negative and significant effect on talking with coworkers about vaccination.[25] This negative effect could be a consequence of the fact that employees expect that events organized by the bank take place during the workweek, so they are less likely to mention this to their coworkers.[26] There is no significant effect on any of the questions regarding information or beliefs about the vaccine, nor on questions that measure how much coworkers influenced the vaccination decision. Moreover, the point estimates are small compared to the baselines, which suggests that peers' behavior did not affect beliefs nor supplied new information about the vaccine and is not the driver of the positive peer effect we find.

To further test if employees following behavior that they deem socially acceptable is the driver of the peer effects on vaccination take-up, we check if extrinsically motivated employees are more likely to be affected by their peers' behavior. Intuitively, extrinsically motivated individuals are more likely to respond to stimuli from their surrounding environment, which implies that they should be more likely to follow their peers' behavior. The pre-intervention survey has questions to determine if employees are intrinsically or extrinsically motivated.[27] Panel B in Table 4 shows

[25] This effect is robust to adjusting for the false discovery rate (FDR) as in Anderson (2008).

[26] Additionally, an employee who learns she is in a unit with a large proportion of assigned to Saturday might feel lucky that she was assigned to the workweek and get vaccinated. This would bias downwards the estimate of the effect of the proportion of vaccinated peers on take-up in Table 3.

[27] The intrinsic motivation measure is a dummy variable based on a median split of a summation of four measures of motivation in the workplace where employees state how important is that they (i) learn something interesting, (ii) get motivated to think about things, (iii) gain a thorough understanding of content and (iv) feel that their opinions are considered.

the reduced form effect of the proportion of peers assigned to the workweek on these subgroups. For extrinsically motivated employees, a ten percentage points increase in the proportion of peers assigned to the workweek would increase take-up by 4.5 percentage points, while intrinsically motivated employees' take-up would increase by only 0.6 percentage points. The difference between the subgroups is significant at the 5% level. These estimates suggest that the estimated peer effects are a consequence of individuals conforming with the norms of their work group.

5. Analysis of the Effects of Vaccination on Health and Risky Behavior

In this section, we exploit random assignment to get vaccinated in the workweek as an instrument to study if flu vaccination improved health by reducing cases of employees diagnosed sick days in our intervention. In order to shed light on one of the potential mechanisms underlying the health results, we then use the same approach to explore if getting vaccinated can induce moral hazard.

5.1 Effects of Flu Vaccination on Health

Flu vaccines may affect health through multiple avenues, direct and indirect. First and foremost, getting vaccinated could have a direct effect on health by increasing immunity against four strands of the flu virus. Besides, the results in the previous section show that if a person gets vaccinated, the likelihood that her close peers get vaccinated increases. This effect would imply that an employee's close peers are more protected against the flu, which may decrease the transmission rate of the disease. Thus, positive peer effects on vaccination take-up could create an indirect channel through which getting vaccinated might have a positive effect on health. While the overall vaccination rate in the firm's 142 units is far too low to provide herd immunity (see Table 1), the proportion of vaccinated peers by unit ranges substantially between 0 and 67%.[28] Thus, in some units, the proportion of vaccinated peers may be high enough to provide some protection. Ideally, we could estimate the effect of flu immunization on health outcomes (Y_{ijc}) - medical diagnoses and sick days- through these two channels as:

[28] Figure A10 displays the number of employees by unit. The CDC and WHO indicate that vaccination rates over 75% grant herd immunity.

$$Y_{ijc} = \alpha + \gamma_c + \theta Takeup_{ijc} + \delta Prop.Takeup_{jc} + \nu_{ijc} \quad (5)$$

However, vaccination take-up and the proportion of peers who get vaccinated are potentially endogenous. For example, individuals with healthier lifestyles could be more likely to vaccinate and less likely to need a sick day, so the estimates of equation (5) by OLS would be biased downwards. Thus, we instrument take-up with an indicator of assignment to vaccination during the workweek, and we instrument the proportion of vaccinated peers in the unit with the proportion of peers assigned to the workweek. The first stage equations have F-statistics of 6.6 and 8.9, respectively, implying that IV estimates of equation (5) may have a problem of finite sample bias (Stock and Yogo, 2002). Thus, we focus on the reduced form estimates of regressing the health outcomes on the instruments, given that those estimates are valid.

--- Table 5 about here ---

Panel A in Table 5 presents the effects of flu vaccination on the probability of having a sick day between November 2017 and February 2018. The OLS estimate in Column 1 suggests that getting vaccinated decreased the probability of having a sick day by 4.1 percentage points (14% of the baseline), although the effect is insignificant. Conversely, the reduced form estimates in Column 2 imply that getting vaccinated did not affect the probability of having a sick day. Being randomly assigned to the workweek, which increases vaccination take-up, increased the probability of having a sick day by 1.3 percentage points (5% of the baseline), insignificantly at conventional levels. Additionally, the results in columns 1 and 2 indicate that the proportion of vaccinated peers does not affect the probability of having a sick day. Panel B shows the effects of flu vaccination on the number of sick days. The OLS correlation suggests that vaccination decreases sick days, which is significant at the 10 percent level. However, the reduced form effect is no longer significant and sensitive to the presence of outliers.[29]

[29] Sick days include severe illnesses, such as cancer, which leads to large numbers of sick days not related to the flu. If we exclude these outliers, the coefficient of the reduced-form changes and becomes positive, in line with our finding in panel A of Table 5 on the probability of having a sick day or not. Also, the effects do not change if we take out the proportion of peers and estimate only the individual effect of vaccination.

--- Table 6 about here ---

Total sick days include many diseases over which the flu vaccine has no immunity benefit. To address this issue, we exploit the data on medical diagnoses and estimate the effect of vaccination on both the probability of being diagnosed with the flu (Table 6 Panel A) and the probability of having a sick day because of the flu (Table 6 Panel B). The OLS estimates in Column 1 suggest that getting vaccinated decreases the probability of being diagnosed with the flu. However, the reduced form estimate in Column 2 indicates that being assigned to the workweek increased the probability of being diagnosed with the flu by 0.4 percentage points (9% of the baseline), not significant at conventional levels. This result further suggests that getting vaccinated was ineffective to decrease the probability of having the flu. Also, the estimates in columns 1 and 2 show that the proportion of vaccinated peers do not affect the probability of being diagnosed with the flu, which suggests that vaccination rates are too low to provide herd immunity. Thus, we drop the proportion of vaccinated peers in the following analyses.

Panel B presents the effects of assignment to the workweek on the probability of having a sick day because of the flu. These results are qualitatively the same as the effects on the probability of being diagnosed with the flu. The confidence interval of the effect of being assigned to the workweek rules out negative effects larger than 0.5 percentage points. In particular, we can rule out a negative effect of 2.2 percentage points that correspond to the CDC's estimate of the effectiveness of the 2017-2018 flu vaccine.[30]

5.2 Can Getting Vaccinated Cause Moral Hazard?

The previous results imply that vaccinating employees against the flu appears to be ineffective. A simple explanation could be that the 2017-2018 vaccine did not match the prevailing flu strains in that particular flu season. The flu vaccine grants protection against three or four strands of the flu virus. If the vaccine does not match the prevailing strands of the flu virus, then vaccination would be ineffective in improving health. Taking into account that the quality of the flu vaccine

[30] In Appendix Table A5 we check the robustness of these results to the inclusion of controls (gender, age, tenure and income) and to using a broader definition of flu-related illness, thereby increasing case numbers. The results are robust to these checks. Also, the results are robust to using a negative binomial or Poisson regression.

could vary by year and by country, the bank and its employees may have had just bad luck. While our design does not allow us to test if the flu vaccine was immunologically effective, we can study if getting vaccinated induces people to engage in riskier practices, which may separately contribute to decreasing the effectiveness of flu vaccination.

As a first empirical test of the idea of behavioral changes due to flu vaccination, we inspect effect heterogeneity. The medical effectiveness of the vaccine does not depend on employee characteristics. Thus, if there is no change in behavior, assignment to the workweek should not have different effects across subgroups defined by gender, age, or having children. However, Appendix Table A6 shows that assignment to the workweek increased the probability of having a flu-related sick day among subgroups who are more likely to be exposed to children, who are more likely to have the flu.

Vaccinated individuals could overestimate the protection of the vaccine and engage in riskier behaviors. As a consequence, it is possible that vaccinated people avoid going to the doctor or wait longer than unvaccinated people to do it when they feel flu-like symptoms. Also, vaccinated individuals could take fewer protective measures, such as washing hands less frequently, and these changes in behavior would expose individuals more to strands of the flu virus that the vaccine might not cover.

To further explore if flu vaccination may cause a moral hazard problem, we test if getting vaccinated makes people react differently than those unvaccinated when they feel flu-like symptoms. The idea here is that non-flu respiratory diseases have symptoms similar to the flu, but the vaccine does not provide any immunity benefit to prevent them. Thus, flu vaccination should not affect the probability of being diagnosed with a non-flu disease, so any effect on this probability would imply a change in how individuals react when becoming sick with a respiratory disease. In particular, if vaccinated employees felt more protected, they might have been less likely to go to the doctor when they felt flu-like symptoms, decreasing the probability of being diagnosed with a non-flu disease. In particular, this would concern cases of mild illnesses where it is up to the individual to decide to go to a doctor or not.

To implement this test, we exploit the richness of the data that differentiates between flu and non-flu respiratory diagnoses by exploiting a policy intervention of the Ecuadorian government that happened in our investigation period. In January 2018, as a result of a significant increment of flu cases nationwide, the Ecuadorian government launched a massive media campaign asking the population to go to the doctor if they felt any flu symptoms. If vaccinated individuals felt protected, we argue that they may not have followed the government's recommendation, resulting in fewer visits to the doctor and fewer non-flu diagnoses in that month.

--- Figure 2 about here ---

We estimate the reduced-form effects of vaccination by month during our investigation period. Figure 2 presents the effects of being assigned to the workweek on flu and non-flu diagnoses. As the main result, assigning employees to the workweek does not affect the probability of being diagnosed with the flu in any month. The point estimates are smaller than 0.7 percentage points in magnitude and insignificant at conventional levels. These results further confirm that vaccination was ineffective.

Regarding non-flu diagnoses, if vaccination did not induce people to feel more protected, we would expect to find no effect on the probability of being diagnosed with a non-flu respiratory disease. This is true in November, December, and February. However, in January when the government asked people to go to the doctor, being assigned to the workweek decreased the probability of being diagnosed with a non-flu respiratory disease by 7.2 percentage points.[31] This result suggests that employees assigned to the workweek, who were more likely to get vaccinated, felt protected and went less to the doctor when they felt flu-like symptoms. These estimates are consistent with the hypothesis of riskier behavior among vaccinated individuals, as they appeared to think that they are protected against the flu.

[31] We also estimate the effect of assignment to the workweek collapsing the data of the four months to a cross-section. In this specification, being assigned to the workweek decreased the probability of being diagnosed with a non-flu respiratory disease by 7.5 percentage points. (Appendix Table A5), almost identical to the effect in January. Another check concerns the fact that the data on sickness diagnoses correspond to employees who went to the onsite doctor or to an external doctor during working hours, while employees who went to an external doctor outside working hours, who were diagnosed sick but were not granted a sick day, are coded as healthy. This measurement error will not bias the previous estimates as long as it is uncorrelated with assignment to the workweek. However, if employees assigned to get vaccinated during the workweek are more likely to go to an external doctor after work, then this would overestimate the effect on non-flu respiratory diagnoses. We bound the effect to address this potential concern (Lee, 2009). First, we calculate the treatment-control difference in the proportion of healthy individuals. Then, we trim this difference from the control group (assigned to vaccination on Saturday) to obtain an upper bound, and we trim this difference from the treatment group (assigned to vaccination on the workweek) to obtain a lower bound. Appendix Table A7 presents these results. The effect of being assigned to the workweek is always negative and bounded between 5.4 and 9.8 percentage points.

--- Figure 3 about here ---

Figure 3 presents the reduced form effects of the assignment to the workweek on the probability of having a sick day because of the flu and other non-flu respiratory diseases. These results answer the question of whether cases of diagnosed sickness that we observe in Figure 2were severe enough also to get a sick day granted. The results in Figure 3 are qualitatively similar to the effects on the probability of being diagnosed with these illnesses but less precise. Assigning employees to the workweek did not affect the probability of having a flu-related sick day. Regarding non-flu respiratory diseases, the point estimates are consistent with the results in Figure 2. While assigning employees to the workweek increased the probability of having a non-flu respiratory sick day in December, the probability decreased in January by 2.9 percentage points. This reduction corresponds to the finding in Figure 2 but suggests that the vaccinated are less likely to go to the doctor in the presence of mild flu symptoms.

--- Figure 4 about here ---

We can also check if vaccination affects the likelihood of going to the on-site doctor. The bank's on-site health center is a convenient feature for its employees because they do not have to ask for time off to go to the doctor as they can take a few minutes of their work time to go to the health center. Before the intervention, the on-site doctors account for 77 percent of all cases of diagnosed sickness. If vaccinated individuals felt more protected, they may have been less likely to visit these doctors when the government launched its media campaign. Figure 4 presents the effects of assigning employees to the workweek on the probability of going to the on-site doctor by month. There was no significant effect in November, December, and February. In January, being assigned to the workweek for vaccination decreased the probability of going to the onsite doctor by 8.6 percentage points (21% of the baseline).

--- Table 7 about here ---

In our final test for moral hazard, we look at self-reported habits and cultural beliefs related to preventing the flu. In the post-intervention survey, the bank asked its employees how often they: (i) exercise; (ii) wash their hands; (iii) use an umbrella; and (iv) take nutritional supplements. Washing hands is a proven measure against the flu, exercising and taking nutritional supplement may improve overall health, and many people including Ecuadorians believe that carrying an umbrella helps to prevent the flu or other respiratory illnesses. Psychology research show that cultures across the world associate the fact that the flu virus survives longer on a cold and wet environment with the belief that people catch the flu by getting wet or cold (Au et al., 2008; Sigelman et al., 1993; Baer et al., 1999; Helman, 1978).[32]

Table 7 shows the effects of assigning employees to the workweek on these outcomes. Assigning employees to the workweek did not affect how often employees wash their hands (1% of the baseline), which is not surprising since they report that they wash their hands very frequently. Assigning employees to the workweek had a negative but statistically insignificant effect on how often employees exercise (5% of the baseline) and how often they take nutritional supplements (19% of the baseline). The effect on how often employees carry an umbrella is statistically significant. Being assigned to the workweek decreases the frequency of carrying an umbrella by 1.22 points (18% of the baseline) on a Likert scale where one means "never" and ten "all the time."[33] We can also investigate heterogeneous effects across individuals' beliefs on the effectiveness of the vaccine using the pre-intervention survey. We find that the effect is driven by individuals who believe the vaccine is very effective to prevent the flu. Thus, this result suggests that vaccinated individuals feel protected, so they neglect other measures that they believe to be helpful in order to prevent respiratory illnesses.

5.3 Other Interpretations of the Results on Moral Hazard

In the previous section, we provide several pieces of evidence supporting the idea that flu vaccination caused a moral hazard problem. In the following, we discuss other interpretations of

[32] Also, since Quito is on the Equator Line, there are no marked seasons in the year. In Quito, temperatures in a day can fluctuate between the upper forties (°F) and the lower eighties (°F), and there are no accurate forecasts for rain.
[33] This effect is significant at the 5% level (p-value=0.012) and robust to adjusting for multiple comparisons following Anderson (2008).

these findings focusing on whether other factors not related to moral hazard could explain these results.

Misdiagnoses could be a competing explanation. If doctors are not able to distinguish the flu from other non-flu respiratory diseases, then the non-flu cases could have been flu cases. If this were true, the results in Figure 2 would indicate that the vaccine was effective in January 2018 when the flu was prevalent in Ecuador. While we cannot directly observe how doctors diagnose the flu in the data, we observe diagnoses from 72 different doctors from different health centers and hospitals. It is unlikely that all doctors misdiagnosed the flu. Also, the results are robust to using a broader definition of flu-related illness. Finally, misdiagnoses do not explain why vaccinated individuals are less likely to carry an umbrella as a cultural protective measure against the flu.

We could also think that doctors misdiagnose conditional on whether a person got vaccinated or not. When a doctor learns that a person who shows flu-like symptoms got vaccinated, the doctor might be more likely to misdiagnose those symptoms as a non-flu respiratory disease. However, the results in Figure 2 show that employees assigned to the workweek, who are more likely to get vaccinated, were diagnosed less with non-flu respiratory diseases.

Finally, an alternative to moral hazard is the idea of adverse selection: employees with higher risk tolerance regarding health are more likely to get vaccinated and to engage in risky health behavior. However, adverse selection cannot be a driver of our results because we use an exogenous source of variation on take-up. The marginal individual who gets vaccinated is a person who would not have gotten vaccinated if assigned to Saturday. This variation is uncorrelated with the underlying risk preferences of employees that could determine adverse selection.

6. Conclusions

Individual behavior may threaten the success of health interventions in multiple ways. First and foremost, individuals can decide not to participate. In this paper, we find that reducing opportunity costs has a substantial effect on participation in a vaccination campaign in the context of employees in working age who live in locations where access to vaccines is not an issue, as in most major cities in both developing and developed countries, and who are not affected by income constraints.

Previous research finds effects of similar magnitudes in rural areas in developing countries (Banerjee et al., 2010; Sato and Takasaki, 2015a) or populations with income constraints (Bronchetti et al., 2015). Regarding the health benefits of the intervention in our study, flu vaccination did not have a significant effect on any of our outcomes. While we cannot rule out that the flu vaccine was medically ineffective, we find evidence consistent with individuals adopting riskier behaviors after getting vaccinated. Moral hazard constitutes a second way through which individual behavior could limit the effectiveness of health interventions.

Our study provides several pieces of evidence that speak to the idea of riskier behaviors regarding health among vaccinated individuals. We argue that getting the vaccine is not relevant to determine the effects we find on diagnosed non-flu respiratory diseases, where the vaccine has no immunity effect. It appears that employees made different decisions about whether to go to the doctor or not, depending on being vaccinated. Furthermore, survey evidence on differences in the likelihood of carrying an umbrella illustrates potential changes in health-related behaviors following vaccination. These results suggest that getting vaccinated could cause moral hazard. Forgoing other protective measures and increasing risky behaviors could partially explain the ineffectiveness of vaccination and could help understand better why health interventions may sometimes fail. Regarding the interpretation of the health effects in our study, moral hazard undermining the effectiveness of vaccination is consistent with quasi-experimental evidence on the effectiveness of flu vaccination. For example, Ward (2014) finds for Canada that: (i) flu vaccination increased sickness absences in years when the flu vaccine had a bad match with the prevalent flu viruses; and (ii) flu vaccination had no effect in years when the flu vaccine had a good match with the prevalent flu viruses. The difference between these two results, which would control for moral hazard, points to the immunological benefits of the vaccine.

To answer the question of whether the vaccination campaign was economically successful for the company carrying out this health intervention, we can perform a back-of-the-envelope calculation of the net benefit of this campaign. This analysis has the limitation that we are not able to fully quantify all of the possible effects that vaccination may have on outcomes relevant to the bank, like morale and productivity.[34] Our calculation suggests that the net benefit of the campaign

[34] A channel pertaining to company morale is the perception of individuals that the company cares more about their health when assigned to the work-week which leads them to behave differently. However, we cannot find evidence for that channel using data on organizational perceptions from our post-survey. Table A8 presents imprecise estimates on self-reported productivity and the duration of the workday measured by the employees' magnetic cards swipes to

was negative regarding sick days. In the best-case scenario, the treatment may result in a net gain of $0.17 regarding gains in work attendance during the flu season, which is not enough to compensate the bank for its costs that include vaccine subsidies of $2.57, $5.05 and $9.99 per vaccine.[35]

Our study allows us to draw practical implications for health interventions in at least two regards. The presence of moral hazard in health-related behavior implies that firms and policymakers should consider this phenomenon in the design of interventions like vaccination campaigns. A promising mechanism to mitigate it could be to increase awareness that the proposed measure, such as flu vaccination, does not guarantee a 100% protection against illnesses. It might be necessary to remind people to continue making use of other protective measures against respiratory viruses and bacteria, instead of letting them rely only on the protection potentially provided by medical technology.

Another lesson learned from our investigation is how to raise participation in health interventions. In this paper, we could find two cost-effective measures that increase vaccination take-up in a workplace context where monetary aspects do not seem to play a significant role in people's willingness to participate in a health campaign. Decreasing opportunity costs is one option to increase participation drastically, which suggests using mobile campaigns in days and locations where people usually congregate. Also, since we find that peer behavior has an important effect on vaccination take-up, and that following social norm is the potential mechanism, employers can increase participation in health campaigns by using mechanisms to incentivize groups of employees. Small rewards for the entire unit when the unit takes part could have significant effects on participation rates. Evaluating the role of such peer incentives in health-related contexts is a promising area for future research.

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enter and exit the bank. The point estimates suggest that assigning employees to get vaccinated in the workweek increased their perception on their productivity, while decreased the duration of their workday by about a third of an hour. Given that the bank pays a fixed salary, these effects could suggest an increase in productivity. However, in the absence of more precise measures of productivity, we cautiously conclude from this analysis that there is no sizable productivity premium. One could argue that from the perspective of a company, sick days have higher economic relevance, given that this often goes along with re-assignment of tasks, compared to when some employees are able to finish tasks and leave earlier than others.

[35] The estimate's confidence interval implies that at most assigning employees to the workweek could decrease the likelihood of having a flu sick day by 0.5 percentage points. We take the median wage of the bank ($750), divide it by the average number of work days in a month (22), and we multiply this value by 0.005.

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Table 1 Summary Statistics

	Full Sample	Control	Altruistic	Selfish	Saturday	F-test (p-value)
Monthly Income ($)	1,766	1,860	1,701	1,681	1,827	0.316
Company Tenure (years)	7.9	8.3	7.7	8.1	7.5	0.761
Prop. Women	0.49	0.51	0.52	0.46	0.47	0.497
Age (year)	36.6	37.2	36.4	36.6	35.7	0.553
Prop. College Education	0.91	0.92	0.91	0.90	0.93	0.759
Pre Survey Participation	0.48	0.50	0.50	0.47	0.40	0.171
Post Survey Participation	0.36	0.36	0.38	0.33	0.35	0.519
Diagnosed Sick	0.66	0.66	0.66	0.64	0.67	0.892
Granted a Sick Day	0.37	0.36	0.39	0.38	0.34	0.344
Diagnosed Flu Sick	0.11	0.09	0.13	0.13	0.10	0.348
Granted a Flu Sick Day	0.02	0.02	0.02	0.04	0.02	0.195
Vaccination Take-up	0.17	0.22	0.17	0.19	0.08	0.070
N	1,164	344	294	310	216	

Notes: This table presents characterizes the mean employee of the bank where we implemented our intervention. We present statistics for the full sample and the four treatment groups. The last column presents the p-value of a joint significance test to check whether there are significant differences across the treatment groups. The proportion of employees diagnosed sick or granted a sick day corresponds to the period between January 1 and November 7, 2017, before the vaccination campaign.

Table 2 Effects of Treatments on Vaccination Take-Up

	Baseline	With Controls	Quito Sample	Non-Compliance	Day of Week Effects
Altruistic Information	-0.0260	-0.0209	-0.0493	-0.0262	
	(0.0310)	(0.0303)	(0.0332)	(0.0306)	
Selfish Information	-0.0032	-0.0011	-0.013	-0.0103	
	(0.0314)	(0.0316)	(0.0339)	(0.0308)	
Thursday					0.0002
					(0.0346)
Friday					-0.0356
					(0.0331)
Saturday	-0.0789***	-0.0791***	-0.0898***	-0.0671**	-0.0818***
	(0.0301)	(0.0304)	(0.0313)	(0.0298)	(0.0315)
Baseline take-up			0.1732		
N	1164	1164	929	1152	929

* p<0.1 ** p<0.05 *** p<0.01

Notes: Robust standard errors in parentheses. This table presents OLS estimates of the effect of the different treatments on vaccination take-up. All specifications control for city fixed effects. Column 1 presents our main estimates from equation (1) without adding additional controls. In Column 2 we test the robustness of the main estimates controlling for the vaccine's price, income, tenure, division in the company, gender, age, and education level. Column 3 presents the estimates using only employees in Quito, the city where we implemented our four treatments. In Column 4 we exclude 12 individuals who were assigned to vaccinate in the workweek but went to vaccinate on Saturday. In Column 5 we test for different effects across the different days of the week using only data from Quito that has all the treatments. Using clustered standard errors at the work unit level (142 clusters) yields similar standard errors with no loss of statistical significance.

Table 3 Effect of Peer Vaccination on Individual Take-up

	First Stage	Reduced Form	OLS	2SLS
		A. Main Effect		
Proportion of Peers:				
Assigned to the Workweek	0.3106***	0.0025***		
	(0.0765)	(0.0008)		
Vaccinated			0.0051***	0.0079***
			(0.0007)	(0.0018)
F-value	16.481			
N	1138	1138	1138	1138
		B. Heterogeneous Effects		
Proportion of Peers:				
Same Gender Vaccinated			0.0041***	0.0076***
			(0.0008)	(0.0019)
Different Gender Vaccinated			0.0038***	0.0048*
			(0.0009)	(0.0025)

* p<0.1 ** p<0.05 *** p<0.01

Notes: Standard errors clustered at the unit level in parentheses. The bank has 116 units with more than one employee. This table presents the effect of peers' vaccination take-up on the individual's vaccination decision. We measure the proportion of peers vaccinated and the proportion of peers assigned to the workweek in percentage points. Thus, the estimates represent the effect of a one percentage point change in the proportion of peers. We define peers as all employees who work in the same unit. All estimates control for Quito fixed effects and individual assignment to the workweek. Panel A presents the main results. Column 1 presents the results for the first stage. Column 2 displays the results of the reduced form. Column 3 presents OLS estimates of the effect of a change in the proportion of peers that get vaccinated. Column 4 presents 2SLS estimates of the effect of a change in the proportion of peers that get vaccinated. Panel B reports 2SLS estimates of heterogeneous effects. For each row the instrument is the corresponding proportion of peers assigned to the workweek, the first stages have F-statistics greater than 10.

Table 4 Potential Mechanisms for Peer Effects

	Effect of Prop. of Peers Assigned to the Workweek on	Baseline	N
A. Beliefs about the Flu, its Vaccine, and Interactions with Coworkers			
Vaccines Effective to Improve Health (1-5)	-0.0017	3.87	378
	(0.0049)		
Talked with coworkers about getting vaccinated (pp)	-0.0065***	1.07	360
	(0.0021)		
Went with coworkers to get vaccinated (pp)	0.0009	0.06	360
	(0.0014)		
Probability of Getting Healthy W/out the Vaccine (0-100)	0.0010	44.17	367
	(0.0722)		
Probability of Getting Healthy with the Vaccine (0-100)	0.0319	54.00	367
	(0.0909)		
Informed about the Flu (0-100)	0.0098	69.03	372
	(0.0723)		
Informed about the Flu Vaccine (0-100)	0.0079	63.09	372
	(0.0977)		
Afraid of the Flu (0-100)	0.0452	33.69	372
	(0.1232)		
Afraid of the Flu Vaccine (0-100)	0.0959	17.20	372
	(0.1173)		
Would Get Vaccinated out of the Workplace (pp)	-0.0025	0.81	367
	(0.0020)		
Coworkers Convinced me to get Vaccinated (0-100)	0.0246	18.70	360
	(0.1266)		
I Convinced my Coworkers to get Vaccinated (0-100)	-0.0622	33.18	360
	(0.1343)		
B. Heterogeneous Effects for Extrinsic and Intrinsic Motivated Individuals			
Vaccination of Extrinsic Motivated Individuals (pp)	0.0045***	0.24	247
	(0.0012)		
Vaccination of Intrinsic Motivated Individuals (pp)	0.0006	0.16	262
	(0.0017)		

* p<0.1 ** p<0.05 *** p<0.01

Notes: Standard errors clustered at the unit level in parentheses. This table presents the reduced form effect of peers assigned to the workweek on a series of outcomes identified by the row headers. The measurement unit of each outcome is in parentheses next to the outcome's name. We measure the proportion of peers assigned to the workweek in percentage points. Thus, the estimates represent the effect of a one percentage point change in the proportion of peers. We define peers as all employees who work in the same unit. All estimates control for Quito fixed effects and individual assignment to the workweek. Column 1 presents estimates. Column 2 displays the baseline value for each outcome. Column 3 presents the sample size.

Table 5 Effects of Vaccination on Overall Sick Days

	OLS	Reduced Form	2SLS
A. Having a Sick Day			
Assigned to the workweek		0.0132	
		(0.0361)	
Prop. peers assigned to the workweek		0.00003	
		(0.0010)	
Vaccinated	-0.0407		0.2404
	(0.0298)		(0.7280)
Prop. peers vaccinated	0.0004		-0.0022
	(0.0009)		(0.0074)
Baseline (percentage points)		0.29	
B. Number of sick days			
Assigned to the workweek		-0.2610	
		(0.6195)	
Prop. peers assigned to the workweek		-0.0140	
		(0.0147)	
Vaccinated	-0.5114*		-3.9719
	(0.2899)		(12.2730)
Prop. peers vaccinated	-0.0075		-0.0137
	(0.0082)		(0.1272)
Baseline (days)		1.29	
N		1120	

* p<0.1 ** p<0.05 *** p<0.01

Notes: Standard errors clustered at the unit level in parentheses. This table presents the effects of flu vaccination on the probability of having a sick day in general between November 12, 2017, and February 28, 2018. Column 1 presents OLS estimates. Column 2 presents the reduced form estimates. Column 3 presents 2SLS estimates. The first panel presents the effect on the probability of having a sick day, and the second panel presents the effect on the number of sick days. The estimates include only units with two or more employees.

Table 6 Effects of Vaccination on Flu Diagnoses and Sick Days

	OLS	Reduced Form	2SLS
A. Being Diagnosed with the Flu			
Assigned to the workweek		0.0044	
		(0.0155)	
Prop. peers assigned to the workweek		-0.0003	
		(0.0006)	
Vaccinated	-0.0254*		0.1103
	(0.0151)		(0.2978)
Prop. peers vaccinated	-0.0001		-0.0020
	(0.0004)		(0.0033)
Baseline (percentage points)		0.05	
B. Granted a Sick Day because of the Flu			
Assigned to the workweek		0.0112	
		(0.0083)	
Prop. peers assigned to the workweek		-0.0002	
		(0.0003)	
Vaccinated	-0.0156		0.2309
	(0.0110)		(0.2194)
Prop. peers vaccinated	0.000003		-0.0026
	(0.0002)		(0.0025)
Baseline (days)		0.02	
N		1120	

* p<0.1 ** p<0.05 *** p<0.01

Notes: Standard errors clustered at the unit level in parentheses. This table presents the effects of flu vaccination on the probability of being diagnosed sick and being granted a sick day because of the flu. Column 1 presents OLS estimates. Column 2 presents the reduced form estimates. Column 3 presents 2SLS estimates. The estimates include only units with 2 or more employees.

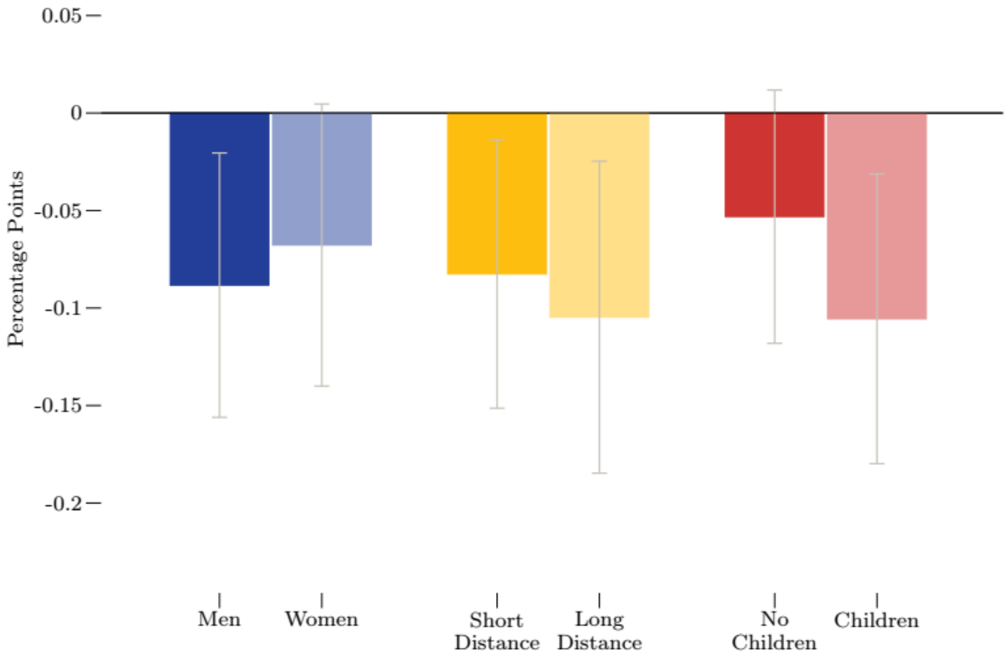
Table 7 Reduced Form Estimates on Health-Related Habits

	Baseline	Coefficient	N
Responses on a scale from 1 (“never”) to 10 (“all the time”)			
How often do you exercise	5.93	-0.3145	359
		(0.4026)	
How often do you take dietary supplements	3.18	-0.6147	359
		(0.4372)	
How often do you carry an umbrella when it rains	6.85	-1.2190**	359
		(0.4856)	
How often do you wash your hands	9.25	0.0980	359
		(0.1836)	

* p<0.1 ** p<0.05 *** p<0.01

Notes: Robust standard errors in parentheses. This table presents the reduced form effects of being assigned to the workweek on four daily habits and activities related to health and preventing the flu. Column 2 presents the reduced form estimates. Column 3 presents the number of individuals who answered the survey.

Figure 1 Heterogeneous Effects of Assignment to Vaccination on Saturday on Take-up



Notes: This figure presents the intent-to-treat effect of assignment to the Saturday on vaccination take-up for different subgroups in the sample. All specifications control for city fixed effects. The figure presents the point estimate and the 90% heteroscedastic robust confidence interval for each subgroup.

Figure 2 Reduced Form Estimates of the Effect of Vaccination on Diagnosed Sickness

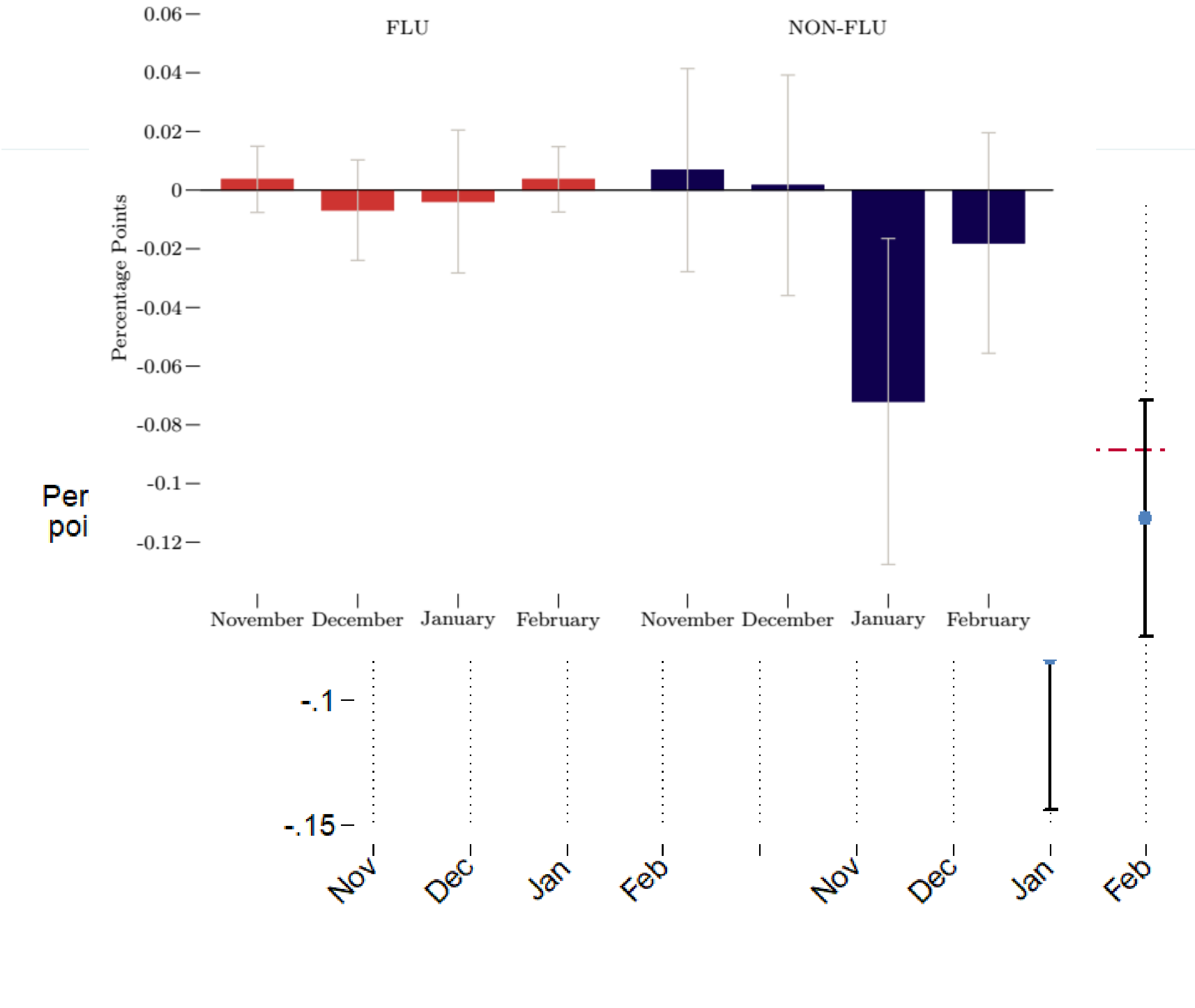
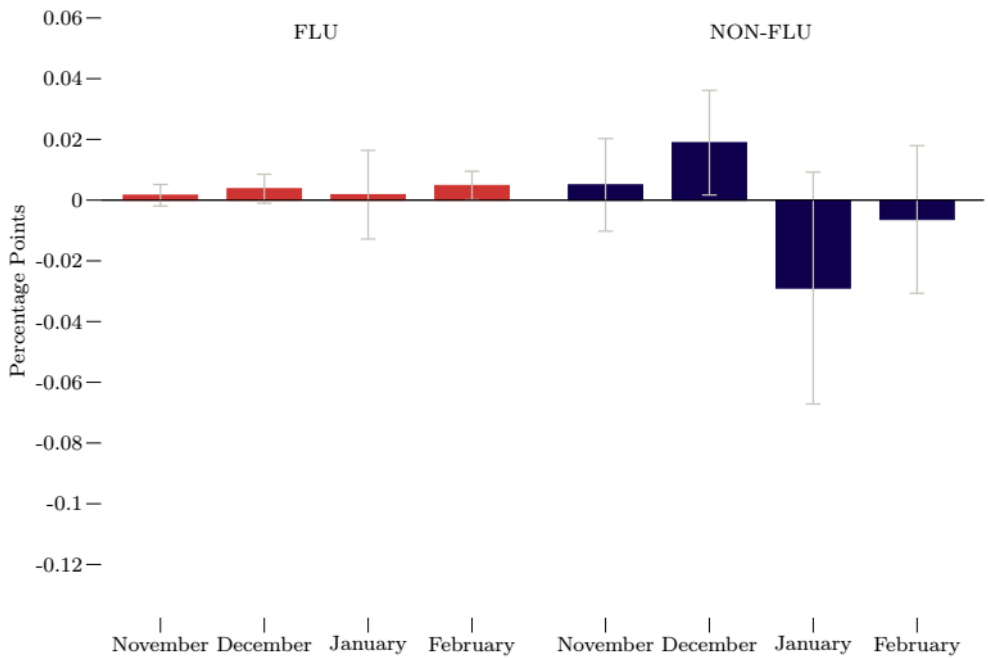
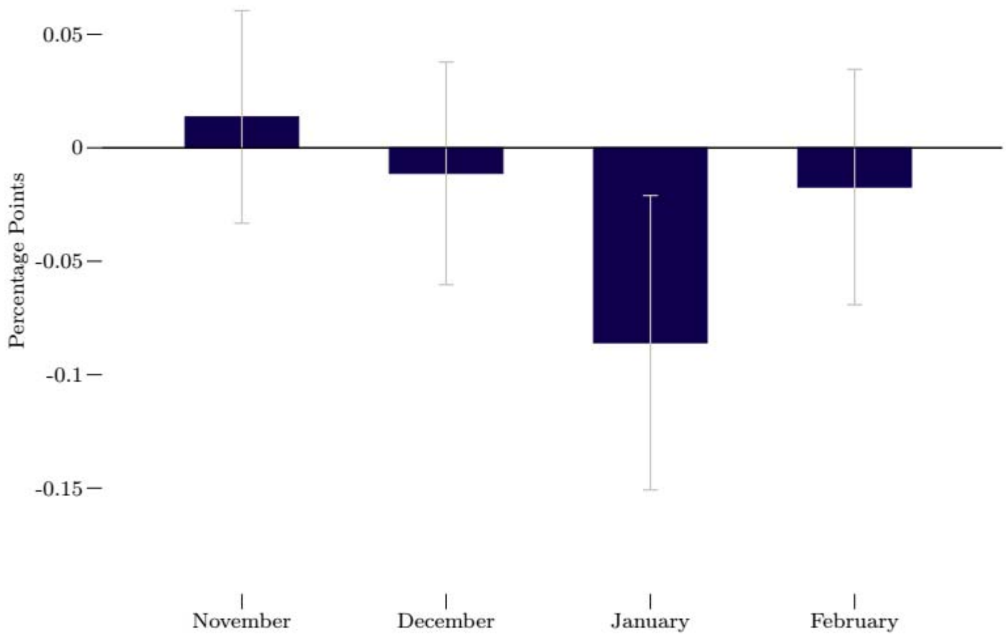


Figure 3 Reduced Form Estimates of the Effect of Vaccination on Sick Days



Notes: This figure presents the reduced form effect of being assigned to the workweek on the probability of being granted a sick day by month. The left panel presents the effect of assignment to vaccination on the workweek on flu sick days, and the right panel presents the effect of assignment to vaccination on the workweek on non-flu respiratory sick days. The figure presents the point estimate and the 95% heteroscedastic robust confidence interval. November includes sick days granted since November 12, after the vaccination campaign.

Figure 4 Reduced Form Estimates on the Probability of Going to the Onsite Doctor



Notes: This figure presents the reduced form effect of being assigned to the workweek on the probability of going to the onsite doctor. The figure presents the point estimate and the 95% heteroscedastic robust confidence interval. November includes sick days granted since November 12, after the vaccination campaign.

Online Appendix

Table A1 Regression Discontinuity Effects of Higher Price on Vaccination Take-Up

	Baseline	With Controls	Quito Sample	Non-Compliance
Threshold	0.0590	0.1603	0.0655	0.0400
	(0.0730)	(0.1514)	(0.0786)	(0.0722)
N	608	608	461	604

* p<0.1 ** p<0.05 *** p<0.01

Notes: Robust standard errors in parentheses. This table presents the local average treatment effects of a small price change on vaccination take-up. We report the normalized coefficient at a wage of $750 and a bandwidth of $300. Individuals who earn more than $750 paid $7.49 for the vaccine, while employees whose wage is below this threshold paid $4.99. There is no visible discontinuity across the threshold — all specifications control for city fixed effects. Column 1 presents our main estimates without adding additional controls. In Column 2 we test the robustness of the main estimates controlling for the vaccine's price, income, tenure, division in the company, gender, age, and education level. Column 3 presents the estimates using only employees in Quito, the city where we implemented our four treatments. In Column 4 we exclude 12 individuals who were assigned to vaccinate in the workweek but went to vaccinate on Saturday. Using clustered standard errors at the work unit level (142 clusters) yields similar standard errors with no loss of statistical significance. Reducing the bandwidth in steps of $50 to $150 does not change the results.

Table A2 Recall Information Statements

	Heard Altruistic Statement	Heard Selfish Statement
Altruistic Information	-1.5050	-8.6603**
	(4.9361)	(4.1577)
Selfish Information	-4.1349	-0.2413
	(4.9398)	(4.0169)
Saturday	-3.9293	-2.8269
	(6.2201)	(5.0108)
Baseline	69.95	78.21
N	378	378

* p<0.1 ** p<0.05 *** p<0.01

Notes: Robust standard errors in parentheses. This table presents the effects of the different treatments on measurements of recalling the altruistic and selfish statements. The post-intervention survey collects these measures on a scale from 0 to 100.

Table A3 Heterogeneous Treatment Effects on Vaccination Take-up

	Men	Women	Short Distance	Long Distance	No Children	Children
Altruistic Information	-0.0017	-0.0508	-0.0564	-0.0477	-0.0163	-0.0368
	(0.0452)	(0.0429)	(0.0441)	(0.0521)	(0.0421)	(0.0454)
Selfish Information	0.0098	-0.0166	-0.0074	-0.0291	0.0188	-0.0253
	(0.0439)	(0.0451)	(0.0460)	(0.0527)	(0.0435)	(0.0452)
Saturday	-0.0883**	-0.0677	-0.0825**	-0.1047**	-0.0531	-0.1056**
	(0.0413)	(0.0441)	(0.0420)	(0.0488)	(0.0396)	(0.0453)
N	593	571	446	449	556	608

* p<0.1 ** p<0.05 *** p<0.01

Notes: Robust standard errors in parentheses. This table presents the effect of the different treatments on vaccination take-up for different subgroups in the study's population.

Table A4 Robustness Check on Peer Effects Estimates

	Unit Size	Peer Characteristics
A. Main Effect		
Proportion of peers:		
Vaccinated	0.0079***	0.0071***
	(0.0018)	(0.0019)
N	1138	1138
B. Heterogeneous Effects		
Proportion of peers:		
Same Gender Vaccinated	0.0075***	0.0072***
	(0.0020)	(0.0020)
Different Gender Vaccinated	0.0048**	0.0043*
	(0.0024)	(0.0025)

* p<0.1 ** p<0.05 *** p<0.01

Notes: Standard errors clustered at the unit level in parentheses. The bank has 116 units with more than one employee. This table presents the effect of peers' vaccination take-up on the individual's vaccination decision. We measure the proportion of peers vaccinated and the proportion of peers assigned to the workweek in percentage points. Thus, the estimates represent the effect of a one percentage point change in the proportion of peers. We define peers as all employees who work in the same unit. All estimates control for Quito fixed effects and individual assignment to the workweek. Column 1 controls for the number of employees in each unit. Column 2 controls for the number of employees in each unit, and peers' age and gender.

Table A5 Robustness Check on Effects of Vaccination on the Flu

	Controls		Broader Definition of Flu	
	Reduced Form	2SLS	Reduced Form	2SLS
a. Being Diagnosed with the Flu				
Assigned to the workweek	0.0011		-0.0118	
	(0.0160)		(0.0173)	
Vaccinated		0.0183		-0.1729
		(0.2434)		(0.2922)
b. Granted a Sick Day because of the Flu				
Assigned to the workweek	0.0095		0.0082	
	(0.0086)		(0.0106)	
Vaccinated		0.1458		0.1218
		(0.1366)		(0.1679)
N	1148		1148	

* p<0.1 ** p<0.05 *** p<0.01

Notes: Robust standard errors in parentheses. This table presents the robustness of the effects of flu vaccination on the probability of being diagnosed sick and being granted a sick day because of the flu to the addition of controls (gender, age, tenure, and income) and using a broader definition of the flu. Column 1 presents the reduced form estimates. Column 2 presents 2SLS estimates.

Table A6 Reduced Form Heterogeneous Effects

	Men	Women	23-45	>45	No Children	Children
			A. Being Diagnosed with the Flu			
Assigned to	0.0008	0.0049	0.0131	-0.0632	0.0089	-0.0021
the workweek	(0.0177)	(0.0271)	(0.0167)	(0.0517)	(0.0235)	(0.0216)
			B. Granted a Sick Day because of the Flu			
Assigned to	-0.0041	0.0263***	0.0176**	-0.0370	0.0018	0.0198***
the workweek	(0.0141)	(0.0087)	(0.0081)	(0.0364)	(0.0149)	(0.0074)
N	585	563	982	166	544	604

* p<0.1 ** p<0.05 *** p<0.01

Notes: Robust standard errors in parentheses. This table presents reduced-form estimates for the effect of being assigned to the workweek on the probability of being diagnosed with the flu and being granted a sick flu day for sample subgroups. All specifications control for Quito fixed effects.

Table A7 Bounds

	Diagnosed with Flu			Diagnosed with Non-flu		
	Main	Lower Bound	Upper Bound	Main	Lower Bound	Upper Bound
Saturday	0.0032	0.0002	0.0023	-0.0748**	-0.0982***	-0.0540
	(0.0160)	(0.0168)	(0.0161)	(0.0363)	(0.0378)	(0.0368)
N	913	899	860	913	899	860

* p<0.1 ** p<0.05 *** p<0.01

Notes: Robust standard errors in parentheses. This table presents bounds for the effect of being assigned to the workweek on the probability of being diagnosed with the flu and other non-flu respiratory diseases. All specifications control for Quito fixed effects.

Table A8 Reduced Form Effects on Productivity

	Post-Survey		Swipe-Cards		
	General Productivity	Productivity Post-Intervention	Entry to Work	Exit from Work	Duration at Work
Assigned to the workweek	0.1684 (0.1357)	0.1534 (0.1718)	-0.1492 (0.1945)	-0.4879 (0.3487)	-0.3387 (0.4004)
N	378	378	403	403	403

* p<0.1 ** p<0.05 *** p<0.01

Notes: Robust standard errors in parentheses. This table presents the intent to treat effect of the assignment to the workweek on self-reported measures productivity and duration of the workday. The post-intervention survey collects these self-reported measures on a scale from 0 to 10. The swipe card information corresponds to January and is measured in hours.

Figure A1 Treatment Message: Control

Notes: The above image portrays the email sent to the control group. Translation: Dear Employee, Diners Club of Ecuador is running an influenza vaccination campaign in November. You are eligible for a flu shot on Thursday, November 9 from 8:30 to 11:30. We obtain a discount on the vaccine's price. For you, the price is $4.95, that will be deducted from your payroll if you choose to get vaccinated. If you have questions, please contact _____. Let's get vaccinated!

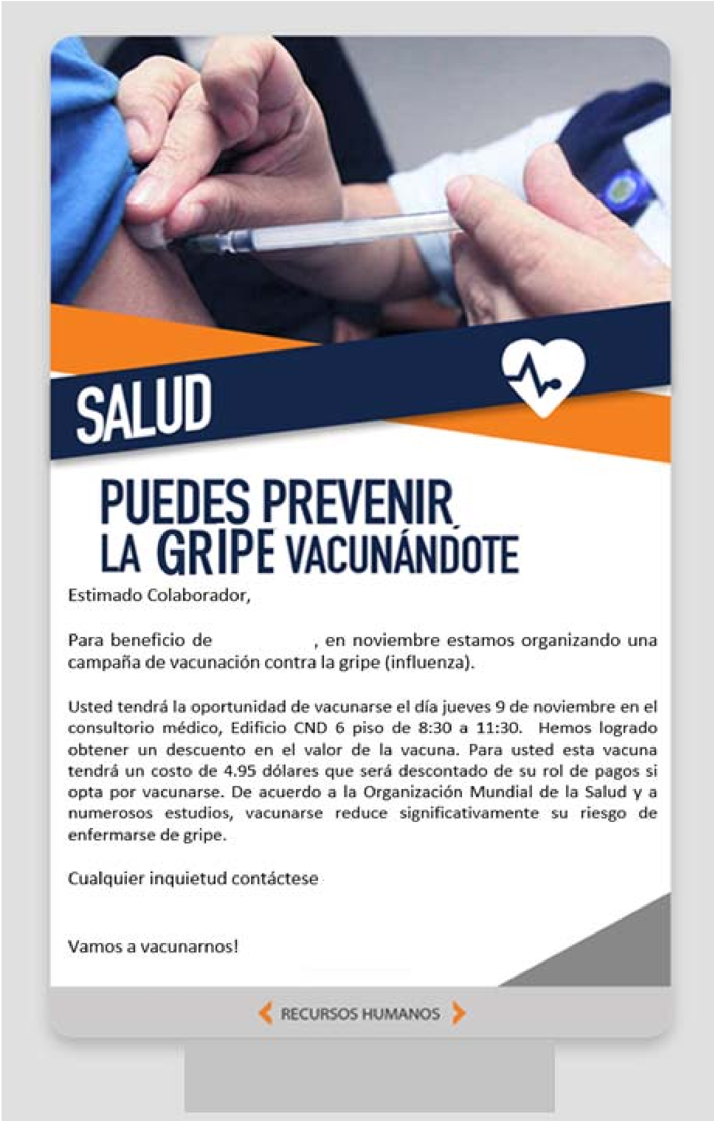
Figure A2 Treatment Message: Opportunity Cost (Saturday)

Notes: The above image portrays the email sent to the "*Saturday*" treatment group. Translation: Dear Employee, Diners Club of Ecuador is running an influenza vaccination campaign in November. You are eligible for a flu shot on Saturday, November 11 from 8:30 to 11:30. We obtain a discount on the vaccine's price. For you, the price is $4.95, that will be deducted from your payroll if you choose to get vaccinated. If you have questions, please contact _____. Let's get vaccinated!

Figure A3 Treatment Message: Altruism

Notes: The above image portrays the email sent to the "Altruistic Treatment" group. Translation: Dear Employee, Diners Club of Ecuador is running an influenza vaccination campaign in November. You are eligible for a flu shot on Thursday, November 9 from 8:30 to 11:30. We obtain a discount on the vaccine's price. For you, the price is $4.95, that will be deducted from your payroll if you choose to get vaccinated. Getting vaccinated yourself also protects people around you, including those who are more vulnerable to severe flu illness, like infants, young children, the elderly and people with dangerous health conditions that cannot get vaccinated If you have questions, please contact _____. Let's get vaccinated!

Figure A4 Treatment Message: Selfish



Notes: The above image portrays the email sent to the "Selfish Treatment" group. Translation: Dear Employee, Diners Club of Ecuador is running an influenza vaccination campaign in November. You are eligible for a flu shot on Thursday, November 9 from 8:30 to 11:30. We obtain a discount on the vaccine's price. For you, the price is $4.95, that will be deducted from your payroll if you choose to get vaccinated. Vaccination can significantly reduce your risk of getting sick, according to both health officials from the World Health Organization and numerous scientific studies. If you have questions, please contact _____. Let's get vaccinated!

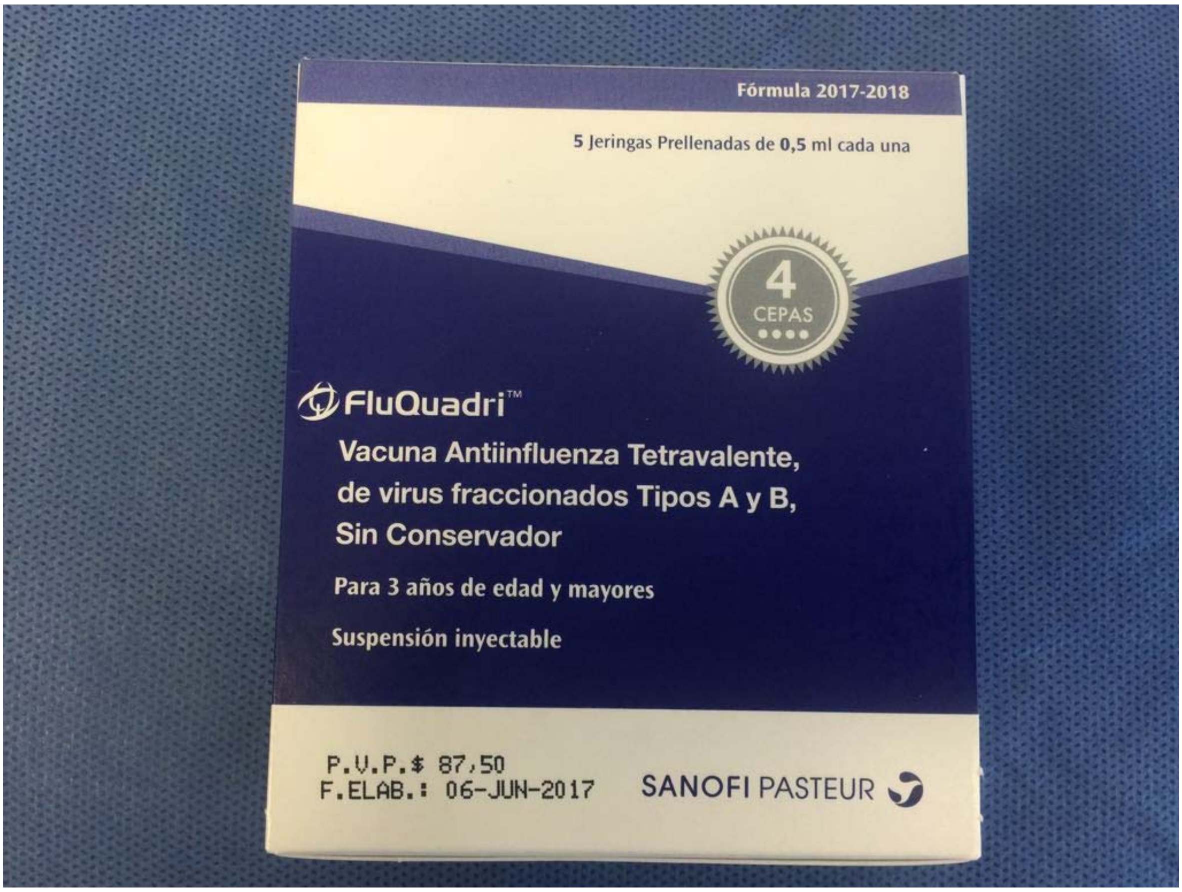
Figure A5 Locations of the Bank in Ecuador

Notes: The map contains the locations of the bank in Ecuador (orange) where we implemented our intervention.

Figure A6 Timeline of Experiment Implementation

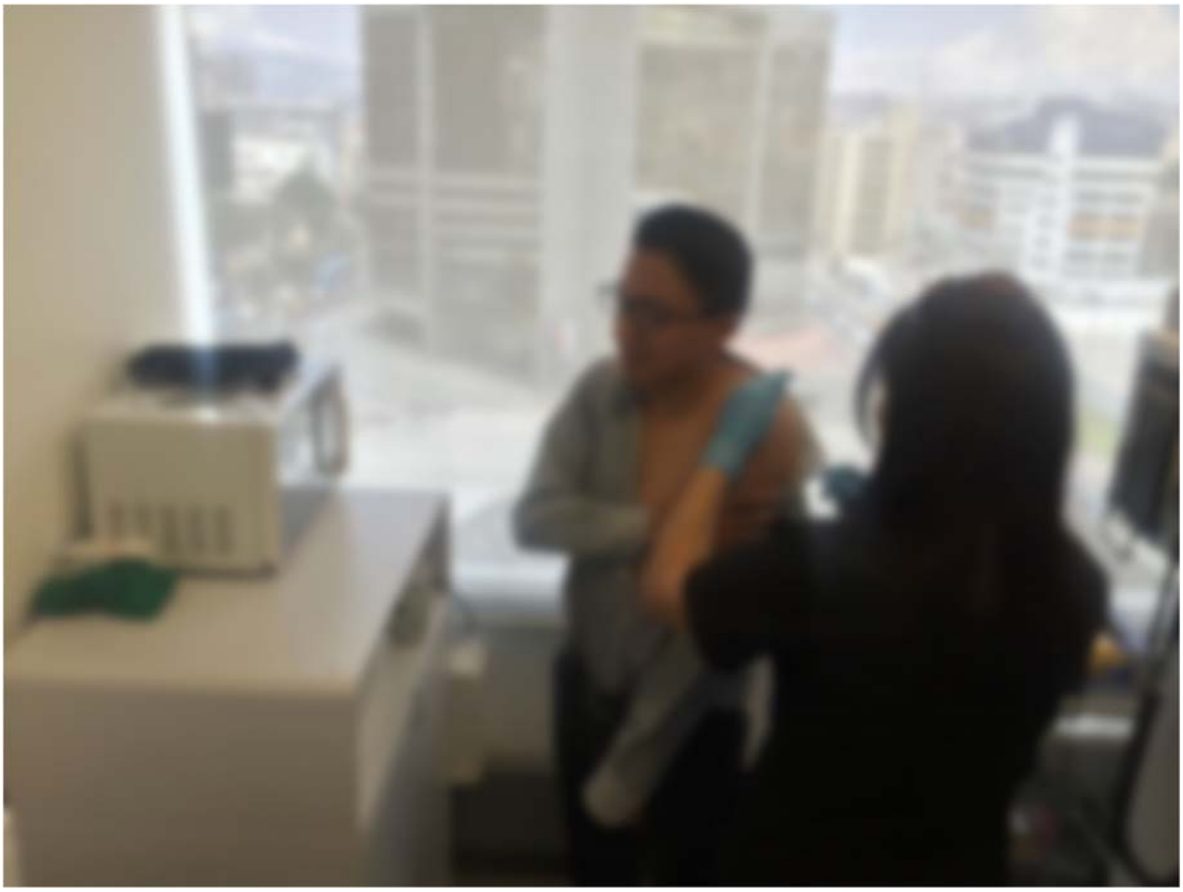
Notes: The bank sent the pre-intervention survey on October 18. The bank sent emails with the different treatments on November 1 using Human Resources' mailing account. Furthermore, it sent a reminder on November 7. The vaccination campaign took place between November 8 and November 11. The post-treatment period (Ecuadorian flu season) went from November 13 to March 1. The bank sent the post-intervention survey during March and April 2018.

Figure A7 Vaccination Campaign: Influenza Vaccine



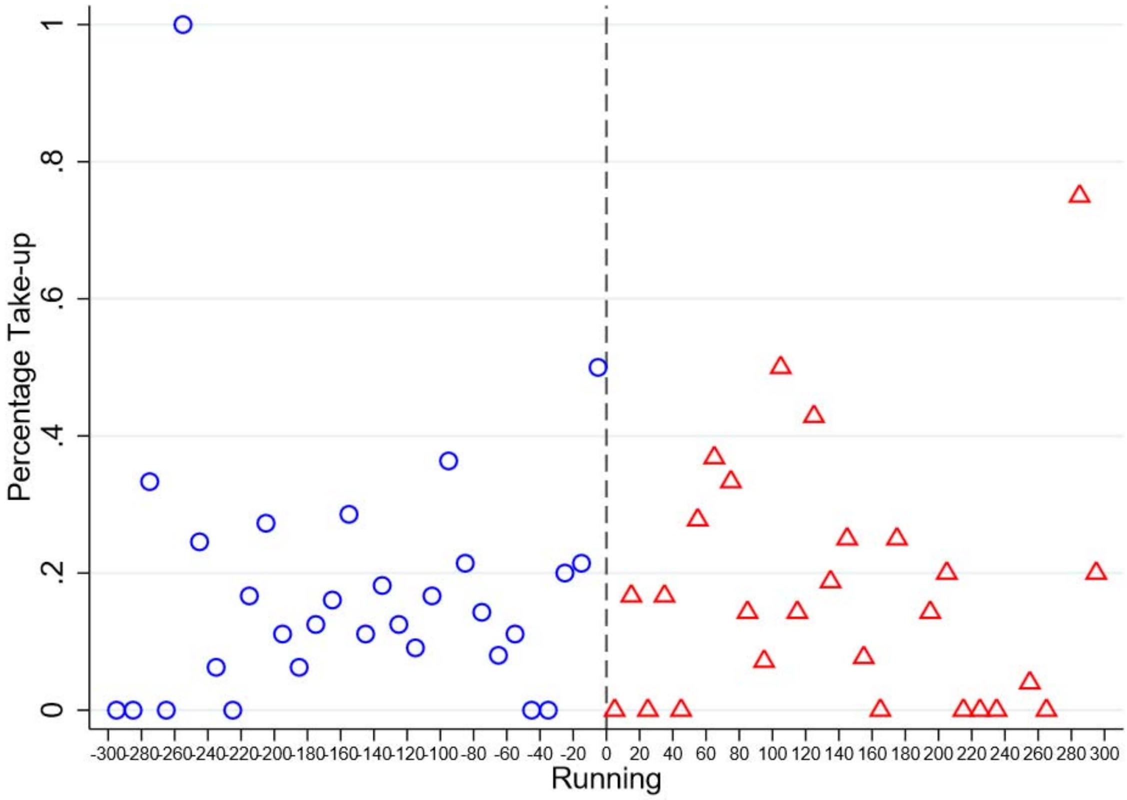
Notes: The above package contains the influenza vaccine used in the campaign. This vaccine protects against four strands of the flu, two from type A and two from type B.

Figure A8 Vaccination Campaign: Flu Shot in Action



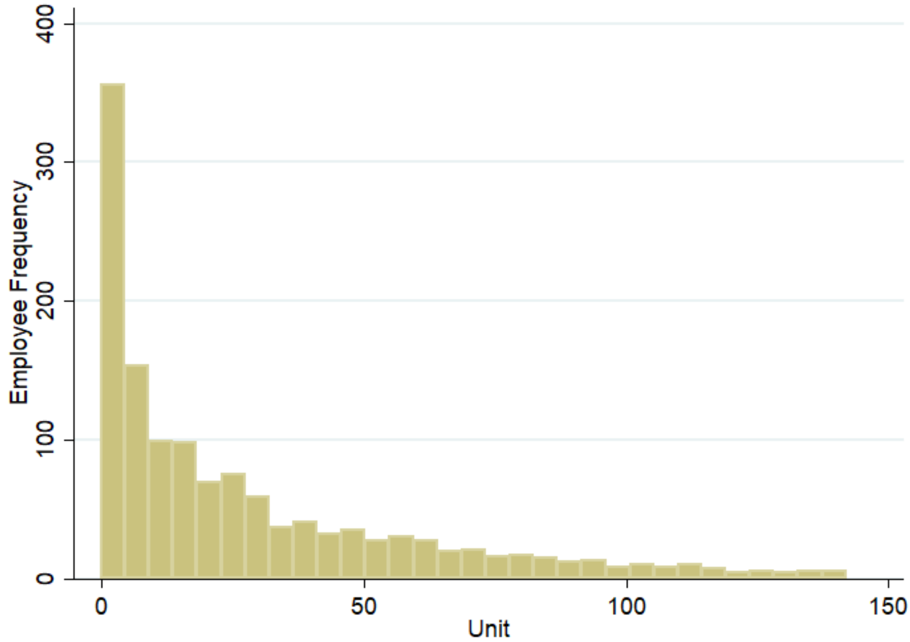
Notes: Immunization at the firm.

Figure A9 Vaccination Take-up around $750 Wage Threshold



Notes: This figure presents the evolution of vaccine take-up around the $750 threshold with a bin size of $10. Individuals who earn more than $750 paid $7.49 for the vaccine, while employees whose wage is below this threshold paid $4.99.

Figure A10 Distribution of Employees in Units



Notes: This figure presents the number of employees in each of the 142 units.