Vaccine uptake in California is lower than optimal. Conditional on having a safe and viable vaccine, we propose administering a public health policy program to encourage vaccine uptake. We propose giving a one-time tax credit to firms to support employee participation in the vaccine program.

We use a simulation to show that policies administered at the employer level are effective. As the economy re-opens, given social distancing in the population, the majority of exposure to Covid-19 is likely to occur in the workplace. Further, conducting interventions at the employer-level takes advantage of social incentives which may encourage higher uptake. Because people are less likely or able to observe social distancing practices in the workplace than in public, creating "firm-level herd immunity" may substantially reduce community transmission. Our simulation indicates that an increase in vaccination rates at the firm-level translates to lower infection rates than without firm-level incentives.

The Covid-19 pandemic is one that the state of California must address, as states have primary responsibility for protecting the public health in the USA. California has 142,000 cases of Covid-19, the third highest of all the states, and has suffered nearly 5,000 deaths. The pandemic has led to a $54 billion deficit in California's budget. Even after a viable vaccine is developed and manufactured, one problem may be low vaccination rates. Depending on the area, some might be hesitant to be vaccinated because they do not see many Covid-19 cases in their area, or for other reasons mentioned below. This problem needs to be addressed, and the state of California must adopt public health measures to ensure firm-level herd immunity.

There are several issues with the uptake rate of vaccines in California, including religious objections, fear of side effects or under-studied vaccines, or health complications preventing vaccination. Another frequently cited reason is conflicting social norms: you are less likely to get vaccinated if your peers do not. By using financial incentives to motivate firms to increase the proportion of employees vaccinated, we will better align the private and social benefits of vaccination. Given large enough tax incentives, firms are likely to increase employee vaccine uptake through private advertising initiatives and other methods. As employers exert (noncoercive) pressure on employees to vaccinate, more individuals will be induced to vaccinate as a result of increased social pressure. Tax credits are a frequently utilized policy for incentivizing firm behavior, and have been used to encourage uptake of public health measures including employer-provided health insurance.

To obtain an estimate of the potential benefit of this policy, we modeled the spread of Covid-19 in 300 simulated firms of varying size. We assume that the vaccine would be 100% effective, so that those who received it would never get Covid-19. Approximately 68% of Californians have received all suggested childhood vaccinations; we assume a similar (but lower) proportion will become vaccinated as soon as the vaccine is available. We thus assume that 54% of the population would voluntarily be vaccinated, 30% would not,while 10% would be asymptomatic, infected, and contagious and 6% would be symptomatic, infected, and contagious. We assume the vaccine will be ineffective for these last two groups.

When modeling the effectiveness of our intervention, we assume that employers would be able to persuade half of the 30% who were not already vaccinated to get vaccinated.

We used a Susceptible, Infected and Recovered model that assumed that everyone was at equal risk of contracting Covid-19, and all infected people were equally contagious. Further research would require looking at heterogeneous results, which are more realistic. Applying these proportions to employee populations, we ran 100 simulations each for small businesses (2-100 employees), medium businesses (101- 500 employees) and large businesses (501+ employees) and examined the number of employees who were infected after the introduction of a vaccine.

Comparing the average number of infected people between the intervention and its counterfactual yielded a difference of 0.14 fewer infections per year for small businesses, 0.97 fewer infections per year for medium sized businesses, and 8.99 fewer infections per year for larger businesses that employed the policy. The average difference over all the simulations was 3.37 fewer infections per year, over a total population of 319,422 employees. If the average cost of treating an infected person was $20,000, this could save $67,400 in treatment fees. We explored other percentages in the population for robustness. If the voluntary vaccination rate is set to California's vaccination rate of 68%, our model predicts .11, .63, and 5.67 fewer average infections per year for small, medium, and large businesses, respectively. Alternatively, if only 30% of people voluntarily got the vaccine, our model predicts 0.26, 1.61, and 15.86 fewer average infections per year respectively.

Based on our results, our proposed recommendation would be for the state of California to provide tax incentives to businesses where a significant fraction of their employees are vaccinated against Covid-19. This would provide monetary incentive to businesses to increase public health, and ties together ideas that benefit both the private and public sector. The impact of tax incentives on economic growth, especially the growth of smaller businesses, has been well documented, and tying this to public health initiatives would improve both public and economic health. We found in all circumstances that increasing the number of people who are vaccinated led to a decrease in infection rates, and this policy would veer California towards a state of firm-level herd immunity, which may be a more viable alternative to full herd immunity.

Once a vaccine is developed, California should implement this policy to ensure that as many people as possible get the vaccine. If implemented, it would likely result in companies encouraging their employees to get the vaccine so they would be eligible for the tax benefit. If this is not implemented, the steps the private sector might take to ensure their employees are immunized would likely be muted. As long as the monetary value of the tax break is lower than the cost of treatment and economic damage caused by each new infection, this policy would benefit all.

Sources

"US: Ensure Affordable COVID-19 Treatment," Human Rights Watch, March 20, 2020.

R Functions adopted from: Tim Churches, "Modelling the effects of public health interventions on COVID-19 transmission using R", Tim Churches Health Science Data Blog, March 17, 2020.

"Immunizations – Children," America's Health Rankings Annual Report, 2019.