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When One Shot Is Not Enough: Ensuring New Yorkers Complete the COVID-19 Vaccine Series

NYS HEALTH FOUNDATION

Introduction

Three vaccines have either received or are on the verge of approval from the U.S. Food and Drug Administration (FDA) for use to prevent COVID-19, the disease caused by the coronavirus. According to clinical testing, each of the vaccines requires more than one dose in order to be most effective. All of the doses are expected to be administered by intramuscular injections, or shots. The vaccine developed by Pfizer will require a second shot of its vaccine three weeks after the first one, while the Moderna and AstraZeneca-Oxford vaccines require a second shot a month later.

Multi-dose vaccines come with logistical challenges, such as requiring twice as many vials and syringes, as well as more storage capacity. They will also require people to make at least two visits to their health care provider for the shots, which creates risk that not everyone will return for the second dose. The recommended number of doses and timing have been determined by what was proven to be most effective during clinical trials. Hence, timely and complete vaccination with multiple-dose schedules is of public health importance, as an incomplete series may yield suboptimal disease protection.

Developing vaccines in less than a year is a historic achievement. However, there are other challenges to overcome in the effort to vaccinate hundreds of millions of Americans. Beyond the logistics, more than one-quarter of Americans in a recent survey expressed strong hesitation when asked if they would take a COVID-19 vaccine. Public health officials will need to figure out how to overcome a multitude of factors leading to that hesitation, including a loss of faith in public health authorities, concerns about the speed and politicization of the development process, unknowns about longer-term effects, distrust of the health care system among some patients of color, and rampant misinformation about vaccines. Given this level of hesitancy, it is all the more important to make sure that people who initiate a vaccine series actually complete it.

What is Behavioral Economics?

Behavioral economics uses insights from psychology to understand human decision-making. It recognizes that humans make irrational decisions—i.e., they choose a less than optimal option, even though they know there is a better one. Behavioral economics also recognizes that our choices are often influenced by fallible "rules of thumb" that people use to make decisions, as well as the environment or context in which the decisions are made. Recognizing these tendencies, behavioral economics can also help identify interventions that can overcome these biases.

Below, we take a closer look at completion rates for other multi-dose vaccines, so that we can better understand the likelihood that people will follow through on the second COVID-19 vaccine shot. We also look at prior research from fields such as psychology and behavioral economics (see **Text Box**) to provide insights on what can be done to ensure people—and New Yorkers specifically—complete their COVID-19 vaccine series.

Key Findings

- Prior studies have shown that a substantial portion of people—often more than half—who take a first dose of a vaccine do not complete multi-dose vaccine series. This applies to a variety of vaccinations and populations.
- Factors associated with not completing a vaccine series include a lack of knowledge about the vaccine, not having a regular source of health care, and cost of the vaccine.
- These factors could be used to identify populations at greater risk for not completing the COVID-19 vaccine series and who might benefit from interventions to help improve completion rates.
- Research from psychology and behavioral economics suggests that simple, low-cost solutions—such as reminders, commitment devices, and social comparisons—can help people follow through on their intentions to complete the vaccine series.
- Federal and State agencies are incorporating behavioral nudges into their vaccine distribution plans. It is critical for them to execute the plans effectively. In particular, it will be important for New York State to ensure that providers are connected to the State's immunization database, which plays a central role in its COVID-19 Vaccination Program. In addition, businesses, schools, and other organizations—as well as individuals—can use these low-cost and simple nudges to help ensure high rates of completed vaccinations.

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HOW MANY PEOPLE DO NOT COMPLETE THEIR MULTI-DOSE VACCINE SERIES?

COVID-19 presents a unique vaccination situation, given the severity of the pandemic from both a public health and an economic perspective. Hence, there may be a collective sense of urgency to vaccinate that is rarely felt on such a broad scale. Meanwhile, as exhibited by recent survey results, strong forces are at play that are making a large proportion of people hesitant to take the vaccine. These circumstances make it less clear whether we can expect similar completion rates with COVD-19 vaccines relative to other vaccines.

Many vaccines, such as the varicella (i.e., chickenpox) vaccine, certain hepatitis A and B vaccines, and the human papillomavirus (HPV) vaccine, require multiple doses, often months apart, for the vaccine to provoke an optimal immune response in the body. However, there is not a lot of data on completion rates, particularly for adults. Many of the studies that have been conducted commonly show a large proportion of people—often greater than 50%—who initiate a multi-dose vaccine series do not complete the series. Adherence to recommended time schedules for the follow-up doses is even lower. For example, in one study of several hundred thousand adults in the U.S. who initiated hepatitis A and B multi-dose vaccines, less than one-third adhered to recommended schedules for completing the vaccine series. The proportion was even lower in a similar study of adults in the United Kingdom.

In another large population-based study of older children, adolescents, and adults in the U.S., only 40–65% of most age groups completed their multiple-dose varicella, hepatitis A, and hepatitis B vaccine series. In each of these studies, a notable proportion of people who completed the vaccine did so with a much longer than recommended interval between doses (in many cases, 1–2 years or more). Such gaps can leave people under-vaccinated and at higher risk for disease for extended periods of time.

WHAT FACTORS ARE ASSOCIATED WITH THE COMPLETION OF A VACCINE SERIES?

Completion rates vary by vaccine and over time; a multitude of factors contribute to the differences. Some factors, such as school and travel requirements, generally help to ensure that completion rates are met, particularly for the populations subject to those requirements. Other important factors can have a more variable impact, such as vaccine education, establishment of a usual source of health care, and cost.

VACCINE EDUCATION. It is important that people know that multiple doses are required for optimal efficacy and understand the recommended vaccine schedules. Unlike with many infant vaccines, research has shown a relative lack of familiarity among health care

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providers—as well as parents and patients—with the recommended schedules for many of the vaccines for older children and adults. A primary reason for this lack of familiarity is that these vaccinations are often not given as part of a mandatory or standard schedule.

In addition to knowing the recommended vaccine schedules, it is important that people are aware of potential side effects. The COVID-19 vaccines have been associated with several side effects. For example, during testing of the Pfizer vaccine, a substantial number of recipients experienced redness or swelling around the injection site (84%), fatigue (63%), headache (55%), muscle pain (38%), chills (32%), joint pain (24%), and fever (14%), among other side effects. In fact, UK public health authorities advised that people with a "significant history of allergic reactions" should not be given the Pfizer COVID-19 vaccine, after two people who were vaccinated experienced concerning symptoms a day after receiving the first dose. The FDA is recommending similar guidance. Although the side effects are generally mild and normal, they might be enough to make some people wary of taking a second dose, particularly if they were not aware of such side effects. Hence, it is important that people know what to expect.

Doctors and other health care providers can play a central role in patient education when it comes to vaccines, as provider recommendation has been strongly associated with vaccine uptake. This makes it critical for providers to stay up to date and routinely make vaccine recommendations during encounters with patients. In a recent survey, people identified their health care providers as the most trusted source for information on COVID-19 vaccines, with 85% saying they trust their health care provider at least a fair amount for reliable vaccine information. This also suggests that it will be important for providers to model good behavior, as frontline providers are set to be among the first to be vaccinated.

USUAL SOURCE OF CARE. There is also evidence that not having a usual source of health care is associated with lower levels of full compliance with multiple-dose vaccine series. This is problematic for many minority groups, particularly Black and Hispanic populations, who are less likely than their white counterparts to have a usual source of care. People with lower socioeconomic status have also been shown to have lower vaccine completion rates. As described in an earlier publication, communities with a large share of minorities and people with low socioeconomic status have been the most afflicted by COVID-19 and thus are most in need of widespread vaccinations.

In October, the New York State Department of Health (DOH) released plans for a COVID-19 Vaccination Program, which provides details on how New York is planning to provide increased vaccine access to communities at higher risk for COVID-19. Aside from working with hospitals, clinics, pharmacies, long-term care facilities, and other provider entities, DOH

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plans to work with businesses, schools, homeless shelters, correctional facilities, and other sites where high-risk populations gather (e.g., senior centers, social service offices, and food pantries) to expand vaccination access. New York State's COVID-19 Vaccination Program also recognizes the importance of tailoring public health messaging to resonate with New York's diverse population. It is imperative that the public health messaging campaign include information on the need for multiple doses of the vaccine.

COST OF A VACCINE. Cost can also be a barrier, as multiple doses require multiple visits to a health care provider. Thus, it is not a surprise that not having health insurance is associated with lower completion rates. Most insured Americans should be able to get the COVID-19 vaccine series at no cost. The federal government and many states, including New York, have already passed directives requiring insurers to cover and waive cost-sharing for a COVID-19 vaccine series.

As for those without health insurance, the federal government has pre-paid for millions of vaccine doses and promises to distribute those to providers for free. Providers who use those doses for uninsured patients are eligible to be reimbursed through the Coronavirus Aid, Relief, and Economic Security (CARES) Act Provider Relief Fund (PRF). However, PRF funds are limited; once those are exhausted, Congress may need to provide additional funding so that uninsured individuals can continue to obtain free vaccinations.

HOW CAN INSIGHTS FROM BEHAVIORAL ECONOMICS BE USED TO IMPROVE COMPLETION RATES?

We already mentioned some important ways to help ensure higher completion rates: improving patient education, increasing access to convenient locations for vaccination, and lowering financial barriers. Other interventions build on the notion that people who have initiated the vaccine series likely have well-meaning intentions to complete it. Research in fields such as psychology or behavioral economics has identified interventions—commonly referred to as nudges—that can help people follow through on their intentions.

Below we describe three sorts of nudges that are applicable to multi-dose vaccines. An important caveat to these interventions is that they have not been tested during the COVID-19 pandemic. As described above, this pandemic has created a unique set of logistical, social, economic, and psychological challenges and circumstances. However, a benefit of these types of behavioral nudges is that they have been tested under a wide variety of circumstances. They are also generally low-cost and do not require any government regulation or mandates; rather, they can be widely implemented by individuals, physician offices, insurance companies, businesses, and schools.

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Reminders

One simple intervention to help people follow through on their intentions are patient reminders. These reminders, which can take the form of phone calls, text messages, e-mails, patient portal notifications, and mailings, notify a patient or their guardian that they are due for a vaccination. One study found that pediatric practices that sent mail reminders for influenza vaccinations significantly increased influenza immunization among children. Other studies found that adolescents whose parents received a text message reminder were significantly more likely to receive a needed vaccination. Similar strategies have also been used to improve medication adherence.

New York's COVID-19 Vaccination Program uses reminders as a tool to increase vaccine series completion. Providers will be able to generate reminder notices for their patients within the New York State Immunization Information System (NYSIIS), the State's immunization database for their patients (see **Text Box**). Furthermore, NYSIIS will support centralized reminders—including postcards, robocalls, and text messages—using its series completion data.

NYSIIS: New York's Immunization Database

According to New York's COVID-19 Vaccination Program, New York State will collect data on COVID-19 vaccine series completion through its existing Immunization Information System (NYSIIS). Launched in 2008, NYSIIS collects data on all pediatric immunizations administered in New York State (excluding New York City, which manages its own immunization registry). NYSIIS is being adapted during COVID-19 to serve as the central system for pre-ordering vaccines, tracking vaccine series completion statewide, and reporting data.

Commitment

Some people intend to get the follow-up vaccine dose, but put off actually going. This could occur because people never get around to making a firm plan for the follow-up shot. This also makes it easier for people to exhibit what behavioral economists refer to as "time inconsistent" behaviors, which occur when a decision-maker's preferences change over time in such a way that a preference can become inconsistent at another point in time. Thus, someone who initially intends to get a follow-up vaccine dose in 3 weeks may let other priorities or procrastination change that plan over the following 3 weeks. By repeating this pattern, a person who has every intention of getting vaccinated at some point in the future would end up never completing the series.

Making a commitment, with an explicit plan of action, can help people follow through with existing intentions. For example, one study examined employees who received a mailing of available influenza vaccination clinics from their employer (see **Figure 1** for two versions of

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the mailer). The study found that employees whose mailing prompted them to write down the date and time they planned to be vaccinated had a higher vaccination rate than employees who received a mailing without a prompt.

FIGURE 1. INTEGRATION OF COMMITMENT DEVICES INTO VACCINE REMINDER MAILERS

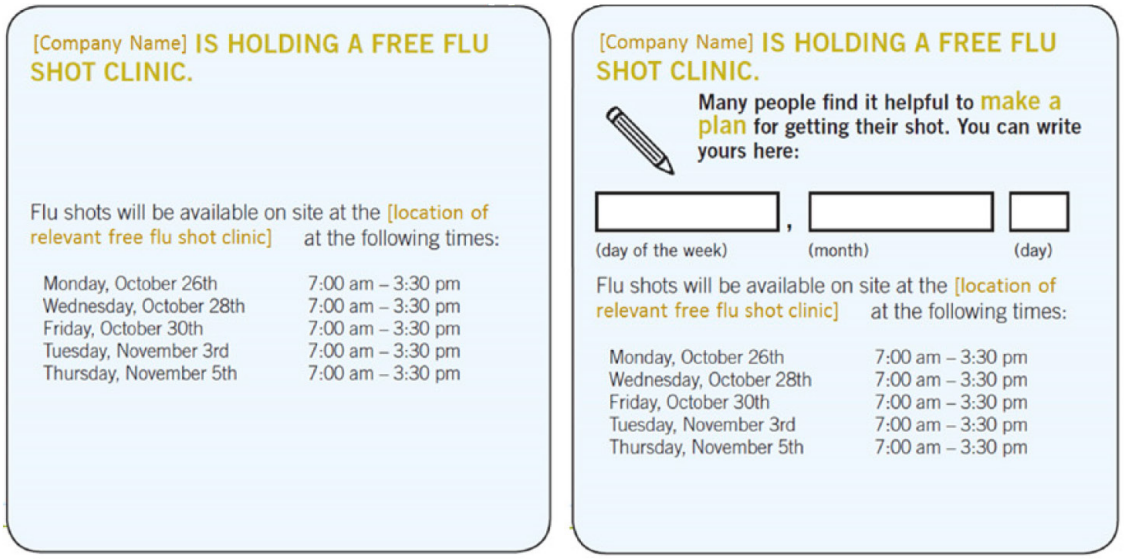

Image source

The federal government, through the Centers for Disease Control and Prevention (CDC), plans to distribute vaccination kits to providers that will contain COVID-19 vaccination record cards (see **Figure 2** for an example). These cards will be given to vaccine recipients and include vaccination information (e.g., vaccine manufacturer, lot number, dates of administration), as well as space for a written reminder of the second-dose appointment. The effectiveness of these cards can be maximized if the cards are used as a commitment device, with providers prompting patients to write down when they intend to get their second dose. In particular, the commitment would be more effective if changing the appointment takes effort (e.g., a phone call) or is costly (e.g., if there is a charge for the missed appointment).

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FIGURE 2. EXAMPLE OF A VACCINATION RECORD CARD

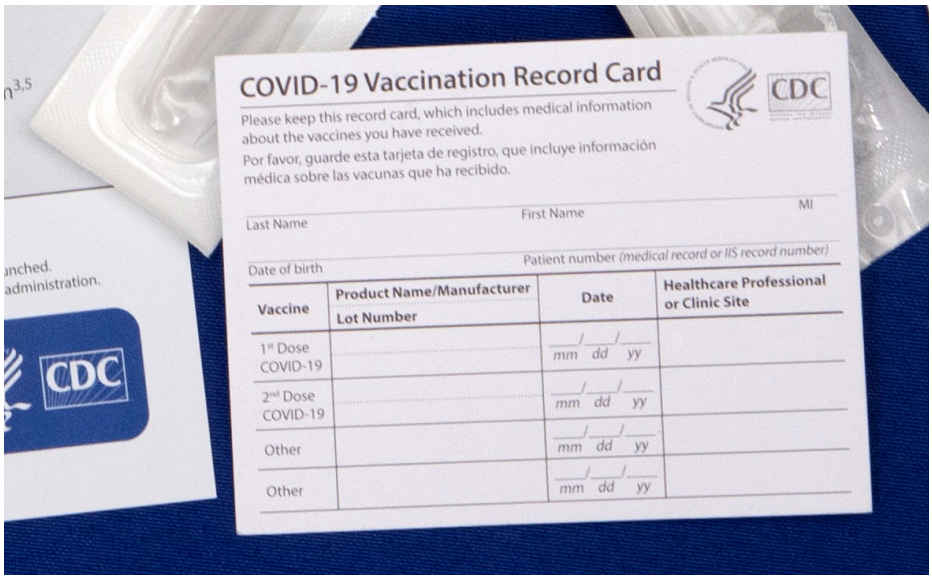

Image source

Using such commitment devices can also help address another barrier to completion rates: lack of patient understanding. As described earlier, multi-dose vaccine adherence increases when providers clearly explain to patients at the time of the first dose that additional doses are needed to complete the series. Providers can assess patients' understanding by using methods like the teach-back method, which asks patients to explain health information back to the provider in their own words.

Social Comparison

Behavioral economics research suggests that people care about how they compare to their peers and that comparative data can motivate change. For example, sending letters to inform households about their energy consumption compared to that of their neighbors led to a reduction in energy use by previously high energy users. Although research specific to using social comparisons in a vaccine context is limited, comparative data have been used to improve provider performance. For example, peer comparative reports were four times more effective than profit incentives in improving mortality rates among cardiac surgeons who performed coronary artery bypass grafts in Pennsylvania.

Provider practices could use this approach by sending out reminder notices that include information on vaccination and completion rates from their practice. Public health agencies and the media may also promote the use of social comparisons by tracking and reporting on

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regional vaccination and completion rates. In fact, New York State will be launching a public dashboard to inform the public of vaccination progress. The dashboard will report vaccine series completion rates by county, age group, and priority groups.

Making information about vaccine completion publicly available helps establish the norm that vaccine completion (not merely first dose vaccination) is expected behavior. Furthermore, providing comparisons by demographic groups can generate vaccination motivation. For example, if an individual sees that their age cohort has the highest rates of vaccine series completion, they may feel more motivated to complete their vaccine series, so as not to differ from their peers. Alternatively, if an individual sees that their county has a low rate of vaccine series completion, they may feel more responsibility to complete their series to improve their county rate.

Comparisons can also stimulate competitive behavior. For example, many universities engage in influenza shot competitions, leveraging existing rivalries to encourage vaccination among their students. It may be possible to use peer comparison to encourage providers to motivate higher completion rates among their patient populations. There are currently efforts to track and publicly report provider-level vaccination rates for influenza and pneumococcal vaccines. Consideration should be given to track a broader array of vaccination metrics, including COVID-19 vaccines, for specific providers and to include peer comparison information. Provider recommendations to vaccinate are thought to be important. However, as mentioned previously, studies have found wide variation in vaccination rates and adherence with vaccination guidelines at the provider level, even for chronically ill patients treated at academic medical settings.

HOW WILL WE KNOW IF PEOPLE ARE COMPLETING THEIR VACCINE?

The CDC and State public health agencies generally have comprehensive monitoring efforts that are conducted to evaluate compliance with vaccination schedules among infants and young children. Less information is available on compliance with multiple-dose vaccine series in the general population, particularly among adults.

New York's COVID-19 Vaccination Program includes resources to help providers track their patients' vaccination progress, as well as a system for providers to report vaccination data through NYSIIS. In the face of the COVID-19 virus, which has caused a global pandemic with severe adverse economic and public health consequences, having a centralized and systematic approach to track completion rates is enormously beneficial.

The capacity to track the progress of vaccinations will not only inform public health outreach

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efforts, but also help ensure an efficient distribution process that prioritizes vaccines for those in high-risk groups. Research has shown that a centralized approach is significantly more cost-effective than relying on individual provider practices. Also, providers will be able to access NYSIIS to confirm whether patients who initiated a vaccine with another provider are actually ready for their second dose. This can be particularly important for individuals who do not have a usual source of care.

Considering the central role of NYSIIS in New York's Vaccination Program, it will be critical for the State DOH to ensure that all providers are connected to the system and trained on how to use it. Until this point, mostly pediatric vaccination providers report to NYSIIS, as only vaccines administered to New Yorkers under the age of 19 are mandated to be reported. New York's COVID-19 Vaccination Program outlines several efforts to enroll new providers into NYSIIS, including the use of technical support and webinars. These trainings will be critical, as adult immunization providers will be providing the bulk of the vaccines and many of them likely have not previously used NYSIIS. In addition, some providers may not be using an electronic health record system that connects seamlessly to NYSIIS. The State will need to ensure that the process of submitting records by mail will be streamlined enough to allow for a second-dose reminder to be generated, or that there are flexible electronic processes in place.

Conclusion

A substantial proportion of Americans have expressed a strong hesitancy to get a COVID-19 vaccine, even if it is freely available. Prior history with multi-dose vaccines also suggests that a substantial proportion of people who initiate a COVID-19 vaccine will remain less than optimally immunized from the virus by not getting the follow-up doses. Such an outcome would hinder the ability for New York and other parts of the country to develop herd immunity.

While the research is not yet definitive regarding the effectiveness of a single dose of each of the COVID-19 vaccines, initial reports regarding a single dose of the Pfizer vaccine suggest it is about 50% effective in preventing symptomatic COVID-19. That is not nearly as good as the evidence for two doses, which has been reported to be 95% effective.

There is the possibility of a single-dose vaccine, which is being worked on by at least one drug manufacturer, but it may not be ready for months at the earliest. In the meantime, it will be critical for public health agencies and providers to use a combination of approaches, including nudges, to help maximize completion rates.

Improving the state of
New York's health

VOICE:
212-664-7656

FAX:
646-421-6029

MAIL:
1385 Broadway,
23rd Floor
New York, NY 10018

WEB:
www.nyshealth.org