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# **Pharmacy Times**®

## **IMMUNIZATION GUIDE FOR PHARMACISTS**

JUNE 2022



**The Pandemic Brought Pharmacy  
to the Fore as Essential  
Public Health Infrastructure**

**From Pandemic to Endemic:  
Challenges and Opportunities for  
Pharmacists in Immunization Services**

**The Role of Hospital Pharmacists  
in Administering and Supporting  
Immunizations in Health Systems**

**2022 ACIP Updates for  
Immunizations in Adults and Children:  
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**Examining the Partnership Between  
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**Dengue Vaccine: What Pharmacists  
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JUNE 2022

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## EDITOR'S NOTE

# The Pandemic Brought Pharmacy to the Fore as Essential Public Health Infrastructure

*Now We Must Turn Our Focus to All Recommended Vaccinations*

By TROY TRYGSTAD, PHARM.D, PH.D, M.B.A, PHARMACY TIMES® EDITOR IN CHIEF



TROY TRYGSTAD, PHARM.D, PH.D, M.B.A,  
PHARMACY TIMES® EDITOR IN CHIEF

**A**s the COVID-19 pandemic disproportionately affects rural, low-income, and ethnic minority populations, community pharmacies have become essential public health infrastructure.<sup>1,2</sup> The ability to receive vaccines in community pharmacies—as well as locations where people live, work, play, and pray—has contributed to well over 500 million doses of COVID-19 vaccinations administered in the United States.<sup>3,4</sup> Pharmacy staff are accessible, reliable, and well-trained and should feel proud of their efforts, especially through all the changes or alterations in workflow instated to accommodate the pandemic surge for the delivery of vaccination administrations, testing, and infusion services. Those workflows and capacities will not recede following the pandemic so long as pharmacies remain economically viable. Pharmacies are a new national strategic reserve of public health services.

## VACCINATION RATES WORSENERED, PROVIDER ACCESS REBOUNDED INSUFFICIENTLY, MISTRUST FESTERERED

Despite pharmacies' efforts and our health care system's near full reopening for non-COVID-19-related services, routine screenings and vaccinations continue to lag at alarming rates. For example, the CDC found that pediatric vaccination rates fell in the first 3 months of the pandemic in 2020, especially for those older than 2 years of age: in this group, rates of vaccination for tetanus, diphtheria, and pertussis (Tdap), measles, mumps, rubella (MMR), and human papillomavirus (HPV) fell by 60% or

*Despite pharmacies' efforts and our health care system's near full reopening for non-COVID-19-related services, routine screenings and vaccinations continue to lag at alarming rates.*

more compared with the same months in the previous 2 years.<sup>5</sup> Even when the health care system opened up in the late summer and fall of 2020, children and adolescents were not being vaccinated at pre-pandemic rates: Tdap administration among patients aged 13 to 17 years, for instance, fell by 30% compared with the same period in 2018 and 2019. In the words of the CDC study authors, "across all age groups and across all vaccine types, none of the jurisdictions [studied] demonstrated a sustained or prolonged increase in the number of weekly doses administered above pre-pandemic administration levels."<sup>5</sup> In adults, save for some populations in certain categories, vaccination rates also dropped substantially at the beginning of the pandemic and did not rebound sufficiently through August 2020 compared with rates during the same periods in 2019.<sup>6</sup> Even the exceptions to this trend may not reflect Americans' desire for basic vaccinations: the uptick in influenza vaccinations for Medicare Advantage from July 2020 to August in 2020 relative to the same period in 2019,<sup>6</sup> for example, was likely associated with co-administration of the influenza vaccine and the COVID-19

## *The health of our communities depends on providers' abilities to close gaps in care.*

vaccine and by patient perceptions that the influenza vaccine would inoculate against COVID-19. Bottom line: Americans are way behind with vaccination relative to pre-pandemic levels, and our rates were not spectacular to start with.

Add to these headwinds a festering mistrust of vaccines. Although many experts and officials lament not having 100% vaccination for COVID-19, the near 90% coverage for first dose administration for those aged 18 years and above<sup>4</sup> is well above the mere 50% coverage for influenza vaccination achieved during the 2020-2021 flu season.<sup>7</sup> Social media has led some to distrust vaccine benefits and safety; however, its continuous reporting of poor outcomes in the unvaccinated—and especially its use of hyperlocal data (eg, hospitals, local health departments, local officials)—has helped others to realize the consequences of the virus. Whether COVID-19 vaccine hesitancy is impacting other vaccination rates remains an open question.

### **PHARMACIES NEED TO STEP UP AND STEP IN TO FULFILL PUBLIC HEALTH ROLE**

All this should compel pharmacies and pharmacy staff to make a purposeful and everlasting commitment to vaccine administration and education. Our role as trusted health care providers in touch with and embedded within our communities is more important than ever. The health of our communities depends on providers' abilities to close gaps in care. Pharmacies are well positioned to expand equity through vaccination and, increasingly, through screening services for chronic disease, mental health, and infectious diseases other than influenza or COVID-19.

### **HEALTH PLANS AND POLICY MAKERS NEED TO STEP UP TO ENSURE VACCINATIONS ARE A REIMBURSEMENT PRIORITY**

Of course, these essential public health functions

cannot be sustained without proper policy, recognition of the roles of the pharmacy, and reasonable reimbursement. Although reimbursement for COVID-19 vaccination services has generally been ubiquitous, claims administration and contracting for other COVID-19 services, such as testing and infusions, have lagged substantially. Moreover, many plans do not pay anything for the service of administering non-COVID-19 vaccinations, let alone for other testing and screening services. To facilitate equity and overall public health, payers, plans, and policy makers must make pharmacy reimbursement a priority. ■

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#### **About the Author**

**Troy Trygstad, PharmD, PhD, MBA**, is the Executive Director of CPESN USA, a clinically integrated network of more than 3500 participating pharmacies. He received his PharmD and MBA degrees from Drake University and a PhD in pharmaceutical outcomes and policy from the University of North Carolina. He has recently served on the board of directors for the Pharmacy Quality Alliance and the American Pharmacists Association Foundation.

## COVER STORY



# From Pandemic to Endemic: Challenges and Opportunities for Pharmacists in Immunization Services

By RANDY P. MCDONOUGH, PHARMD, MS, BCGP, BCPS, FAPHA



RANDY P. MCDONOUGH,  
PHARMD, MS, BCGP, BCPS, FAPHA

The COVID-19 pandemic came on quickly, disrupted our communities, and impacted the delivery of health care, especially through pharmacies.<sup>1</sup> Pharmacists had to adjust their delivery of care to those who came into the pharmacy. In addition to utilizing new strategies for medication delivery, pharmacists had to develop processes and procedures to keep patients and staff safe.<sup>2</sup> As COVID-19 vaccines became available, pharmacists were tasked with figuring out storage requirements, as well as appropriate handling and reconstitution of vaccines.<sup>3</sup> New policies and procedures also were required to handle the large influx of people while maintaining social distancing and safety concerns.<sup>3</sup> Simultaneously, pharmacists had to deal with vaccine misinformation and hesitancy issues, medication shortages and misuse problems, patient questions and concerns,<sup>4,5</sup> and a constant barrage of information coming from professional organizations, social media, and the media. As tragic as the pandemic has been, it was also a time for pharmacists to innovate, create new care

processes, collaborate with new community partners, and further develop their immunization knowledge and skills.

## PHARMACY CHALLENGES

Early during the pandemic, pharmacists focused on the safety of their staff and patients while attempting to maintain services.<sup>5</sup> It was a challenge to minimize face-to-face interaction while ensuring that patient's pharmaceutical services were being met. Many pharmacies closed their lobbies to limit the individuals in the pharmacy to staff; however, this meant developing new processes for delivering not only medications, but also clinical services. Pharmacy staff also were navigating an increase in questions from patients, health care providers, and other community stakeholders about COVID-19, vaccines, testing, and nonapproved treatments. To stay abreast of the latest information, pharmacists were constantly reviewing new information released through drug information sources, press releases, and news reports with alarming speed.

Pharmacists and staff had to maintain social distancing, use appropriate personal protective equipment (PPE), and perform regular cleaning and disinfecting of the pharmacy. Furthermore, employees were screened daily for COVID-19 symptoms and received temperature checks. Developing new policies and procedures to address these new challenges became critical—for example, how to proceed when an employee tested positive for COVID-19.

The pandemic also exacerbated the already existing challenge of understaffing due to illness, technician shortages, and reductions in the labor market.<sup>6,7</sup> As COVID-19 tests and vaccines became available and implemented in the practices, pharmacists and technicians were trying to handle being chronically understaffed and overworked.<sup>8</sup> Because of the increased stresses at the workplace, pharmacy staff were experiencing burnout,<sup>9-11</sup> and many were postponing other clinical services because of a lack of time due to the onslaught of COVID-19 vaccination services and testing being performed daily. Drug shortages and supply chain issues also became a concern causing inventory management challenges, quantity limits on certain medications, and complications around planning for future needs.<sup>12</sup>

Pharmacy staff were stretched even further with the need to effectively plan for remote vaccination clinics, in which large numbers of people were expected to attend. To plan and execute these remote clinics, pharmacy staff coordinated between multiple community stakeholders, including city governments, public safety, health and works departments, community organizations, transportation companies, churches, and community volunteers. In addition, pharmacy staff were required to arrange and ensure there was adequate PPE, vaccination supplies, and large enough spaces to host the clinic that allowed not only a place to safely vaccinate, but also a monitoring area that provided adequate social distancing for those who just received a vaccine. Promoting the vaccination clinic, enrolling, scheduling and managing people, and implementing people flow to promote social distancing required tremendous effort and planning.<sup>3</sup>

## PHARMACY INNOVATION

Although the pandemic created multiple challenges for pharmacy staff, it also led to innovation, creativity, and the use of new technology. Because of the number of people requesting and needing COVID-19 vaccines, testing, or other clinical services, many pharmacies such as Towncrest Pharmacy, developed remote scheduling platforms (**Figure**).

These platforms allow people to schedule their services on their own by accessing the pharmacy's website, identifying the service needed, and choosing an open time on the schedule that meets their availability.

In addition, some pharmacies created documentation platforms that enabled pharmacy staff to record their work related to COVID-19 vaccinations and batch upload this information into state registries. Other technologies implemented by pharmacies during the pandemic included point-of-care diagnostics for COVID-19 and influenza (eg, polymerase chain reaction and rapid antigen tests), telepharmacy consults, and clinical documentation via e-care plans.<sup>5,13-15</sup>

Pharmacists and pharmacy staff also developed creative ways to provide services to those who may be positive for COVID-19 while minimizing their own exposure. These changes included curbside-only delivery for prescriptions and testing and vaccination services. Designated parking spaces were identified and marked with signage that included the pharmacy phone number so that individuals could call to alert the pharmacy staff of their needs.

In addition, some pharmacies created makeshift clinical offices outside the pharmacy. At Towncrest Pharmacy, like many other pharmacies, some of these outdoor clinical offices are rented trailers that can be used during inclement weather (**Photograph 1**). Other pharmacies developed strategies to limit the flow and number of people inside the pharmacy at the same time. At Towncrest Pharmacy, a stoplight system was used to alert people when they could enter the pharmacy (**Photograph 2**). Additional equipment was also needed in some cases, such as ultracold freezers, additional office furniture and furniture supplies, signage, and vaccine supplies.

## PHARMACY TECHNICIAN INNOVATION

Many pharmacy practices utilize their pharmacy technicians to manage certain tasks and processes, such as synchronizing medication, dispensing, and triaging processes to free up pharmacists to provide clinical services<sup>16</sup>; however, during the COVID-19 pandemic, pharmacy technicians saw a further evolution of their roles in the pharmacy. Technicians have proven to be as effective as pharmacists in product verification,<sup>17</sup> so practices in states that allowed technician product verification, were able to free up the pharmacists even more to provide clinical services. Utilizing well-trained technicians enables pharmacists to practice at their level of education and expertise, improving service delivery.

FIGURE. Screenshot of Remote Scheduling Platform for Towncrest Pharmacy<sup>a</sup>

Returning? [Log in](#)

### 1 Choose Appointment

**Adult Vaccination (Influenza, Pneumonia, Tetanus or Shingles)** (30 minutes)

**Testing**

**Rapid COVID-19 Antigen Testing** (15 minutes)  
This test costs 95 dollars and the results are ready in 15 minutes.

**Rapid COVID-19 PCR Testing** (1 hour)  
This test costs 125 dollars and the results are ready in 1 hour.

**Vaccine Administration**

**Pfizer Covid Vaccine (Initial or Booster)** (30 minutes)  
Initial: For anyone 12 years and older (parent must accompany those under 18). The second dose must be given at least 21 days after the first dose.  
  
First Booster doses are available for those 12 years of age and older AND must be at least 5 months after completing your COVID-19 primary series.  
Second Booster doses are available for 50 years of age and older or immunocompromised. All must be at least 4 months after completing COVID-19 booster vaccine.

**Moderna Covid Vaccine (Initial or Booster)** (30 minutes)  
Initial: For anyone 18 years and older. Your second dose of the Moderna vaccine should be given 28 days.  
  
First Booster doses are available for those 18 years of age and older AND must be at least 5 months after completing your COVID-19 primary series.  
Second Booster doses are available for those 50 years of age and older or immunocompromised. All must be at least 4 months after completing COVID-19 booster vaccination.  
  
For Immunocompromised: Boosters can be given 3 months after primary series

- Returning users can log in to the patient portal.
- Patients can choose the type of appointment they prefer, such as general adult vaccinations, COVID-19 testing, or COVID-19 vaccination.
- The estimated length of time needed for each type of appointment also is provided.

<sup>a</sup>For illustrative purposes only. Please consult COVID-19 vaccine administration guidelines from the CDC for the most up-to-date guidance.

PHOTOGRAPH 1. Outdoor Clinical Office at Towncrest Pharmacy



PHOTOGRAPH 2. Stoplight System at Towncrest Pharmacy



The pandemic also highlighted the role of pharmacy technicians as immunizers with the appropriate training.<sup>16</sup> The availability of another group of providers able to vaccinate afforded a new level of flexibility to pharmacies to provide remote vaccination clinics without disrupting services in the pharmacy.

### INFORMATION CHALLENGES

During the pandemic, people were exposed to an onslaught of information about COVID-19 itself, as well as appropriate safety measures, testing, available vaccinations, and alternative treatments. People needed to sift through a high volume of information from a variety of sources, such as social media, which contributed to information overload, misinformation, and medical mistrust. This led to vaccine hesitancy among many individuals,<sup>18-20</sup> and some sought alternative treatments for COVID-19.

The pandemic also impacted administration rates for other vaccines. The influenza vaccination rate increased whereas other vaccines, in the aggregate, decreased<sup>21,22</sup>; stay-at-home restrictions may have impacted this decrease. Anecdotally, some people were less willing to receive other vaccines, especially during the COVID-19 vaccine initial series, because of concerns over adverse events (AEs) associated with COVID-19 vaccines. Many people were knowledgeable of the more common AEs associated with COVID-19 vaccination. Data from the first 6 months of the US COVID-19 vaccination program indicated that most individuals experienced AEs during the first and second dose; however, most AEs were mild.<sup>23</sup>

Although some pharmacies saw an increase in willingness to receive other vaccines at the same time as a COVID-19 booster, there appears to have been a reduction in the rate of eligible people receiving boosters compared with the rate of those who received primary COVID-19 vaccinations.<sup>24</sup>

Furthermore, homebound, nonambulatory people presented unique challenges to pharmacies and the community. The complexities of the storage and special monitoring requirements for COVID-19 vaccines made it difficult to vaccinate these individuals effectively and efficiently. This population also posed increased challenges for the safe delivery of medications and services.

### LESSONS LEARNED: IMPROVEMENTS IN IMMUNIZATION SERVICES

As we move from a pandemic to an endemic, many lessons have been learned to improve the delivery of immunization

services at pharmacies. It is interesting to note that some of the creative solutions implemented during the pandemic have continued into the endemic. Curbside delivery of medications and services continues for some pharmacies post pandemic—because people appreciate the convenience. The use of remote scheduling platforms also proved beneficial not only to the pharmacy, but also to patients because they found they can schedule clinical services at their convenience. Integrating the review of state registries to proactively assess individuals' vaccine status during the medication synchronization process provided an opportunity for discussions on vaccination needs. Utilizing an appointment-based model for delivery of care offered an efficient and effective way to provide vaccines. The sharing of clinical information between pharmacists and prescribers enhanced communication, assured that individuals were candidates for certain vaccines, and confirmed that immunization records were up-to-date.

New and improved care processes implemented during the pandemic also increased the visibility of pharmacies in the community—even among those individuals who normally filled prescriptions elsewhere. Providing enhanced clinical services created an opportunity to bring new people to a pharmacy practice. This provided pharmacy staff the ability to highlight their full array of clinical services beyond those related to COVID-19, such as pediatric vaccination services. As such, Towncrest Pharmacy experienced an increase in the number of pediatric individuals, which brought new families and new opportunities to expand into the pediatric market for other vaccines.

The COVID-19 pandemic also created new opportunities for pharmacists to collaborate with other community stakeholders who may not have worked with, or recognized, the value of pharmacies prior to the pandemic. There were many examples of pharmacies partnering with public health departments, emergency management agencies, social services, senior centers, and other community organizations to ensure that communities maximized their immunization opportunities. These organizations worked closely together to coordinate vaccination clinics, share resources, and manage community outreach strategies. For some community organizations, this was the first time that they worked with a pharmacy. It demonstrated the importance of a pharmacy to a community—not just as a place where prescriptions are filled, but also as a partner and a solution to a community's collective health needs.

These relationships are just as important now for the provision of vaccination services, including remote clinics. The

pandemic highlighted issues related to social determinants of health (SDOH) that were experienced by many community members. Pharmacies became part of the solution to address these issues by collaborating with key stakeholders, such as local social service departments, local health departments, health care providers, and other community-based organizations (CBOs).<sup>25,26</sup> Incorporating assessments of SDOH as part of medication management services and referring people to an appropriate CBO became another new role for pharmacists.

## THE FUTURE ROLE OF PHARMACISTS AND VACCINES POST COVID-19

The COVID-19 pandemic highlighted new vaccine technology: mRNA and viral vector. These technologies are effective, allow for new vaccines to be developed expeditiously, and offer advantages for rapidly emerging infectious diseases.<sup>27</sup> Because of the misinformation that people are exposed to, pharmacists have a role to educate, counsel, and advise individuals and other health care providers about the efficacy and safety of new technology and the rigorous process new vaccines undergo before FDA approval.

The pandemic also highlighted the value of pharmacists. With most of the US population living within 5 miles of a pharmacy,<sup>28</sup> pharmacists demonstrated they are key health care team members providing vaccine services, education, and other clinical services to their communities. Although the pandemic is evolving into an endemic, pharmacists continue to have an important role within their communities to ensure vaccine service delivery that improves the health of all people. ■

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## HOSPITAL AND HEALTH SYSTEM PHARMACY

# The Role of Hospital Pharmacists in Administering and Supporting Immunizations in Health Systems

By MONICA V. MAHONEY, PHARM.D, BCPS, BCIDP



MONICA V. MAHONEY,  
PHARM.D, BCPS, BCIDP

Vaccinations are a critical preventive health measure and are routinely recommended from an early age. Indeed, the first hepatitis B vaccine in the series can be administered within 12 to 24 hours of birth.<sup>1</sup> Although children receive many vaccinations during routine pediatric visits, adults typically receive vaccinations from a primary care provider (PCP) or at a community pharmacy. In 2018, almost 70% of adults received an influenza vaccine at a doctor's office or retail health clinic.<sup>2</sup> In addition to these locations, vaccinations also may be provided at hospitals and emergency departments (EDs), which provide a safety net for those who may not otherwise have access. Although most vaccines are administered by nurses in the hospital setting, there is still a role for the hospital pharmacist. This article explores the role of hospital pharmacists in administering and supporting immunizations, including in inpatient, ED, and ambulatory settings.

## IMMUNIZATIONS SUPPORT IN THE INPATIENT SETTING

Many hospitals are part of larger health care systems, which may encompass a traditional inpatient hospital, urgent care and emergency centers, ambulatory clinics, retail pharmacies, and private physician offices. Health systems typically follow 1 systemwide medication formulary. Hospital pharmacists are integral members of pharmacy and therapeutics committees, and as medication experts, they often guide formulary decisions.<sup>3</sup> Based on their knowledge and clinical expertise, pharmacists may be called upon to manage the formulary placement of vaccines. For example,

influenza and pneumococcal vaccines are 2 common vaccines administered to inpatients. Pharmacists can be involved in programming clinical decision support interventions into electronic health records to identify patients who may be eligible for these vaccines. Potential clinical decision support interventions may include standing orders or collaborative practice agreements.<sup>4</sup> Hospital pharmacists also can provide vaccinations to health system employees and counseling to inpatients who decline a vaccination.<sup>5</sup>

Beyond inpatient or employee vaccination, hospital pharmacists also may be called upon to implement and oversee mass vaccination clinics.<sup>6</sup> For example, drawing on their experience in providing pop-up influenza vaccine clinics for employees during the COVID-19 pandemic, hospital pharmacists were able to set up vaccine clinics and provide education regarding COVID-19 vaccines.<sup>7</sup> Inpatient vaccination has shown to be an effective means of providing COVID-19 vaccine doses and booster doses, and hospital pharmacists played an integral part in both planning for and administering these vaccines.<sup>8,9</sup>

Another unique role for hospital pharmacists is the identification of patients who are asplenic due to trauma, surgery, or past medical history.<sup>10</sup> Patients who lack a functioning spleen are at risk of severe infection from encapsulated bacteria, and *Haemophilus influenzae* type b, meningococcal ACWY, meningococcal type B, pneumococcal, and annual influenza vaccines are recommended for these patients. Hospital pharmacists can identify patients who need these vaccines and administer

the vaccines while these patients are in the hospital or refer them to colleagues for follow-up after discharge.

Hospital pharmacists also can play an important role in vaccine reconciliation. Vaccine reconciliation is important because patients may receive vaccines in a variety of health care settings. Similar to medication reconciliation, nurses ask about vaccinations during screening interviews; however, patient recollection of vaccinations can be inaccurate.<sup>11</sup> Evidence has shown that implementing a multidisciplinary approach that involves nurses working together with pharmacy staff and employing protocols to identify and follow up on patients who are eligible for vaccines can increase rates of inpatient vaccination.<sup>12,13</sup> Furthermore, granting pharmacists access to state immunization information systems can make it easier to maintain more complete vaccination records, at least for vaccines administered within the same state.<sup>12</sup>

### IMMUNIZATION SUPPORT IN THE ED

The ED is another area where hospital pharmacists can be involved in vaccination efforts. Approximately 25% of Americans do not have a PCP<sup>14</sup> and thus may use the ED for routine care. When an individual is in the ED, there is an opportunity for education and to provide preventive vaccinations, especially if the patient does not have a PCP. ED visits can be an avenue for successful vaccination programs against influenza,<sup>15</sup> COVID-19,<sup>16,17</sup> and hepatitis A.<sup>18</sup> Hospital pharmacists can administer first vaccine doses and play a key role in coordinating appointments for individuals to receive subsequent doses of multidose series. These vaccine efforts can be applied to other disease outbreaks or pandemics.

### IMMUNIZATION SUPPORT IN AMBULATORY CLINICS

Pharmacists employed at ambulatory clinics also make vaccine recommendations, provide education regarding vaccines, and administer vaccinations. Patients may experience improved continuity during transitions of care from the inpatient or ED setting to the ambulatory clinic setting, especially when the ambulatory clinic is part of the same health system. Also, patients may have better insurance coverage when visiting an outpatient clinic via utilization of outpatient or pharmacy benefits, and such visits may result in revenue for the institution.

An evolving niche for ambulatory pharmacists is the establishment of vaccine clinics for patients about to undergo immunosuppressive therapy.<sup>19</sup> With the increase in use of monoclonal antibodies and other immunosuppressive

medications for a variety of diseases related to immune system dysfunction (eg, Crohn disease, psoriasis, multiple sclerosis), pharmacists are poised to screen patients and provide recommendations regarding vaccines, particularly before patients initiate immunosuppressive medication.

### CONCLUSIONS

Although the administration of vaccines is not traditionally viewed as part of the responsibilities of hospital pharmacists, based on their knowledge and experience regarding the provision of vaccines, pharmacists can help with vaccination in many ways and in a variety of health care settings. As hospitals continue to expand and evolve into health systems and share accountability for patient care, hospital pharmacists will continue to expand their roles regarding immunizations. ■

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## LEGAL &amp; REGULATORY UPDATES

# 2022 ACIP Updates for Immunizations in Adults and Children: What Pharmacists Need to Know

By KIMBERLY MCKEIRNAN, PHARMD, BCACP



KIMBERLY MCKEIRNAN,  
PHARMD, BCACP

Pharmacy team members are an integral part of vaccination efforts in the United States. According to the CDC, as of May 11, 2022, more than 248 million doses of COVID-19 vaccines have been administered in pharmacies across the United States.<sup>1</sup> This includes more than 8 million doses that pharmacists administered at long-term care facilities in 2021 to some of the most vulnerable patients in the nation. Pharmacists, student pharmacist interns, and pharmacy technicians, however, have given substantially more immunizations than those documented by the CDC for COVID-19 vaccines. They also administer seasonal influenza (flu) vaccines and routine adult and pediatric vaccines. Even before the pandemic, pharmacy team members played a major role in immunizations. During the 2020-2021 influenza season, more than 47 million doses of flu vaccine were administered to adults in US pharmacies, compared with 32 million doses administered in physician offices.<sup>2</sup>

The third amendment of the Public Readiness and Emergency Preparedness Act was issued in August 2020 to combat declining routine childhood immunization rates during the pandemic.<sup>3</sup> It authorizes pharmacists in all US states to administer routine pediatric vaccines to children as young as 3 years of age. Pharmacy team members are now able to administer more types of vaccines to more patients than at any time in history. However, this also means that keeping up to date on immunization advancements, changes, and updates is more important than ever. This article provides an update on the vaccine recommendations from

the Advisory Committee on Immunization Practices (ACIP) that have been made and approved for 2022.

## HOW ARE DECISIONS ABOUT VACCINE RECOMMENDATION UPDATES MADE?

Each year, a new immunization schedule is recommended by the ACIP, a committee within the CDC, after in-depth consideration of vaccine-related data. The ACIP comprises 15 voting members whose medical and public health expertise includes vaccinology, immunology, pediatrics, internal medicine, nursing, family medicine, virology, public health, infectious diseases, and preventive medicine. When making recommendations about vaccines, the ACIP considers data that include epidemiology and societal impacts of diseases and effectiveness and safety of the vaccines. Historically, the ACIP meets 3 times each year to review new information and vote on vaccine recommendations, although more frequent meetings were needed during the pandemic. Recommendations made by the ACIP are reviewed and approved by the CDC, the American College of Physicians, the American Academy of Family Physicians, the American College of Obstetricians and Gynecologists, the American College of Nurse-Midwives, the American Academy of Physician Associates, and the Society for Healthcare Epidemiology of America. Official vaccine recommendations are published in the CDC's *Morbidity and Mortality Weekly Report (MMWR)*.<sup>4</sup>

Anyone interested in learning the new vaccine recommendations in the United States may consider watching upcoming

**TABLE 1.** A Summary of the ACIP Recommended Changes From the 2021 to the 2022 Adult Immunization Schedule<sup>6,7</sup>

Vaccine	Change
COVID-19	The <b>Notes</b> section now includes hyperlinks to the ACIP recommendations for the use of COVID-19 vaccines and the CDC's Interim Clinical Considerations for the use of COVID-19 vaccines.
Hepatitis B	<p>In <b>Table 1 (Adult Routine Immunization Schedule, by age)</b>, the text now states “2, 3, or 4 doses depending on vaccine or condition.”</p> <p>The row for adults aged 19 to 59 years is <b>yellow</b>, indicating that hepatitis B vaccination is recommended for adults in this group.</p> <p>The row for adults aged 65 years and older is <b>purple</b>, indicating that vaccination is recommended if another risk factor or indication is present.</p> <p>In <b>Table 2 (Adult Routine Immunization Schedule, by medical condition or indication)</b>, the row is now <b>yellow</b> through all columns, indicating vaccination is recommended for all risk-based groups. The text reads “2, 3, or 4 doses depending on vaccine or condition” and “3 doses (see notes)” in the pregnancy column.</p> <p>Updated <b>Notes</b> also were provided.</p> <p>The <b>Routine vaccination</b> section states that adults aged 19 to 59 years are recommended to receive a 2-, 3-, or 4-dose series, with details provided.</p> <p>The <b>Special situations</b> section outlines the risk-based recommendations for adults aged ≥ 60 years and language has been added stating that “anyone age 60 years or older who does not meet risk-based recommendations may still receive Hepatitis B vaccination.”</p>
HPV	<p>The <b>Notes</b> were updated.</p> <p>The <b>Routine vaccination</b> section was reworded and now states, “No additional dose recommended when any HPV vaccine series has been completed using the recommended dosing intervals.”</p> <p>The <b>Special situations</b> section, under the immunocompromising conditions subbullet, now reads, “3-dose series, even for those who initiate vaccination at age 9 through 14 years.”</p> <p>Wording for the <b>pregnancy</b> subbullet was rearranged to improve clarity.</p>
Influenza	<p>In <b>Table 2</b>, the text for LAIV4 was changed to “Contraindicated” to increase clarity and align with ACIP recommendations.</p> <p>The <b>Notes</b> also were updated.</p> <p>The language was edited to clarify the age as “19 years or older” to be consistent with the schedule.</p> <p>A hyperlink to the 2021–2022 influenza recommendations and a bullet for the 2022–2023 influenza recommendations were added.</p> <p>The <b>Special situations</b> section was condensed by referring to the appendix listing the contraindications and precautions for the influenza vaccines.</p>
MMR	<p>In <b>Table 2</b>, the text for the <b>red</b> boxes was changed to “Contraindicated” to increase clarity and align with ACIP recommendations.</p> <p>In the <b>Notes: Special situations</b> section, CD4 percentages and CD4 counts were added to the HIV infection bullet.</p>
Meningococcal	The <b>Notes</b> section now states “MenB vaccines may be administered simultaneously with MenACWY vaccines if indicated, but at a different anatomic site, when feasible.”
Pneumococcal	<p>In <b>Table 1</b>, all the recommended pneumococcal vaccines (PCV15, PCV20, and PPSV23) are now included in 1 row rather than separately.</p> <p>The row for adults aged 19 to 64 years is <b>purple</b> since pneumococcal vaccination is recommended for adults with additional risk factors.</p> <p>The row for adults aged 65 years and over is <b>yellow</b>, indicating that pneumococcal vaccination is recommended for everyone in this age group who has not previously been vaccinated with a pneumococcal conjugate vaccine. The text now specifies “1 dose of PCV15 followed by PPSV23 or 1 dose of PCV20 (see notes).”</p> <p>The <b>Notes</b> section was updated to reflect ACIP's new recommendations for PCV15 and PCV20 vaccines.</p> <p>The <b>Routine vaccination</b> section now states that persons aged ≥ 65 years “who have not previously received a pneumococcal conjugate vaccine or whose previous vaccination history is unknown should receive 1 dose of PCV15 or 1 dose of PCV20. If PCV15 is used, this should be followed by a dose of PPSV23.”</p> <p>The <b>Special situations</b> section has changed and states that anyone “aged 19 through 64 years with certain underlying medical conditions or other risk factors who has not previously received a pneumococcal conjugate vaccine or whose previous vaccination history is unknown should receive 1 dose of PCV15 or 1 dose of PCV20. If PCV15 is used, this should be followed by a dose of PPSV23.”</p> <p>Guidance for <b>dosing intervals</b> between PCV15 and PPSV23 and for patients who have previously received PCV13 or PPSV23 in the past is also included.</p> <p>A new note at the end lists all the <b>underlying medical conditions</b> or risk factors that would render those aged 19 to 64 years eligible to receive pneumococcal vaccination.</p>

**TABLE 1.** A Summary of the ACIP Recommended Changes From the 2021 to the 2022 Adult Immunization Schedule<sup>6,7</sup> (continued)

Varicella	In <b>Table 2</b> , the text for the <b>red</b> boxes was changed to “Contraindicated” to increase clarity and align with ACIP recommendations. In the <b>Notes: Special situations</b> section, CD4 percentages and CD4 counts were added in the HIV infection bullet.
Zoster	In <b>Table 1</b> , the zoster row was changed to <b>purple</b> for adults aged 19 to 49 years, indicating that RZV is now recommended for adults with immunocompromising conditions. The text was updated to state “2 doses for immunocompromising conditions (see notes).”  In <b>Table 2</b> , The RZV row is now <b>yellow</b> under the Immunocompromised and HIV infection columns, indicating that it is recommended for these subgroups. The text specifically states, “2 doses at age ≥ 19.”  In the <b>Notes: Special situations</b> section under pregnancy, the language was revised to state, “There is currently no ACIP recommendation for RZV use in pregnancy. Consider delaying RZV until after pregnancy.” The immunocompromising conditions bullet was revised and now states, “RZV is recommended for use in persons aged 19 years and older who are or will be immunodeficient or immunosuppressed because of disease or therapy.”

ACIP, Advisory Committee on Immunization Practices; CD4, cluster of differentiation 4; HPV, human papillomavirus; LAIV4, live-attenuated influenza vaccine, quadrivalent; MMR, measles, mumps, rubella; PCV13, 13-valent pneumococcal conjugate vaccine; PCV15, 15-valent pneumococcal conjugate vaccine; PCV20, 20-valent pneumococcal conjugate vaccine; PPSV23, pneumococcal polysaccharide vaccine; RZV, recombinant zoster vaccine.

ACIP meetings, which are livestreamed for free to the public.<sup>5</sup> Additionally, the CDC allows written public comments and requests to make oral public comments at upcoming meetings. Dates for upcoming meetings, agendas, registration information, and directions on submitting a public comment are available under the Meeting Information section on the ACIP website. After each meeting, the presentation slides and videos are available online.

## CHANGES TO THE RECOMMENDED ADULT IMMUNIZATION SCHEDULE FOR AGES 19 YEARS AND OLDER

The recommended immunization schedule for adults aged 19 years and older is available in different formats, and pharmacy team members should be aware of the options.<sup>6</sup> One version of the schedule is organized by age group. This version can be useful when helping a new or existing patient identify which vaccines may be needed, which can be determined simply by asking their age. Another version of the schedule is organized by medical condition or indication. This version may be useful when a patient receives a new diagnosis or has another indication that necessitates additional vaccinations.

When reading the immunization schedule, it is important to be familiar with the color coding and the meaning of each color.<sup>6</sup> On the schedule organized by age, **yellow** indicates that the vaccination is recommended for adults who have not been vaccinated who meet the indicated age requirement, lack documentation of previous vaccination, or lack evidence of past infection. For example, the schedule organized by age, in the column for adults 65 years and older, the row for pneumococcal is yellow, indicating pneumococcal vaccination is recommended for that age group. **Purple** indicates that the vaccination

is recommended for adults in an age group who have an additional risk factor or indication. When a patient meets the criteria in the purple section, the Notes section of the schedule should be checked for more details. When the schedule row is **blue**, shared clinical decision-making about vaccination is recommended.

In addition to the yellow, purple, and blue color coding, the adult schedule organized by medication condition or indication includes **red**, indicating that the vaccination is contraindicated and should not be administered, and **orange**, which indicates precaution that the vaccination might be indicated if the benefits of protection outweigh the risk of adverse reactions.

The ACIP approved the recommended adult immunization schedule for adults at least 19 years old at the November 2021 meeting.<sup>7</sup> The 2022 schedule includes several updates and changes from the 2021 schedule, in addition to an appendix listing contraindications and precautions for all vaccines in the schedule. Changes for the 2022 adult immunization schedule include revised recommendations for the hepatitis B, influenza, pneumococcal, zoster, and COVID-19 vaccines. Also, the language for recommendations regarding measles, mumps, rubella; meningococcal; and varicella vaccines was revised to improve clarity. A summary of the changes is shown in **Table 1**.<sup>6,7</sup>

## CHANGES TO THE RECOMMENDED CHILD AND ADOLESCENT IMMUNIZATION SCHEDULE FOR AGES 18 YEARS OR YOUNGER

Similar to the adult schedule, the recommended immunization schedule for children and adolescents is available in different formats.<sup>8</sup> The recommended child and adolescent immunization schedule for ages 18 years or younger consists of 3 tables: (1) by age group; (2) by catch-up schedule; and (3) by medical condition or

**TABLE 2.** A Summary of the ACIP Recommended Changes for the 2022 Children and Adolescents Immunization Schedule<sup>8,9</sup>

Vaccine	Change
COVID-19	Similar to the adult schedule, the <b>Notes</b> section for the COVID-19 vaccination was updated to include a hyperlink to the webpage for CDC's interim clinical considerations for use of COVID-19 vaccines currently approved or authorized in the United States.
Dengue	Dengue vaccine (Dengvaxia) has been added to the table of vaccine abbreviations and trade names.  In <b>Table 1 (Child and Adolescent Immunization Schedule, by age)</b> , a new row was added for dengue with the boxes for children and adolescents aged 9 to 16 years highlighted in <b>yellow</b> to indicate vaccination is recommended for this age. The text states "Seropositive in endemic areas only (see notes)."  A new row was added to <b>Table 2 (Child and Adolescent Immunization Schedule, catch-up)</b> for the minimum age and minimum dosing interval for the dengue vaccine.  In <b>Table 3 (Child and Adolescent Immunization Schedule, by medical conditions and other indications)</b> , a new row outlining the recommendations by medical conditions or other indications for the dengue vaccine was added.  A new section in <b>Notes</b> was added for routine dengue vaccination in areas with endemic dengue. In addition, a hyperlink referring health care providers to the latest guidance on areas with endemic dengue is included.
Hib	In <b>Table 2</b> , text for Hib now reads, "if current age is younger than 12 months <b>and</b> first dose was administered at younger than age 7 months <b>and</b> at least 1 previous dose was PRP-T (ActHib, Pentacel, Hiberix), Vaxelis, or unknown." In addition, because Hib-HepB (Comvax) is no longer available, it was removed from the text for the 8-week minimum interval between doses 2 and 3.  The <b>Notes</b> section was updated to include the recommendations for routine and catch-up vaccination when DTaP-IPV-Hib-HepB (Vaxelis) is used.
Hepatitis A	A <b>Note</b> was added clarifying that the recommended age for routine vaccination is 12 to 23 months.
Hepatitis B	The <b>Notes: Special situations</b> text was changed to clarify and emphasize the recommendations for postvaccination serology and revaccination.
HPV	In <b>Table 1</b> the color for children aged 9 to 10 years was changed from <b>blue</b> to <b>yellow with brown checks</b> , which is a new color code in Table 1. Within the table's legend, this color indicates that "Recommended vaccination can begin in this age group."  In the <b>Notes: Special situations</b> section, the text for immunocompromising conditions was revised to clarify the administration of 3 doses regardless of age at initial vaccination.
Influenza	The <b>Notes</b> section was updated to reflect the recommendations for the 2021-2022 influenza season. The <b>Special situations</b> section was condensed by moving information on contraindications and precautions for influenza vaccines to the newly created appendix.
MMR	The <b>Notes</b> section on routine vaccination was updated to include recommendations for use of the MMRV vaccine.
Meningococcal	The <b>Notes</b> section language regarding the recommendation for simultaneous administration with the MenB vaccine was changed to, "MenACWY vaccines may be administered simultaneously with MenB vaccines if indicated, but at a different anatomic site, when feasible."
Tdap	The text in <b>Table 1</b> for children aged 11 to 12 years was changed from "Tdap" to "1 dose" for consistency with other vaccines in the table.
Varicella	The <b>Notes</b> section was updated to include recommendations for using the MMRV vaccine and to clarify that a second dose inadvertently administered after at least a 4-week interval may be counted as a valid dose.

ACIP, Advisory Committee on Immunization Practices; Hib, *Haemophilus influenzae* type b; HPV, human papillomavirus; MenACWY, meningococcal serogroups A, C, W, Y; MenB, meningococcal serogroup B; MMR, measles, mumps, rubella; MMRV, measles, mumps, rubella, varicella; Tdap, tetanus, diphtheria, and pertussis.

indication. The catch-up schedule is useful for pediatric patients who are behind on their routine immunizations or have missed a dose.

One difference between the immunization schedule for adults and the schedule for children and adolescents is the addition of a variegated color code, **yellow with brown checks**.<sup>8</sup> In the table organized by medical indication, this color code is used to indicate that vaccination is

recommended and that additional doses may be needed. In the schedule organized by age, yellow with brown checks indicates that recommended vaccination can begin in a particular age group. When a pharmacy team member identifies a child or adolescent with characteristics that correspond with the yellow with brown checks coding, the Notes section should be consulted to find additional information. **Table 2** shows a summary of the

## PUBLIC HEALTH FOCUS

# Examining the Partnership Between Pharmacy and Public Health During the COVID-19 Pandemic

By CHRISTINA M. MADISON, PHARM.D., FCCP, AAHIVP



CHRISTINA M. MADISON,  
PHARM.D., FCCP, AAHIVP

Pharmacy and public health have a long history of collaboration during an emergency. One example involves efforts taken during the H1N1 influenza pandemic, when pharmacy was mobilized to help administer thousands of influenza vaccines across the country as an extension of public health services.<sup>1</sup> More recently, the world faced a new pandemic: coronavirus disease 2019 (COVID-19). Pharmacies and pharmacists continue to play a vital role during this pandemic in providing education and clinical services to support public health mitigation strategies. Since the first COVID-19 vaccines were authorized for emergency use in the United States, strategies have evolved to provide COVID-19 vaccinations, booster doses, testing, and treatment. In addition, steps have been taken to ensure that people wear high-quality masks, maintain social distancing, and access good ventilation in indoor spaces.<sup>2</sup> This article highlights the myriad of ways that pharmacists have reinforced and bolstered public health policies over the last 2 years to meet the challenges of the COVID-19 pandemic head-on.

## EXPANDING CAPABILITIES THROUGH THE PREP ACT

As a result of the COVID-19 pandemic, in March 2020, the secretary of the US Department of Health & Human Services (HHS) issued a declaration under the Public Readiness and Emergency Preparedness (PREP) Act. This statement provides liability protection to persons and federal, state, and local governments (including tribes and territories) involved in the development,

*Ensuring that all staff adhere to safety recommendations may increase the likelihood that they remain healthy, present at work, and able to provide much needed services to the community.*

manufacture, evaluation, distribution, and administration of covered countermeasures to COVID-19, such as therapeutics authorized by the FDA.<sup>3,4</sup> Among persons protected under the declaration are pharmacy professionals and other health care workers who administer covered products to counter medical conditions related to COVID-19.<sup>3,4</sup> The PREP Act authorizes the secretary of HHS to issue a health declaration when there is a present or credible risk of a future public health emergency. In these cases, health care workers and other parties are protected from liability related to loss that is caused by, related to, or a result of administration or use of antidotes to diseases, threats, and conditions, except when willful conduct can be proven.<sup>3</sup> The PREP Act and the declaration preclude state requirements (eg, more limited licensing or scope of practice requirements) that could prevent a qualified person from prescribing, dispensing, or administering vaccines (**Table 1**).<sup>3</sup>

Since it was issued, this declaration has been amended several times to expand

**TABLE 1. COVID-19 PREP Act, 9th Amendment: Expanded Coverage of Qualified Persons<sup>4</sup>**

<p>COVID-19 therapeutics must be authorized, approved, licensed, or cleared by the FDA.</p> <p><b>In the case of a licensed pharmacist ordering COVID-19 therapeutics, the therapeutic MUST BE:</b></p> <ul style="list-style-type: none"> <li>• ordered for SQ, IM, or PO administration; and</li> <li>• in accordance with FDA approval, authorization, clearance, or licensing.</li> </ul>	<p><b>In the case of licensed pharmacists, qualified pharmacy technicians, and licensed or registered pharmacy interns administering COVID-19 therapeutics, the therapeutic MUST BE:</b></p> <ul style="list-style-type: none"> <li>• administered SQ, IM, or PO; and</li> <li>• in accordance with FDA approval, authorization, clearance, or licensing.</li> </ul> <p>In the case of qualified pharmacy technicians, the supervising pharmacist MUST BE readily and immediately available.</p>
<p>In the case of COVID-19 therapeutics administered via IM or SQ injections, licensed pharmacists, licensed or registered pharmacy interns, and qualified technicians must complete practical training approved by the ACPE.</p> <p><b>Training MUST include:</b></p> <ul style="list-style-type: none"> <li>• hands-on injection technique;</li> <li>• clinical evaluation of indications and contraindications of COVID-19 therapeutics;</li> <li>• recognition and treatment of emergency reactions to COVID-19 therapeutics; and</li> <li>• any additional training required by the FDA approval, authorization, clearance, or licensing of a therapeutic.</li> </ul>	<p>Licensed pharmacists, licensed or registered pharmacy interns, and qualified technicians must have a current certificate in basic cardiopulmonary resuscitation.</p> <p><b>Licensed pharmacists must comply with recordkeeping and reporting requirements of their jurisdiction, including:</b></p> <ul style="list-style-type: none"> <li>• informing the patient's primary care provider when available, and</li> <li>• complying with requirements for reporting adverse drug events.</li> </ul> <p>Licensed pharmacists, licensed or registered pharmacy interns, and qualified technicians must comply with any applicable requirements or conditions for use that apply to the administration of COVID-19 therapeutics.</p>

ACPE, Accreditation Council for Pharmacy Education; COVID-19, coronavirus disease 2019; IM, intramuscularly; PO, orally; PREP, Public Readiness and Emergency Preparedness Act; SQ, subcutaneously.

liability protections, including amendments to cover licensed health care professionals who cross state borders and federal response teams.<sup>5</sup> On October 20, 2020, the HHS declared expanded access to childhood vaccines under the PREP Act to decrease the risk of vaccine-preventable disease outbreaks during the COVID-19 pandemic; this action permits licensed pharmacists, qualified pharmacy technicians, and pharmacy interns to administer routine childhood vaccines to children aged 3 to 18 years.<sup>6</sup> This includes the age-appropriate provision of COVID-19 vaccines and COVID-19 testing.

**FEDERAL RETAIL PHARMACY PROGRAM FOR COVID-19 VACCINATIONS**

With the PREP Act in place, pharmacists were faced with the unique and daunting task of vaccinating hundreds of millions of people. To streamline this process and provide needed vaccine access to communities across the country, the Biden administration created the Federal Retail Pharmacy Program (FRPP) for COVID-19 Vaccinations in February 2021.<sup>7</sup> The FRPP is a collaboration between the federal government, states, and territories and 21 national pharmacy partners and independent pharmacy networks across the country.<sup>8</sup> With most Americans living within 5 miles of a pharmacy, the FRPP is built upon the existing strength and expertise of pharmacy partners to rapidly deploy vaccinations to the public.<sup>8</sup>

As of May 11, 2022, the FRPP reported that more than 248 million doses of the COVID-19 vaccine have been administered.<sup>8</sup> This includes 8 million doses administered onsite at long-term-care facilities in the early days of the vaccine rollout. Health care workers at more than 41,000 locations have been administering doses nationwide, and these vaccinations are available free of charge. This is especially important as we receive new and evolving recommendations concerning the need for booster doses, including a second booster dose for certain populations.<sup>9</sup> A list of FRPP partners is available at <https://www.cdc.gov/vaccines/covid-19/retail-pharmacy-program/participating-pharmacies.html>.

The COVID-19 pandemic also reinforced the importance of vaccine safety. Ensuring that all staff adhere to safety recommendations may increase the likelihood that they remain healthy, present at work, and able to provide much needed services to the community. A list of recommended protective safety measures is available at <https://immunize.org/catg.d/p2009.pdf>.

**AVAILABLE COVID-19 VACCINES, BOOSTERS, AND GUIDANCE**

Currently, the only FDA-approved vaccines for COVID-19 are the Pfizer-BioNTech vaccine (Comirnaty; an mRNA vaccine formulated for individuals aged ≥ 16 years) and the Moderna vaccine (Spikevax; an mRNA vaccine indicated for individ-

**TABLE 2.** COVID-19 Vaccines and Dosing Frequency in Persons Aged 5 Years and Older Who Are Not Moderately or Severely Immunocompromised<sup>16</sup>

Type	Recipient age, years	Product	Diluent	Dosage (amount injected)	Frequency	
					Primary series <sup>a</sup>	Booster dose <sup>b,c</sup>
mRNA vaccine	5-11	Pfizer-BioNTech Orange cap and bordered label	1.3 mL 0.9% sodium chloride (normal saline, preservative free)	Doses 1 and 2: 0.2 mL Booster dose: 0.2 mL	2 doses; separate doses 1 and 2 by $\geq 3$ wk	$\geq 5$ mo after dose 2
	12-17	Pfizer-BioNTech Gray cap and bordered label	NONE	Doses 1 and 2: 0.3 mL Booster dose <sup>d</sup> : 0.3 mL	2 doses; separate doses 1 and 2 by $\geq 3-8$ wk <sup>e</sup>	$\geq 5$ mo after dose 2 <sup>f</sup>
	$\geq 18$	Pfizer-BioNTech Purple cap	1.8 mL 0.9% sodium chloride (normal saline, preservative free)		2 doses; separate doses 1 and 2 by $\geq 3-8$ wk <sup>d</sup>	$\geq 5$ mo after dose 2 <sup>f</sup>
		Moderna Red cap	NONE	Doses 1 and 2: 0.5 mL Booster dose: 0.25 mL	2 doses; separate doses 1 and 2 by $\geq 4-8$ wk <sup>e</sup>	$\geq 5$ mo after dose 2 <sup>f</sup>
Viral vector vaccine	$\geq 18$	Janssen/Johnson & Johnson <sup>g</sup>	NONE	Dose 1: 0.5 mL Booster dose <sup>d</sup> : 0.5 mL	1 dose	$\geq 8$ weeks after dose 1 <sup>h</sup>

COVID-19, coronavirus disease 2019; mo, month(s); wk, week(s); y, year(s).

<sup>a</sup>Complete the primary series using the same product. Every effort should be made to determine which vaccine product was received as the first dose. If the vaccine product previously administered cannot be determined or is no longer available, any age-appropriate mRNA COVID-19 vaccine product may be administered at least 28 days after the first dose.

<sup>b</sup>A different COVID-19 vaccine product than the primary series may be administered for the booster dose. An mRNA COVID-19 vaccine is preferred.

<sup>c</sup>Persons with a recent SARS-CoV-2 infection may consider delaying their first or second COVID-19 vaccine booster dose by 3 months from symptom onset or, if patient was asymptomatic, positive test results are obtained.

<sup>d</sup>Some persons may receive a second booster dose. Administer the Moderna or Pfizer-BioNTech COVID-19 Vaccine ONLY. Administer the correct product based on the recipient's age. If administering the Moderna COVID-19 Vaccine, administer 0.25 mL.

<sup>e</sup>An 8-week interval may be optimal for some people, including boys and men aged 12 to 39 years, because of the small risk of myocarditis associated with mRNA COVID-19 vaccines. Vaccine effectiveness may also be increased with an interval longer than 3 or 4 weeks (depending on the product used).

<sup>f</sup>Persons aged 50 years and older may receive a second mRNA booster dose at least 4 months after the last dose.

<sup>g</sup>The mRNA COVID-19 vaccines are preferred over the Janssen/Johnson & Johnson COVID-19 vaccine for all vaccine-eligible people. However, the Janssen/Johnson & Johnson COVID-19 vaccine may be offered in some situations.

<sup>h</sup>Persons may receive a 2nd booster dose if they are aged 18 years and older and received 2 doses of Janssen vaccine (administer Moderna or Pfizer-BioNTech COVID-19 vaccine only) or aged 50 years and older and received a primary dose of Janssen/Johnson & Johnson vaccine and a mRNA booster dose (administer Moderna or Pfizer-BioNTech COVID-19 vaccine only).

**Adapted from:** Interim COVID-19 immunization schedule for ages 5 years and older. Centers for Disease Control and Prevention. May 26, 2022. Accessed June 1, 2022. <https://www.cdc.gov/vaccines/covid-19/downloads/COVID-19-immunization-schedule-ages-5yrs-older.pdf>

uals aged  $\geq 18$  years).<sup>10-12</sup> Other formulations of the Pfizer-BioNTech vaccine (for individuals aged 5-11 years and  $\geq 12$  years) and the Janssen/Johnson & Johnson vaccine (a viral vector vaccine indicated for individuals aged  $\geq 18$  years) are authorized for emergency use at the time of this publication.<sup>13,14</sup> The recommendations for vaccination include a primary series (2 doses of an mRNA vaccine [preferred] or 1 dose of a viral vector vaccine).<sup>15</sup>

Booster doses using the mRNA vaccine are recommended to increase or restore protection against COVID-19 that may decline after the primary vaccination series is completed. Everyone aged at least 5 years who has completed their pri-

mary vaccination series is eligible for a first booster dose. A second booster dose is currently recommended no less than 4 months after receiving the first booster dose for adults 50 years and older, some individuals with immunosuppressive conditions, and people who received 2 doses—1 primary dose plus 1 booster dose—of the Janssen/Johnson & Johnson viral vector vaccine. The latest guidance is available on the CDC website: <https://www.cdc.gov/coronavirus/2019-ncov/vaccines/booster-shot.html>.

**Table 2** summarizes COVID-19 vaccine options that are available to individuals aged 5 years and older who are not moderately or severely immunocompromised; it

includes recommended frequency of primary and booster doses, published in May 2022.<sup>16</sup> Additional information on COVID-19 vaccine eligibility and availability also can be found by visiting [https://www.vaccines.gov/\(1-800-232-0233\)](https://www.vaccines.gov/(1-800-232-0233)), by texting a zip code to 438829 (GETVAX), or by contacting a state health department website.<sup>8</sup>

### ADDITIONAL VACCINATION SERVICES

There is no doubt that the measures involving pharmacy have had a positive impact on helping to limit the morbidity and mortality related to the COVID-19 pandemic. In addition, increased responsibilities and tasks have led pharmacists to develop new and creative ways to optimize staffing. The roles of student pharmacists, pharmacy interns, and pharmacy technicians have been bolstered to support patient care and safety as COVID-19–related services are delivered. Community outreach and onsite services—which provide vital opportunities to address COVID-19 vaccine misinformation, hesitancy, and trust—could not have been offered without the help of additional pharmacy staff.

### ADDRESSING VACCINE HESITANCY

In addition to administering COVID-19 tests and vaccinations, pharmacy staff have had an important role in vaccine education. Patients who may be hesitant to receive a vaccination are more likely to get vaccinated when given incentives, and a trusted relationship with a pharmacist may increase vaccine uptake.<sup>17</sup> Ultimately, it is the patient who has the final decision about receiving a vaccination. Through motivational techniques (eg, asking open-ended questions, showing empathy, acknowledging concerns, reframing and reflecting language, providing information, and asking for feedback), pharmacists can provide each patient with the guidance they need to confidently make an informed decision.<sup>18</sup> Multiple patient handouts are available on the Immunization Action Coalition website (<https://www.immunize.org/handouts/>). In addition, the University of California, San Francisco, website offers recommended health coaching techniques regarding COVID-19 at <https://cepc.ucsf.edu/health-coaching>.

### CONCLUSIONS

The profession of pharmacy has stepped up to meet the challenges of caring for patients during the COVID-19 pandemic. Pharmacists represent one of the most accessible types of health care providers, and they have played a key role in the administration of COVID-19 vaccines. The positive results of these efforts have proven the effectiveness

of a collaboration between pharmacy and public health. It is currently unknown when the COVID-19 emergency declarations will end; however, solidification of the expanded scope of pharmacy professionals remains critical, especially since most Americans now rely on their neighborhood pharmacy for COVID-19 vaccination and related health care needs. Looking forward, when the public health emergency declarations do expire, organizations such as the Centers for Medicare & Medicaid Services should ensure that improved access to quality care and pharmacists is preserved. We must learn from this pandemic so that we are prepared for the next one. ■

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## VACCINE SPOTLIGHT

# Dengue Vaccine: What Pharmacists Need to Know

By NABILA ISMAIL, PHARM.D



NABILA ISMAIL, PHARM.D

Although COVID-19 is not completely behind us, prepandemic life is starting to make a comeback. With stay-at-home orders being lifted and the Northern Hemisphere shifting to warmer weather, more people are venturing outside. Although many of us are relishing this newfound freedom, so too are the mosquitoes, ticks, and fleas, anxiously awaiting the opportunity to feast on exposed skin and spread disease. Indeed, the World Health Organization reports that globally, vector-borne diseases account for more than 17% of all infectious diseases, with dengue being the most prevalent viral infection.<sup>1</sup> In 2019, there were 5.2 million cases of dengue reported across 129 countries,<sup>2</sup> including several US territories.<sup>3</sup>

There are no effective antiviral treatments available against dengue, and up until recently, there was no available prophylaxis. In May 2019, however, the FDA approved the first vaccine for dengue disease, Dengvaxia (Sanofi Pasteur).<sup>3</sup> The vaccine will be available in the United States this year (2022); however, its use comes with restrictions.<sup>4</sup> This article provides information on the vaccine and eligible individuals who can receive it.

## OVERVIEW OF DENGUE

Dengue is an infection caused by a virus transmitted through infected mosquitoes, primarily female *Aedes aegypti*, and *Aedes albopictus* to a lesser extent. There are 4 viral serotypes: DENV-1, DENV-2, DENV-3, and DENV-4.<sup>2</sup>

Dengue affects approximately 100 million to 400 million people each year and continues to be a growing public health concern.<sup>2</sup> Although rare in the continental United

States,<sup>5</sup> territories of American Samoa, Puerto Rico, and the US Virgin Islands, and freely associated states, including the Federated States of Micronesia, the Republic of the Marshall Islands, and the Republic of Palau are considered dengue-endemic.<sup>4</sup>

Most cases of dengue are asymptomatic or mild, but some cases can be severe with flu-like symptoms such as<sup>2</sup>:

- High fever (104 °F)
- Headache
- Muscle and joint pain
- Nausea
- Vomiting
- Pain behind the eyes
- Swollen glands
- Rash

If an individual has just returned from traveling in any of these regions and presents with many of these symptoms, dengue should be suspected. Severe dengue usually presents 3 to 7 days after illness onset; symptoms, which can be fatal, include plasma leaking, fluid accumulation, respiratory distress, bleeding, and organ failure. Severe dengue infection remains a leading cause of illness and death in some Asian and Latin American countries.<sup>2</sup> Those with first dengue infections generally experience mild or no symptoms; however, subsequent infections can lead to a more severe form of the disease.<sup>3</sup> Approximately 95% of hospitalized patients with dengue have a subsequent infection, underscoring the need for greater prevention.

## DENGUE VACCINE

Dengvaxia is a live-attenuated chimeric tetravalent vaccine.<sup>6</sup> It is made using recombinant DNA technology; sequences encod-

ing the premembrane and envelope proteins of the yellow fever 17D backbone were exchanged with the homologous sequences encoding for dengue virus serotypes 1, 2, 3, and 4.<sup>6,7</sup> Before Dengvaxia, the CDC's Advisory Committee on Immunization Practices (ACIP) had no recommendations regarding vaccines to prevent dengue.<sup>7</sup> With the approval of Dengvaxia, the ACIP has recommended the vaccine for individuals aged 9 to 16 years who live in an area where the virus is endemic and have had a previous dengue infection with a confirmed laboratory test (positive dengue reverse transcription-polymerase chain reaction [RT-PCR] test result or positive dengue nonstructural protein 1[NS1] antigen test or positive results on both anti-dengue virus immunoglobulin G tests in a 2-step testing algorithm).<sup>7,8</sup>

Because of the cross-reactivity of dengue with other flaviviruses than can be circulating in dengue-endemic areas (eg, Zika virus), a single positive anti-dengue virus immunoglobulin M test result is not sufficient proof of dengue virus infection for vaccination.<sup>8</sup> An acute dengue diagnosis can be made using blood or serum collected no more than 7 days after symptom onset to detect viral RNA through nucleic acid amplification tests, viral antigens by enzyme-linked immunosorbent assay (ELISA) or rapid diagnostic tests, or immunoglobulin M antibodies via serologic testing.<sup>7</sup> It is important to note that if a person not previously infected with dengue receives Dengvaxia, the vaccine could act like a first dengue infection (without actually infecting the person) and a subsequent infection could lead to the severe form of the disease.<sup>9</sup> Health care professionals should confirm prior dengue infection before proceeding with the vaccine series. A prevaccination checklist is available from the CDC (Figure).<sup>10</sup>

### Vaccine Formulation, Safety, and Efficacy

Dengvaxia is a lyophilized powder that needs to be reconstituted with the supplied diluent (0.4% NaCl). Three doses (0.5 mL each) are given 6 months apart.<sup>6</sup>

The safety of Dengvaxia was assessed in 9 randomized, placebo-controlled, multicenter clinical trials. A total of 19,102 individuals (aged 9-16 years) received at least 1 dose of Dengvaxia and 9484 received placebo. Common adverse reactions were headache (40%), injection site pain (32%), malaise (25%), asthenia (25%), and myalgia (29%).<sup>6</sup>

Vaccine efficacy was studied in 2 randomized, observer-blind, placebo-controlled, multicenter studies. The first trial was conducted in 20,869 individuals (aged 9-16 years) from 4 Latin American countries and Puerto Rico. The second

FIGURE. Pre-Vaccination Checklist for Dengvaxia From the US Centers for Disease Control and Prevention<sup>10</sup>

## Dengvaxia Pre-vaccination Checklist

Good news! A new dengue vaccine is available to protect your patients.



Does your patient meet ALL of these criteria?	
<b>Age</b> Is between the ages of 9–16	✓
<b>Lives in</b> <ul style="list-style-type: none"> <li>• U.S. territories of Puerto Rico, U.S. Virgin Islands, and American Samoa</li> <li>• Freely associated states of Federated States of Micronesia, Republic of Palau, and Republic of the Marshall Islands</li> </ul>	✓
<b>Testing results</b> <ul style="list-style-type: none"> <li>• Evidence of prior acute dengue virus infection with               <ul style="list-style-type: none"> <li>◦ Positive dengue RT-PCR test result, or</li> <li>◦ Positive dengue NS1 antigen test result</li> </ul> </li> <li>• <b>OR</b>, positive results on <b>BOTH</b> of the following dengue IgG antibody tests               <ul style="list-style-type: none"> <li>◦ EUROIMMUN Anti-Dengue Virus NS1 Type 1-4 ELISA (IgG)* and</li> <li>◦ CTX BIOTECH OnSite Dengue IgG Rapid Test*</li> </ul> </li> </ul>	✓
<b>Allergies</b> Does <b>not</b> have a history of severe allergic reaction to a previous dose of Dengvaxia or any component of the vaccine	✓
<b>Immune suppression</b> Has <b>no</b> diagnosis or history of severe immunodeficiency or immunosuppression caused by disease or therapy	✓
<b>If you answer NO to ANY of these criteria,</b> your patient is <b>NOT</b> eligible for vaccination at this time.	⊘

\*Disclaimer: The names of these companies and/or linking to their websites are provided as a service to our users. These links do not constitute an endorsement of these organizations or their products by CDC and none should be inferred. CDC and the federal government assume no responsibility for any content on these sites.

To learn more, visit: [cdc.gov/dengue](https://www.cdc.gov/dengue)

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To access this hand-out, please visit: [https://www.cdc.gov/dengue/resources/DVBD\\_FS\\_Vaccination\\_Checklist-508.pdf](https://www.cdc.gov/dengue/resources/DVBD_FS_Vaccination_Checklist-508.pdf)

trial was conducted in 10,275 participants (aged 2-14 years) from 5 Asian-Pacific countries. Participants were monitored for symptomatic virologically confirmed dengue (VCD) starting on day 0. VCD was defined as an acute febrile illness with temperatures of at least 38 °C on at least 2 consecutive days verified by a dengue RT-PCR or dengue NS1 ELISA antigen test. Efficacy against VCD was assessed from 28 days following dose 3 for a period of 12 months.<sup>6</sup>

The efficacy analysis of Dengvaxia was limited to participants who were seropositive for dengue at baseline and who received all 3 doses of the vaccine. Among those enrolled in the first study, Dengvaxia was associated with an 80.6% (95% CI, 50.7%-93.2%) efficacy rate in preventing symptomatic VCD. Similarly, in the second study, Dengvaxia demonstrated an efficacy rate of 77.2% (95% CI, 18.3%-94.9%). Of note, the studies were not designed to assess the efficacy of Dengvaxia in the individual dengue serotypes.<sup>6</sup>

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## THE FUTURE OF VACCINES FOR GLOBAL PUBLIC HEALTH

The development and approval of a dengue vaccine is a critical step in combatting this global public health challenge. Although not indicated as a travel vaccine, the availability of Dengvaxia in the United States to those who qualify may be important as travel increases and travelers may be exposed to diseases regional to their destination. Indeed, the market for travel vaccines is expected to explode in the upcoming years, with estimates of US\$ 5.91 million by 2028.<sup>11</sup> It is an exciting time for new vaccine technology and pharmacists will be at the helm to educate patients and health care colleagues on all the latest vaccines. ■

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### About the Author

**Nabila Ismail, PharmD**, is a pharmacist and engagement marketing manager at GoodRx in Los Angeles, California. She is also the founder and creator behind Dose of Travel, LLC. You can find her sharing travel content from the 40+ countries she's been to and find her work in Forbes, Fodors, Travel and Leisure, and more! You can follow her at @doseoftravel on Instagram.

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### About the Author

**Randy P. McDonough, PharmD, MS, BCGP, BCPS, FAPhA**, is the chief executive officer at Towncrest Pharmacy Corp in Iowa City, Iowa and professor of pharmacy management and innovation at Loma Linda University School of Pharmacy.

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### About the Author

**Monica V. Mahoney, PharmD, BCPS, BCIDP**, is a clinical specialist in outpatient infectious diseases at Beth Israel Deaconess Medical Center in Boston, Massachusetts.

◀ page 18, from "2022 ACIP Updates for Immunizations in Adults and Children: What Pharmacists Need to Know"

recommended changes to the 2022 child and adolescent immunization schedule.<sup>8,9</sup> In addition, the definition of severe immunosuppression due to HIV infection was changed to "< 15% or total CD4 cell count of < 200/mm<sup>3</sup>" for consistency with the ACIP's General Best Practice Guidelines for Immunization.

## CONCLUSIONS

One of the most important things that immunizing pharmacy team members can do is stay up to date on the most recent immunization recommendations. By utilizing the recommended immunization schedules to identify those in need of vaccination, we are protecting ourselves, our patients, and providing an important public health service. ■

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### About the Author

**Kimberly C. McKeirnan, PharmD, BCACP**, is an associate professor in the Department of Pharmacotherapy and the director for the Center of Pharmacy Practice Research at Washington State University College of Pharmacy and Pharmaceutical Sciences in Spokane.

### About the Author

**Christina M. Madison, PharmD, FCCP, AAHIVP**, is the founder and CEO of The Public Health Pharmacist, PLLC, in Las Vegas, Nevada.

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