Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Increasing Coronavirus Disease 2019 Vaccine Uptake in Pediatric Primary Care by Offering Vaccine to Household Members

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Pediatric primary care is a trusted source for treatment and information. In the 6 months after coronavirus disease 2019 vaccines became available for adolescents, we administered 2286 doses (1270 to patients; 1016 to household members) to 1376 individuals (64.1% Black; 10.1% Latinx), providing opportunities to address family concerns in a familiar location. *(J Pediatr 2022;247:150-4).*

As of November 2021, more than 254 million people have been infected with the novel coronavirus (severe acute respiratory syndrome coronavirus 2; coronavirus disease 2019 [COVID-19]) causing more than 5.1 million deaths worldwide.[1] In the US, there have been more than 47 million cases and 771 000 deaths.[1] Significant health disparities in COVID-19 outcomes exist, with racial and ethnic minority groups having greater hospitalization and mortality rates compared with White patients.[2] To counter adverse health outcomes resulting from COVID-19, safe and effective vaccines have received Emergency Use Authorization status and, for certain age groups, full approval from the Food and Drug Administration.[3]

Although >68% of the US population has received at least 1 dose of a COVID-19 vaccine,[4] the intention to receive the vaccine remains low among unvaccinated vulnerable populations.[5] Common sources of vaccine hesitancy cited by minority groups are side effects/safety, rapid vaccine development, and mistrust of the government.[6] Historically, strong and consistent vaccine recommendations from clinicians have been effective in decreasing vaccine hesitancy.[7-9]

To address hesitancy and accessibility barriers, vaccines should be administered in a familiar, trusted, and convenient location. As clinicians are considered the most trusted source of accurate COVID-19 vaccine information,[10] the pediatric primary care office is an ideal setting where entire families—not just patients—can receive the COVID-19 vaccine. In addition, pediatricians are poised to address vaccine hesitancy, given their experiences related to counseling on vaccine safety and efficacy. Our practices have historic experience offering annual influenza vaccine to nonpatients; extending this model to include COVID-19 vaccine was, therefore, familiar to both staff and families. Thus, we sought to implement universal COVID-19 vaccination for both our pediatric patients and their household members to contribute to increased, equitable vaccine uptake in our community.

COVID-19	Coronavirus disease 2019
EHR	Electronic health record

Methods

To increase COVID-19 vaccine uptake, we implemented a novel strategy: universally offering COVID-19 vaccine to eligible patients and household members during any routine pediatric primary care visit. This innovative clinical model was established in 3 pediatric primary care practices, serving 33 000 children, affiliated with Cincinnati Children's Hospital Medical Center. Two practices are in economically disadvantaged urban settings; the third practice is in a suburban location and is geographically closer to rural communities. All locations serve 75%-90% publicly insured patients; 72% of patients self-identify as Black and 7.4% as Latino. On average, our practices complete 250 total visits daily.

In May 2021, eligibility for the Pfizer vaccine expanded to children ≥12 years.[11] Our clinical sites prepared to provide COVID-19 vaccines and were outfitted to provide on-site vaccination soon after that emergency use authorization. Thus, starting May 13, 2021, we organized 2 prescheduled COVID-19 vaccine clinics. Due to these clinics having relatively low attendance rates, we quickly pivoted to offer opportunities for vaccination during routine care, in order to capitalize on ease of access and convenience for families. Therefore, beginning May 24, 2021, our Cincinnati Children's Hospital Medical Center primary care centers began offering COVID-19 vaccine administration to eligible patients during daily office flow, including during scheduled or walk-in well child, ill, and follow-up appointments. We also offered dedicated, scheduled vaccine-only visits.

We knew that many of those individuals accompanying patients to appointments (eg, eligible siblings, parents/

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guardians, extended family members, and community members hearing via "word of mouth"—hereafter referred to as "household members") remained unvaccinated, despite ample vaccine availability within the community. We were concerned that although we might see uptake among youth seeking care in our primary care centers, the neighborhoods (ie, zip codes) in which many of our families lived had some of the lowest vaccination rates in the region.[12]

We hypothesized that household members would consider receiving the vaccine in the pediatric primary care center, as the pediatric office serves as a trusted, convenient space for treatment and information.[13] Thus, we designed our system to have COVID-19 vaccine available and offered to all eligible household members from the inception of our vaccination program on May 13, 2021. This system created opportunities for pediatricians to counsel household members about the COVID-19 vaccine and address relevant concerns, even when the patient being seen for the visit was not yet eligible (eg, an infant's parent).

When vaccine-eligible adolescents ≥12 years old were present for any visit (eg, well, ill, or follow up), providers offered the COVID-19 vaccine. When accepted, providers documented in the vaccine administration order if the family decided to get their child vaccinated before or during the office visit and influence/reason for vaccine acceptance (this question was added starting the week of August 15, 2021). Common influences and reasons reported in the literature for vaccine acceptance[6,14-16] were embedded in the electronic order for the COVID-19 vaccine and were recorded in the electronic health record (EHR). These included studies/data supporting vaccination; concerns of contracting new variants; input from parent/family member; input from friends; input from medical provider; media outlet; family/friend/self had COVID-19; not applicable—second/third dose; and other.

During the registration process, eligible household members also were asked if they wanted to receive a COVID-19 vaccine. Those agreeing to vaccination were registered in the EHR and were subsequently vaccinated. Undecided household members were able to ask a provider about the vaccine and have questions or concerns addressed while their child received his/her routine care. Those who elected to receive the vaccine after talking to their child's clinician returned to the reception area to be registered and were vaccinated.

Our registration staff used an expedited workflow to limit the administrative burden of registering nonpatients. This included obtaining limited demographics (name, sex, date of birth, ZIP code) and minimizing EHR hard-stops (COVID-19 vaccine consent and Health Insurance Portability and Accountability Act of 1996 acknowledgement only). Insurance information of household members was entered into the EHR, if available, although families were not billed for any liability if no insurance information was available. Descriptive statistics were used to detail our progress to date in vaccinating both eligible patients and household members.

Results

Between May 13, 2021 (the first COVID-19 vaccine clinic), and November 7, 2021, in total 2286 doses of COVID-19 vaccine were administered to 1376 unique individuals—746 patients and 630 household members (**Table I**). Of the vaccines given, 55.6% (1270 doses) were given to patients and 44.4% (1016 doses) went to household members. The proportion of doses delivered to patients compared with household members was generally stable over time (**Figure**). A total of 64.1% of individuals (882 of 1376) who received COVID-19 vaccine self-identified as Black and 10.9% (150 of 1376) as Latino. Of note, the race and ethnicity of our eligible patient population seen during this same period was 82.2% (3218 of 3913 patients) Black and/or Latino. Of eligible children presenting to our primary care locations for routine care, 29.8% completed at least 1 COVID-19 vaccine dose. During our first 6 months of offering COVID-19 vaccine in primary care, 79.4% of patients and 70.9% of household members completed their 2-dose Pfizer vaccine series at our primary care centers.

Of the 1270 vaccine doses given to patients, 44.9% (570 doses) were given in the context of routine care during a well, ill, or follow-up visit (ie, not for COVID-19 vaccine alone). Of the doses given during routine care (n = 570), 43.2% (n = 246) of those patients reported being undecided about accepting vaccination before the visit. Of routine care encounters that resulted in COVID-19 vaccine delivery, 427 included documentation of factors influencing a family's decision to pursue vaccination for their adolescent recorded in the EHR in the prompt that was added in August 2021. The most common reasons cited were input from parents/family members (32.3%, n = 138), "other" (16.6%, n = 71), data/studies supporting vaccination (12.4%, n = 53), and recommendations from medical providers (8.4%, n = 36) (**Table II**; available at www.jpeds.com).

Discussion

Our data demonstrated that universally offering COVID-19 vaccines to household members during routine pediatric primary care office visits is both feasible and a strategy to mitigate vaccine hesitancy and increase vaccination rates. Nearly one-half of our vaccine doses went to eligible household members. Providing access to vaccination for household members in pediatric primary care offices creates opportunities to address vaccine concerns and offers vaccine accessibility in a trusted environment.

As pediatric offices are offering the COVID-19 vaccine, practices should consider including household members, especially in regions with low vaccine uptake, to remove barriers to access and address vaccine concerns. Our data illustrate continued vaccine acceptance and uptake among household members despite having already had ample opportunity to be vaccinated in other settings (eg, mass vaccination sites, pharmacies, the office of their own physician).

Table I. Descriptive results and demographics of persons receiving COVID-19 vaccine in primary care

Categories	Patients (n = 746)	Household members (n = 630)	Totals (n = 1376)
Doses of vaccine given	1270	1016	2286
Vaccines given during			
Routine care	570 (44.9%)	0 (0%)	570 (24.9%)
Vaccine-only visit	700 (55.1%)	1016 (100%)	1716 (75.1%)
Demographics			
Age range, y	12-20	12-81	12-81
Race			
Black/African American	551 (73.9%)	331 (52.5%)	882 (64.1%)
White and others	195 (26.1%)	299 (47.5%)	494 (35.9%)
Ethnicity			
Latinx	73 (9.8%)	77 (12.2%)	150 (10.9%)
Non-Latinx	673 (90.2%)	553 (87.8%)	1226 (89.1%)
Insurance			
Public	606 (81.2%)	332 (52.7%)	938 (68.2%)
Private	121 (16.2%)	136 (21.6%)	257 (18.7%)
Self-pay/none	19 (2.6%)	162 (25.7%)	181 (13.1%)

Despite our successes, there is evidence that racial disparities in vaccine uptake remain. Interestingly, household members who opt to pursue vaccination in our clinical setting are more likely to be White than the predominantly Black population in our patient panel. As such, it is possible, even with our intentional efforts and even within our primary care centers, that racial and ethnic disparities in vaccine uptake remain.

In patients who were vaccinated as part of routine care, factors influencing acceptance most commonly included parent/family member perspectives, studies/data supporting vaccination, and medical providers' recommendations. This supports previous data that have identified factors such as parent and peer norms as particularly salient determinants of vaccine uptake.[17] It also highlights the important role pediatricians, and a pediatric offices, can play, in line with research that consistently identifies pediatricians as trusted sources for information on the COVID-19 vaccine.[16] Many indicated "other" as a reason for vaccine acceptance, suggesting more personal or nuanced factors influenced their decision to vaccinate. Although we are not able to determine from the data available exactly what was included within this domain, it does highlight the potential for a range of

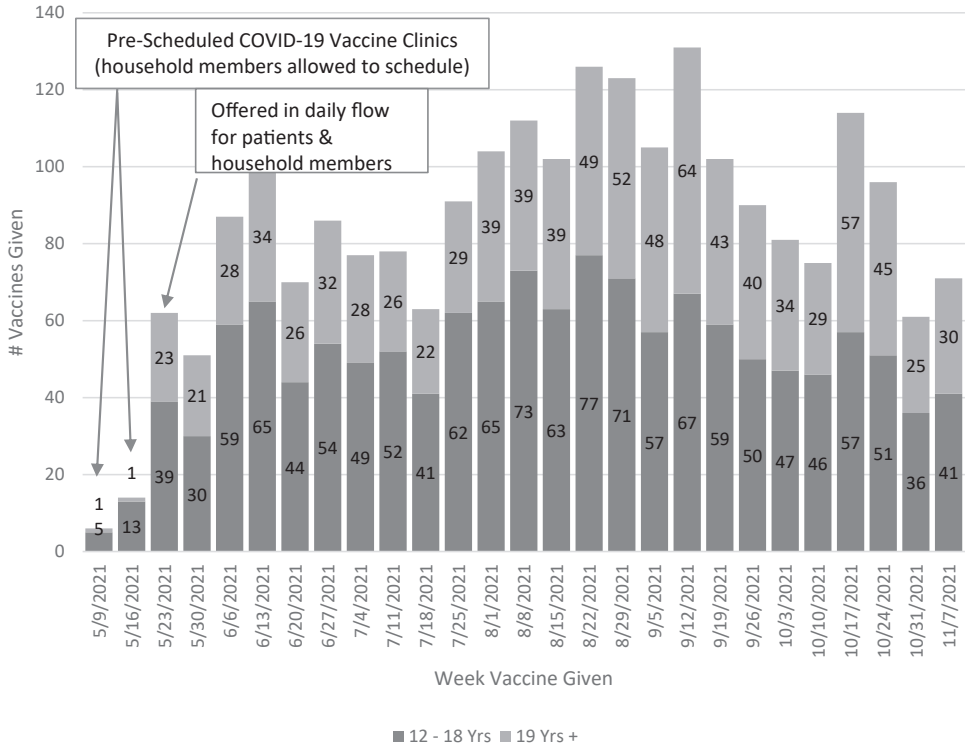

Figure. COVID-19 vaccines administered per week and age of recipient.

determinants influencing COVID-19 vaccine acceptance, underscoring the importance of personalized counseling.

Despite providing more than 2200 vaccinations to a vulnerable population of patients and household members, as of November 2021, the overall eligible patient vaccination rate at our clinical sites was just 29.8%. This continues to place patients, their families, and their communities at risk for COVID-19 and associated adverse health outcomes, elongating the pandemic. At the time of our analyses in November 2021, 61% of residents in Hamilton County (Ohio)—the site of our primary care centers—had started their vaccine series, yet only 27% of those aged 0-19 years had initiated COVID-19 vaccination.[18] The rate among youth in our setting was on par with community rates and above rates among children from minoritized groups (those identified as Black and/or Latinx, those living in our more impoverished communities). Across the US, such groups continue to have lower rates of vaccine acceptance.[19,20]

It is important to determine how to reach marginalized populations more effectively in ways that build trust, answer questions, and enhance vaccination coverage. Pediatricians and pediatric primary care centers could play a key role, particularly now that school-aged children are eligible for vaccination. Although widespread vaccination across communities requires multilayered approaches, pediatric offices play an important and impactful role, bringing access and trust to a situation requiring both. As the pandemic evolves, now that more ages of children have become eligible, identifying additional effective strategies to increase vaccination is crucial. In addition, such strategies could outlast COVID-19, enabling more effective and complete vaccination coverage of children, families, and communities.

There were limitations to this study. First, it was not feasible to calculate the number of eligible household members who were offered COVID-19 vaccine and declined given high office visit volumes and privacy protection considerations. Adult household members generally do not receive care in our pediatric system; thus, we did not have access to household members' health record data. We could not assess past vaccination history or determine if household members received subsequent doses at different sites. Second, we only have one-way communication with our state immunization information system, thus we had to obtain vaccine information directly from patients and families if vaccination occurred outside our health system, making data potentially incomplete. In addition, we readily acknowledge that not all unvaccinated household members accepted our offer of vaccination. However, each acceptance could protect that household and community in meaningful ways. Each acceptance led to slowly improving community rates and, in many cases, protected our patients, many of whom were not yet eligible for vaccination themselves. Our presence as a trusted provider in a majority Black population also likely contributed to narrowing equity gaps in community vaccination. Finally, data characterizing factors influencing vaccine acceptance was incomplete because this was added midway through the study period. Answers may also have tended toward perceived socially acceptable answers because providers directly asked (and documented responses to) this question.

Future directions include continued iteration of this community vaccination model. In parallel, we plan to track reasons for nonvaccination and develop effective, adaptable methods to address these reasons in partnership with patients and parents. ■

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References

1. World Health Organization. WHO Coronavirus Dashboard 2021. Accessed November 17, 2021. https://covid19.who.int
2. Gold JAW, Wong KK, Szablewski CM, Patel PR, Rossow J, da Silva J, et al. Characteristics and Clinical outcomes of adult patients hospitalized with COVID-19 - Georgia, March 2020. MMWR Morb Mortal Wkly Rep 2020;69:545-50.
3. Centers for Disease Control and Prevention. COVID-19 Vaccine Emergency Use Authorization (EUA) Fact Sheets for Recipients and Caregivers 2021. Accessed July 12, 2021. https://www.cdc.gov/vaccines/covid-19/eua/index.html
4. Centers for Disease Control and Prevention. COVID-19 vaccinations in the United States. Accessed November 17, 2021. https://covid.cdc.gov/covid-data-tracker/#datatracker-home
5. Kelly BJ, Southwell BG, McCormack LA, Bann CM, MacDonald PDM, Frasier AM, et al. Predictors of willingness to get a COVID-19 vaccine in the U.S. BMC Infect Dis 2021;21:338.
6. Nguyen KH, Srivastav A, Razzaghi H, Williams W, Lindley MC, Jorgensen C, et al. COVID-19 vaccination intent, perceptions, and reasons for not vaccinating among groups prioritized for early vaccination—United States, September and December 2020. MMWR Morb Mortal Wkly Rep 2021;70:217-22.
7. Oh NL, Biddell CB, Rhodes BE, Brewer NT. Provider communication and HPV vaccine uptake: a meta-analysis and systematic review. Prev Med 2021;148:106554.
8. Rodriguez SA, Mullen PD, Lopez DM, Savas LS, Fernandez ME. Factors associated with adolescent HPV vaccination in the U.S.: a systematic review of reviews and multilevel framework to inform intervention development. Prev Med 2020;131:105968.
9. Smith LE, Amlot R, Weinman J, Yiend J, Rubin GJ. A systematic review of factors affecting vaccine uptake in young children. Vaccine 2017;35:6059-69.
10. Nguyen KH, Kahn K, Hoehner J, Hendrich M, Pedraza O, Fisun H, et al. COVID-19 vaccination intent, perceptions, and reasons for not vaccinating among groups prioritized for early vaccination, United States. September 2020. Accessed July 12, 2021. https://www.cdc.gov/vaccines/imz-managers/coverage/adultvaxview/pubs-resources/COVID-online-report2020.html#
11. Coronavirus (COVID-19) Update. FDA Authorizes Pfizer-BioNTech COVID-19 Vaccine for Emergency Use in Adolescents in Another Important Action in Fight Against Pandemic [press release]. U.S. Food & Drug Administration; May 10, 2021.

12. Center for Clinical and Translational Science and Training. COVID-19 Data and Research Projects Cincinnati 2021. Accessed July 12, 2021. https://www.cctst.org/covid19
13. Mbaeyi S, Fisher A, Cohn A. Strengthening vaccine confidence and acceptance in the pediatric provider office. Pediatr Ann 2020;49:e523-31.
14. El-Mohandes A, White TM, Wyka K, Rauh L, Rabin K, Kimball SH, et al. COVID-19 vaccine acceptance among adults in four major US metropolitan areas and nationwide. Sci Rep 2021;11:21844.
15. Joshi A, Kaur M, Kaur R, Grover A, Nash D, El-Mohandes A. Predictors of COVID-19 vaccine acceptance, intention, and hesitancy: a scoping review. Front Public Health 2021;9.
16. Hamel L, Lopes L, Kearney A, Kirzinger A, Sparks G, Stokes M, et al. KFF COVID-19 vaccine monitor: parents and the pandemic. August 11, 2021. Accessed November 17, 2021. https://www.kff.org/coronavirus-covid-19/poll-finding/kff-covid-19-vaccine-monitor-parents-and-the-pandemic/
17. Rogers AA, Cook RE, Button JA. Parent and peer norms are unique correlates of COVID-19 vaccine intentions in a diverse sample of U.S. adolescents. J Adolesc Health 2021;69:910-6.
18. COVID-19 Vaccination Dashboard [Internet]. Ohio Department of Health. 2021. Accessed November 30, 2021. https://coronavirus.ohio.gov/wps/portal/gov/covid-19/dashboards/covid-19-vaccine/covid-19-vaccination-dashboard
19. Pingali C, Meghani M, Razzaghi H, Lamias MJ, Weintraub E, Kenigsberg TA, et al. COVID-19 vaccination coverage among insured persons aged ≥16 years, by race/ethnicity and other selected characteristics—eight integrated health care organizations, United States, December 14, 2020-May 15, 2021. MMWR Morb Mortal Wkly Rep 2021;70:985-90.
20. Centers for Disease Control and Prevention. Demographic Characteristics of People Receiving COVID-19 Vaccinations in the United States: 2021. Accessed November 17, 2021. https://covid.cdc.gov/covid-data-tracker/#vaccination-demographic

50 Years Ago in *THE JOURNAL OF PEDIATRICS*

Advances in the Understanding of Prader–Willi syndrome

Hall BD, Smith DW. Prader–Willi syndrome. A resumé of 32 cases including an instance of affected first cousins, one of whom is of normal stature and intelligence. J Pediatr 1972;82:286-93.

In 1972, Drs Hall and Smith, who helped pioneer the field of dysmorphology, focusing on phenotype for diagnosis, reported a series of 32 individuals with features often observed in individuals with Prader–Willi syndrome (PWS), including neonatal hypotonia, early childhood obesity, and hypogenitalism in males. The etiology of PWS was unknown at the time, making confirmation of the clinical diagnosis difficult. PWS is now known to be due to an absence of paternally expressed genes on chromosome 15q, most frequently from chromosomal microdeletion or maternal uniparental disomy.[1] PWS is one of the hallmark conditions used in medical education to teach the concept of genomic imprinting. PWS can now be reliably diagnosed with DNA methylation analysis, but careful phenotyping is still critical to identify individuals requiring confirmatory testing.

Despite the small number of cases described by Hall and Smith, their hypothesis that a localized defect in the hypothalamus could provide a unifying etiology for the noted features is still thought to be the case. The growth failure described appears to be due to central growth hormone deficiency; growth hormone therapy was approved in 2000 to improve longitudinal growth, as well as lean body mass. Recognition of other hypothalamic and pituitary hormone deficiencies, including hypogonadism and hypothyroidism, has also led to more regular use of hormonal replacement. Hyperphagia and low metabolic rate, now known to be the cause of the well-described early onset obesity, remain the most difficult aspects of clinical management, with behavioral modification and caloric restriction as the current standard of care. However, potential treatments are an area of significant interest, and there are multiple clinical trials currently underway aimed at decreasing this major cause of morbidity in PWS. Fifty years after publication of this case series, our understanding of the genetics and phenotype of PWS has improved significantly. As is now becoming more common for genetic disorders, therapeutic options continue to be developed to improve the lives of those with PWS.

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Reference

1. Butler MG, Miller JL, Forster JL. Prader–Willi syndrome—clinical genetics, diagnosis and treatment approaches: an update. Curr Pediatr Rev 2019;15:207-44.

Table II. Patient/caregiver reported reasons for influencing COVID-19 vaccine acceptance

Influencing factors	% (n = 427)
Studies/data supporting vaccination	12.4% (53)
Concerns of contracting new variants	5.2% (22)
Parent/family member	32.3% (138)
Friends	0.7% (3)
Medical provider	8.4% (36)
Media outlet	0% (0)
Family/friend/self had COVID-19	1.6% (7)
Other	16.6% (71)
N/A—second or third dose	11.5% (49)

N/A, not applicable.