The Risk of Resurgence in Vaccine Preventable Infections

Due to COVID-Related Gaps in Immunization

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Summary: Immunizations have significantly decreased during COVID, increasing the risk for a resurgence of vaccine-preventable infections including measles, pertussis and polio. Providers and public-health departments must work to reassure families that vaccine delivery is safe and catch-up those under-immunized children.

Abstract:

Nationally, immunization delivery has decreased significantly during COVID-19. Internationally, over 60 national vaccine programs have been disrupted or suspended. As a result of these immunization declines, the global community is at risk for a resurgence in vaccine preventable infections including measles, pertussis and polio; all highly contagious diseases that result in significant morbidity and mortality in children. Measles outbreaks have already occurred in many countries who suspended their vaccination programs. Outbreaks in the United States are likely to occur when social distancing stops and children return to school. Health care providers have acted quickly to institute multiple risk mitigation strategies to restore vaccine administration. However, childhood immunization rates remain below pre-COVID levels. Partnerships between healthcare providers, community leaders and local, state, regional and national public health departments are needed to reassure families that vaccine delivery during COVID is safe and to identify and catch-up those children who are under-immunized.

Key Words: COVID-19, vaccine preventable infections, measles, pertussis

Abbreviations:

CDC: Centers for Disease Control and Prevention
COVID-19: Coronavirus Disease 2019

DTaP: Diphtheria, tetanus and pertussis vaccine

MMR: Measles, mumps and rubella vaccine

PCPs: Primary care physicians

VPI: Vaccine preventable infection

WHO: World Health Organization

On March 13, 2020, the United States declared a national emergency in response to the SARS-CoV-2 virus that causes Coronavirus Disease 2019 (COVID-19).[1] In an effort to mitigate spread of COVID-19, stay-at-home and shelter-in-place orders were activated and people were encouraged to social distance. The Centers for Disease Control and Prevention (CDC) and the Centers for Medicare and Medicaid Services recommended that health care providers prioritize urgent visits, delay elective care, and convert in-person clinic visits to telehealth encounters whenever possible. Although the CDC recommended that childhood immunizations (especially for infants and younger children) continue to be delivered, many parents delayed or cancelled their child's well-child visits. In addition, many outpatient clinics were forced to significantly decrease their number of available appointments or temporarily close as they faced costly new infection control and prevention recommendations, personal protective equipment shortages, absenteeism from exposed or ill staff and/or financial difficulties.[2] Overall, outpatient pediatric visits decreased by 62% from baseline in March and April 2020.[2, 3] In addition to these declines in preventive care clinic visits, in some areas local health departments also stopped offering vaccines.[4]

Using data from the CDC's Vaccine Tracking System which reports the number of vaccines ordered through the federally funded Vaccines for Children Program (VFC), the number of non-influenza vaccines ordered between January and April 2020 compared to the same period of time in 2019 was significantly decreased on the order of 500,000 to 3 million doses.[5] Likewise, data from the Vaccine Safety Datalink demonstrated a significant reduction in administration of measles-containing vaccines beginning the week of March 16, 2020.[5] A study performed by Blue Cross Blue Shield suggests that there has been a 26% decrease in measles, mumps and rubella (MMR); diphtheria, tetanus and pertussis (DTaP); and polio vaccines administered form January-September 2020 compared to the same period in 2019. Study results estimate that 9 million doses of these three vaccines could be missed by the end of 2020 due to COVID.[6] Individual city and state data show similar trends; during the pandemic vaccine doses declined by 21.5% in Michigan, by up to 82%

in Colorado and by up to 91% in New York City compared to the same time-periods in 2019.[7-9] Further research is needed to understand whether COVID has exacerbated disparities in immunization rates of minority and socioeconomically disadvantaged children, groups who historically have experienced significant barriers to healthcare access [10] and who carry the highest burden of COVID infection.[11-13] In one recent study evaluating MMR vaccination in a large primary care network in Ohio, patients without insurance were less likely to be vaccinated than those with private insurance or Medicaid.[4]

Internationally, the pandemic had an even more alarming impact on vaccination coverage as entire immunization programs were disrupted or suspended due to COVID-19. Loss of funding, cessation of international air-travel and closure of country borders preventing delivery of vaccines to remote countries, redeployment of medical personnel, lack of personal protective equipment and concerns about how to safely social distance while delivering immunizations forced many countries to scale down their immunization programs. In March 2020, the World Health Organization (WHO) recommended that countries utilizing mass vaccination programs "temporarily suspend the conduct of mass vaccination programs due to the increased risk of promoting community circulation."[14] According to a survey collaboratively conducted by UNICEF, the WHO, Gavi, the CDC, the Sabin Vaccine Institute and the Johns Hopkins Bloomberg School of Public Health, immunization programs in at least 68 of 129 low and middle-income countries surveyed experienced moderate to severe disruptions or terminations during COVID-19.[15, 16] Measles and polio vaccination programs were most significantly impacted with measles campaigns suspended in 26 countries and polio campaigns suspended in 38 countries.[15, 16] The WHO, CDC, Red Cross and GAVI estimate that 94 million people are currently at risk for not receiving their measles vaccines due to these suspensions.[15, 16]

These national and international declines in routine immunizations have placed the global community at significant risk for outbreaks of vaccine-preventable infections (VPIs) including measles, polio and pertussis, diseases which are more deadly, more contagious and have a higher

reproductive factor (R0) amongst children than COVID-19 (Table 1). The measles virus can remain active and contagious in the air or on infected surfaces for up to 2 hours after a person coughs or sneezes and can be transmitted by an infected person from 4 days prior to 4 days after rash eruption. A child with measles can infect 90% of those unimmunized individuals he or she comes in to contact with. Prior to the pandemic, certain VPIs were already having national and international resurgences. In 2019, there were over 1200 cases of measles in the United States and 800,000 confirmed cases globally.[17] In 2018, 15,000 cases of pertussis occurred in the United States with over 150,000 cases globally.[18] COVID-19 related declines in routine childhood immunizations could decrease vaccination rates even further, well below the level necessary to ensure population herd immunity. Before the pandemic, two states (Colorado and Idaho) reported kindergarten measles vaccination rates below the 90% level necessary to ensure herd immunity against measles; it is likely that many additional US states are now below the herd-immunity threshold.[19] Measles outbreaks have already occurred this year in at least half of the 26 countries who suspended their measles vaccination programs.[16] It is concerning to imagine how measles could spread across the United States when social distancing restriction are relaxed and unvaccinated children return to school and usual community engagement.

VPIs cause more significant morbidity and mortality in children compared to adults, particularly in those with primary or acquired immunodeficiencies. Immunizations prevent 20 million disease cases and 42,000 deaths in each birth cohort in the United States and 2-3 million deaths a year globally.[20] Compared to COVID-19 with a 1 in 10,000 case-fatality rate in children[21, 22], the case-fatality rate for unvaccinated children with pertussis can approach 5% and for unvaccinated adolescents with paralytic polio can approach 30%.[23] Pertussis remains one of the top ten causes of infant mortality worldwide with an estimated 24 million cases and 160,000 deaths annually in children younger than 5.[18, 24, 25] Measles mortality in children living in the developing world is roughly 10%, and can approach 60% for malnourished Vitamin A deficient children and those with pneumonia.[26, 27] Up to 30-40% of patients with measles will develop 1 or more complications and

these complications are generally worse in young and malnourished children.[26] Measles infection can also suppress the immune system's antibody response to other infections putting infected individuals at risk for infection with other pathogens.[28] Even in the United States, 25% of children with measles require hospitalization and 5% develop pneumonia, the leading cause of death from measles in young children.[29] Permanent medical impairments including neurologic deficits, intellectual disabilities, cognitive decline, motor dysfunction, vision loss, hearing loss and paralysis can occur in those children who survive a VPI (Table 1).

Health care providers and the public health community have acted quickly to restore vaccine administration to children. Primary care clinics have implemented multiple risk mitigation strategies including use of personnel protective equipment by all clinic staff, utilizing pre-clinic phone/telehealth screening calls to identify patients who may be infected with COVID before they enter clinic, instituting limits on the number of people in the clinic waiting area (or eliminating waiting areas altogether), and making use of curbside or drive-up immunization clinics.[30] These efforts have helped to restore some of the public's confidence in the safety of coming in for immunizations, and vaccine rates began to increase in May and June 2020.[8] However, childhood immunization rates remain well below pre-COVID rates and creative partnerships between health care providers and local, state, regional and national public health departments across the United States are needed not only to reassure families that vaccine delivery during COVID is safe, but also to integrate catch-up policies into essential immunization services across the country. To that end we recommend the following actions:

Individual Provider Practices in the United States:

- Use of telehealth visits and social media to help inform parents of the multiple safety precautions in place at individual clinics to prevent spread of COVID-19 during a vaccine visit[31]
- Utilization of the clinic's electronic health record to identify children in the practice who have fallen behind on standard vaccines during COVID

- Utilization of emails, text-messages and communication through the electronic health record to inform parents that their child is overdue for immunizations[32]
- Provide opportunities for children to receive vaccines without physically entering the clinic (e.g. providing vaccines in the parking lot or through a drive up window)
- When COVID vaccine becomes available for children, utilize COVID-vaccine visits as an opportunity to review a child's immunization records and catch them up on other needed vaccines

Local, State, Regional and National Health System Practices:

- Public service announcements through television, digital and social media platforms to educate parents about the critical importance of vaccines and the health risks of the diseases they prevent
- Public service announcements to inform parents who may have lost their job and/or insurance during COVID about free or low-cost immunization programs through the Vaccines For Children federally funded program[33]
- Utilization of state immunization information systems to identify children who have fallen behind on standard vaccines[34]
- Provide vaccine opportunities during all healthcare encounters (not just primary care visits) including subspecialty visits, urgent care visits, emergency room visits, inpatient visits
- Use of mobile health clinics to provide vaccines for children in communities where access to health care clinics is limited
- Systematic efforts to provide a medical home for children with poor access to care. In places where there are limited vaccination services available within a medical home (e.g., some rural areas), partnerships with community stakeholders and public health to provide additional vaccination opportunities (i.e. at pharmacies, schools, recreational centers, churches, faith-based institutions, community centers and during weekend and evening hours for working parents)

- Focused efforts to inform and vaccinate subgroups of individuals (minorities and underserved populations) who historically have experienced difficulty accessing healthcare. This may include focused public service and social media announcements, restoration of disrupted VFC programs and Immunization Quality Improvement for Providers (IQIP) site visits and use of mobile health clinics and community vaccine opportunities as discussed above
- State and federally funded resources to financially support primary care clinics and community groups as they implement expensive infection prevention strategies

In the 21st century, we have made so much progress in preventing childhood death from infectious diseases through immunization. We cannot permit the COVID-19 pandemic to reverse this progress and allow VPIs to resurge.

Acknowledgements/Notes:

Funding: This work was supported by the Agency for Healthcare Research and Quality [K08 HS026510-01A1to A.G.F.].

Potential conflicts: LDI reports Contracted Clinical Research from Astellas and Ansun BioPharma, personal fees (DSMB, Consultancy, and Contracted Clinical Research) from Merck and Takeda, and grants/Clinical Research Support from Viracor, outside the submitted work. All other authors have no potential conflicts to disclose.

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Table 1: Contagiousness, Morbidity and Mortality From Infections

Disease	Reproductive Factor	Case-Fatality Rate Among Unvaccinated Individuals	Disease Associated Morbidity	Peak cases in the United States (pre-vaccine)
COVID-19	2-7	0.1 (children)- 28.8 (adults older than 80), average 4.9%	Respiratory failure Blood clots	24,861,388 (as of January 22, 2021)
Measles	12-18[35]	2-15% in low and middle income countries, up to 70% in immune-suppressed individuals	Ear infections Diarrhea Pneumonia Encephalitis Hearing Loss Intellectual disability Subacute sclerosing panencephalitis	763,094 (1958)
Pertussis	12-17[36]	1% of infants	Pneumonia Failure to thrive Rib fractures Seizures Encephalopathy	265,269 (1934)

			Pulmonary hypertension	
Polio	5-7	Up to 57%	Muscle weakness Meningitis Paralysis	58,000 (1952)