

# Vaccine Exemptions and the Risk of Continued Disease Outbreaks

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Highly transmissible viruses have tremendous capacity for targeting vulnerable populations, especially clusters of unvaccinated individuals. Over the last decade, this scenario has resulted in serious and even lethal outbreaks of measles and, more recently, coronavirus disease 2019 (COVID-19).

The latter half of 2021 has been notable for a devastating “fourth wave” epidemic of COVID-19, especially in US southern states where COVID-19 vaccination uptake among young people, including teenagers, is profoundly low. Across many parts of the South, fewer than 30% of teenagers are vaccinated, allowing the highly transmissible severe acute respiratory syndrome coronavirus 2 Delta variant to accelerate and spread rapidly. During this surge, states such as Louisiana, Mississippi, and Florida have sustained the highest incidence of COVID-19 globally. The result has been catastrophic rates of hospitalizations, including pediatric ICU admissions and deaths.

This devastating impact of COVID-19 on pediatric populations reflects a “one-two punch” of a Delta virus variant with a high reproductive number ( $R_0$ ) ( $R_0 > 5$ ),<sup>1</sup> together with a concentration of susceptible individuals. The  $R_0$  is the number of new cases generated within susceptible individuals from each case.

This is a concerning scenario that has already played out with other infectious diseases in the United

States. We have extensive previous experience with this combination in combatting measles, which is much more transmissible ( $R_0 > 12$ ), especially in pockets of low measles, mumps, and rubella vaccination coverage. Similar to our current COVID-19 situation, poor pediatric vaccination coverage has not been due primarily to lack of resources but to outright vaccine refusal or hesitancy. Although measles has been officially eliminated in the United States since 2001, defined as incidence below 1 case per 1 million population,<sup>2</sup> its high transmissibility means that outbreaks can occur at any point when vaccination coverage declines.

After a serious measles epidemic in 2014–2015, the state of California enacted a law to halt the practice of allowing nonmedical exemptions for school-associated childhood vaccinations.<sup>3</sup> The impact of Senate Bill 277 was an immediate reduction in both nonmedical exemptions and in the number of unvaccinated children entering kindergarten.<sup>3,4</sup> Shutting down nonmedical exemptions for childhood vaccinations became a national public health success story. In some school districts, however, there was a compensatory increase in other types of exemptions, including medical exemptions.<sup>4–6</sup> This was particularly true in areas of California where hesitant parents identified complicit medical practitioners to claim dubious exemptions. Thus, there emerged new concerns that unregulated medical exemptions

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could lead to clusters of susceptible children and therefore measles outbreaks.<sup>7</sup>

In this issue of *Pediatrics*, Gromis and Liu<sup>8</sup> examined how the spatial clustering of vaccine exemptions before and after Senate Bill 277 affected the potential for measles outbreaks. When exemptions were clustered, not surprisingly, this created a new and concentrated population of unvaccinated children. An introduction of measles into this population could potentially produce thousands of infections and a full-on outbreak or epidemic. Although there is currently, appropriately, a great deal of focus on prevention of COVID-19 infections in children, it is worth remembering that measles is a much more severe disease in children than COVID-19, hospitalizing between one-quarter and one-third of infected children and causing death in roughly 2 in a thousand in high-resourced countries, with mortality far higher in under-resourced countries and in children suffering from malnutrition.<sup>9</sup> These analyses further underscore the tenuous control that exists in preventing highly transmissible diseases, such as measles, from flourishing once again. For example, in 2019, the United States experienced the greatest number of measles cases reported since 1992, the majority of which were among individuals who were not vaccinated against measles. This led the United States to the brink of losing its status of measles elimination, bolstered only by extensive vaccination efforts especially focused on populations with high rates of vaccine refusal and misinformation.<sup>10</sup>

The policy implications of clustered vaccine-exempt populations require a closer examination of alternative paths for vaccine exemptions, including medical exemptions, particularly in areas where

immunization rates are already low because of widespread vaccine hesitancy or barriers to vaccine access. The findings highlight the need for close surveillance and monitoring of the practice and standards of granting medical exemptions by state licensing boards, and the urgency to implement triggering alerts if medical or other alternative exemptions exceed predefined thresholds in a geographic cluster. Such areas could benefit from implementation of evidence-based practices for increasing vaccination uptake.<sup>11</sup> These actions are relevant not only for routine school-entry vaccinations, but also may become important as COVID-19 immunizations are introduced for younger age groups, a potential reality in the coming months. For example, given the low uptake of adolescent COVID-19 vaccination already described in the southern states, we might anticipate this will remain a problem as immunizations begin among younger age groups. Ultimately, however, the level of acceptance for school-entry vaccinations for COVID-19 for younger groups remains unknown and must be a focus of public health surveillance.

Given the unprecedented levels of COVID-19 vaccine hesitancy and refusal that emerged across many regions of the United States in 2021,<sup>12</sup> efforts to bolster our public health systems for immunization vigilance should be strongly considered, similar to well-tested and successful national pharmacovigilance mechanisms that are already in place, such as the Vaccine Safety Datalink, a collaborative project between the Centers for Disease Control and Prevention and 9 health care organizations, which monitors vaccine safety in real time. The study by Gromis and Liu reminds us

of the vulnerabilities created by clusters of vaccine exemptions in the face of highly transmissible viruses, and the risk of returning to a dangerous era where vaccine-preventable diseases may once again become endemic.

#### ABBREVIATIONS

COVID-19: coronavirus disease 2019  
R<sub>0</sub>: reproductive number

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