

Pediatric vaccine stockpile policies need to be revisited, researcher says

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Vaccine manufacturers and public health decision-makers need to collaborate in a more efficient and effective manner not only to reduce the likelihood of supply shortages for pediatric vaccines but also to maximize community immunity, says Sheldon H. Jacobson, a University of Illinois researcher who specializes in statistics and data analysis. Credit: L. Brian Stauffer

Vaccine manufacturers and public health decision-makers need to collaborate in a more efficient and effective manner not only to reduce the likelihood of supply shortages for pediatric vaccines but also to maximize community immunity by using vaccine doses to increase coverage, according to research published by a University of Illinois researcher who specializes in statistics and data analysis.

Sheldon H. Jacobson, a professor of computer science and the director of the simulation and optimization laboratory at Illinois, says that the Pediatric Vaccine Stockpile Program administered by the [Centers for Disease Control and Prevention](#) should not simply be seen as a repository of vaccines, but rather as a "repository of opportunities" for enhancing

the collective immunity of children.

"We hear a lot about bioterrorism and [pandemics](#), but the fact of the matter is, the threat to routine immunization is one of the greatest threats we face," Jacobson said. "If we had problems with our vaccine supply chain, it would have the potential to cause more deaths than any of those other issues."

With an average of 11,000 children in need of immunization on any given day, Jacobson says that managing pediatric vaccine stockpiles shouldn't simply be limited to increasing the levels of the stockpile itself.

"Just like perishable goods, vaccines have a shelf life," Jacobson said.

"They're not like canned goods that you can simply stockpile and forget about for an extended period of time.

"When you have finite economic resources, you have to make choices. But we also want to create a buffer that will create the widest possible [public health](#) safety net."

The CDC's current policy of maintaining a six-month rotating vaccine stockpile isn't the most optimal solution for achieving "herd immunity," which Jacobson defines as "the smallest percentage of a population that must be immunized against a disease so that unvaccinated individuals are also protected."

Jacobson, who published his research in the *Journal of Industrial and Management Optimization*, considered the relative mortality and morbidity of diseases to determine what levels stockpiles should be set at to minimize the risk of shortage and maximize coverage opportunities while minimizing costs.

"We took all of these factors into account and created a multi-attribute model using utility theory to solve for appropriate levels."

Jacobson said that when actual vaccine shortages have occurred over the last 10 years, the duration of the shortages were between 16 and 18 months.

"Even though we're preparing for six months out, we never see six months," he said. "The shortest time period in the last 10 years has been a 7-month period. That's a byproduct of one-size-fits-all policy for stockpiles. Although it's easy and simple to do, it's not the most efficient policy. We need to re-engineer the objectives of our pediatric vaccine stockpiles and establish more flexible policies for maximizing their utility."

Jacobson's research proposes a stochastic model to determine the stockpile levels that minimize the risk of a vaccine shortage during a supply interruption while also maintaining a given coverage rate.

"For some vaccines, you need very little stockpiles; for others, you need much larger ones," he said.

Pertussis, or whooping cough, as it's more commonly known, can be a "very deadly, virulent disease if it spreads, while mumps, on the other hand, rarely causes death," Jacobson said.

"When we're talking about vaccines, equal is not effective. The recent pertussis outbreaks in California and Ohio highlight the needs for differentiated stockpile levels, meaning we have to look at the characteristics of the diseases in terms of achieving herd immunity as well as how deadly the disease is."

Jacobson, who also is a professor of pediatrics at the College of Medicine on the Urbana campus, said that although routine immunization is the most effective public health strategy to prevent the occurrence and spread of infectious diseases, there's always going to be a

certain small percentage of the population who will not be immunized, because of religious beliefs or allergies to the vaccine.

"The CDC's goal for immunization is 95 percent compliance," he said. "They don't expect 100 percent. But if you get to 95 percent, you're typically going to have a herd immunity."

Ultimately, vaccination is a critical public health issue that can't be run by the vagaries of emotion.

"If we allow our emotions to guide our policies, we'll pay the price somewhere down the line. The public health system saves rather than costs our nation money. And any way that we can reduce mortality and morbidity through immunization would be beneficial to the health-care system both in cost and value and to the nation as a whole."

Provided by University of Illinois at Urbana-Champaign

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