

Vaccine overload

There is a school of thought that childhood immunisations are adversely impacting the immune system. **Apoorva Mandavilli** reports

It's an idea as popular as it is incorrect: American babies now receive too many vaccines, which overwhelm their immune systems and lead to conditions such as autism.

This theory has been repeated so often that it has permeated the mainstream, echoed by President Donald Trump and his pick to be the nation's top health official, Robert F. Kennedy Jr.

"When you feed a baby, Bobby, a vaccination that is, like, 38 different vaccines, and it looks like it's been for a horse, not a 10-pound or 20-pound baby," Trump told Kennedy on a call in July. "And then you see the baby all of a sudden starting to change radically — I've seen it too many times."

Last month, Trump returned to the theme, saying Kennedy would investigate whether childhood vaccines caused autism, even though dozens of rigorous studies have already explored and dismissed that theory.

But the idea that today's vaccines are overtaxing children's immune systems is fundamentally flawed, experts said. Vaccines today are cleaner and more efficient, and they contain far fewer stimulants to the immune system — by orders of magnitude — than they did decades ago.

The immune reactions produced by vaccines are "minuscule" compared with those that children experience on a daily basis, said Dr Yvonne Maldonado, who is a pediatrician at Stanford University, US, who advises the Centers for Disease Control and Prevention or CDC on matters related to vaccines.

Children harbour trillions of bacteria, more than the number of their own cells, and encounter pathogens everywhere — from caregivers and playmates; in kitchens, bathrooms and playgrounds; and on toys, towels and sponges.

"That's just the normal course of growing up, is to have fevers and develop immunity to all of the organisms that are in the environment around you," Maldonado said. "We are built to withstand that."

A vaccine's power comes

from the so-called antigens it contains — bits of a pathogen, often proteins, that elicit an immune reaction in the body.

By learning to recognise antigens from a dangerous pathogen, such as measles or polio, the immune system becomes prepared to fight it off if exposed.

"Since infants' immune systems are more 'naive' than older children's and adults', their bodies are learning everyday how to protect themselves against outside threats," a spokesperson for the CDC said in an emailed statement. "Vaccines help protect them before they get exposed to an infectious disease threat so when that bacteria or virus comes around, the child's immune response is prepared and can respond faster and more robustly," the statement said.

In most states, children must be vaccinated against about a dozen diseases, a schedule that typically adds up to about 17

doses, administered before they begin kindergarten. (A few additional shots, including for respiratory syncytial virus, flu and Covid-19, are recommended but not required.) Each of the shots contains about 10 antigens. Older vaccines packed a much bigger punch, having up to 300 times as many.

More than a century ago, children were vaccinated only against smallpox, which had previously killed about one in three infected people. Smallpox is among the largest viruses known to infect people, and the vaccine dose contained as many as 200 proteins that could cause the body to react.

In the 1940s, a vaccine for pertussis, or whooping cough, was in wide use. Pertussis is caused by bacteria — which are roughly 10 times the size of an average virus — and that shot held at least 2,000 proteins.

As scientists learned more about the pathogens that harm or kill children, they homed in on the most important proteins. They also made big strides in refining techniques to purify and standardise vaccine components. "We have purer vaccines than we've ever had before because of those advances," said Dr Paul Offit, director of the Vaccine Education Center at Children's Hospital of Philadelphia and an adviser to the Food and Drug Administration.

By the 1990s, smallpox had been eradicated, and the messy pertussis vaccine was replaced with a sleeker version containing two to five proteins per dose, depending on the formulation.

Many other vaccines, including the one against measles, rely on just one or two antigens per dose. Kennedy and others have claimed that thimerosal, a mercury-based preservative in some childhood vaccines, causes au-

tism. They have pointed, in particular, to the combined vaccine against mumps, measles and rubella. But that vaccine has never contained thimerosal.

Even when the preservative appeared in other vaccines, trace amounts were present at about the levels found in a can of tuna fish.

Vaccines are thoroughly tested for safety and effectiveness in animals, and then in progressively larger studies of people, sometimes over decades. (The Covid vaccines were a notable exception.)

Some of the vaccines have now been in use for decades, and federal agencies have multiple mechanisms to continue monitoring safety.

"We have not seen any signals from any of these vaccines being dangerous to kids, either on the short term or on the long term," Maldonado said.

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