The sting in the needle

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Doubts are emerging about the long-term effect of vaccinations on bacteria, writes Julie Robotham.

FOR a baby, it is a brief moment of anguish
as the needle punctures the arm. For public health experts, the rapidly expanding Australian childhood immunisation program is presenting longer-term concerns that cannot be so quickly overcome with a cuddle and a feed.

They are balancing the attractions of preventing serious illness and death today against the unknown effects of mass vaccination on patterns of disease in future.

What if banishing one set of bugs provides a golden opportunity for others to set up shop in the body? What if bacteria that are only occasionally deadly serve an as yet unrecognised but beneficial function? How will we provide boosters if the protection vaccines afford turns out to diminish over time? If childhood diseases are deferred to adulthood, will they be more severe?

Mahomed Patel believes so little is known about the natural balance of microbes in the nose and throat that vaccines against bugs that reside there "must be regarded as an experiment in restructuring the local bacterial population".

Bacteria in the gut are known to be important for immunity and digestive health, says Patel, an epidemiologist at the Australian National University. "We don't understand the microbiology of the throat at all. My guess is that they must be doing us some good ... we're knocking out some bugs which relatively infrequently cause disease."

Many people carry meningococcal bacteria, for example, benignly in their throats. Only in about one in 100,000 does the bug invade the blood or brain to become a life-threatening infection. Meanwhile, the vaccine against the C strain of meningococcal disease has been given universally to children since 2003.

Mass immunisation against seven dangerous strains of pneumococcus - also part of the standard childhood jab schedule since 2005 - vastly decreases the amount of disease they cause by ridding the throat of any trace of the organisms.

Among Boston preschoolers the proportion who carried the vaccine strains fell from 22 per cent to 2 per cent during the three years after immunisation began. But colonisation by other pneumococcal strains - there are more than 90 - increased from 7 per cent to 16 per cent. Given time to evolve, those too might turn nastier.

"The prognosis for a lasting suppression of pneumococcal disease is guarded," Patel wrote last month in the *Medical Journal of Australia*, reigniting discussion of scientific uncertainties surrounding some aspects of Australia's immunisation program, even among its most ardent proponents.

Patel, who has worked in central Australia and Papua New Guinea, where infectious disease outbreaks are rife, believes vaccine technology offers too simplistic a technical fix to diseases that are more truly based in poverty, overcrowding and poor hygiene.

Robert Booy, the co-director of the National Centre for Immunisation Research and Surveillance, is an enthusiastic advocate of immunisation programs, but readily agrees they raise consequences for the future that can only partially be foreseen.

Booy says the evidence to date suggests that no new disease-causing strains for meningococcal, pneumococcal or the meningitis-causing Haemophilus influenzae type b (Hib) bacteria - against which Australia has been immunising since 1993 - have arisen to take the place of those knocked out by vaccines. "Over 10 to 15 years we haven't seen replacement," he says.

Nevertheless, says Booy, there is clear evidence from studies of people with chronic lung disease that different bugs do compete with each other to occupy a susceptible respiratory tract, and it may be that now is simply too soon to breathe a sigh of relief. "[Strain replacement] is a very real possibility," he says. "It may be it's a function over time."

And there is also solid evidence that mass immunisation can lead to the still more serious scenario of so-called capsule switching - in which, for example, the disease-causing core of the C strain meningococcal bacteria might swap genes with another meningococcal strain, allowing it to spread more readily and evade vaccine defences.

Booy says such instances are so few and far between that they have not posed a health threat. "It's a hypothetical concern that in practice hasn't amounted to anything more than isolated cases," he says.

A more immediate worry - as the most immunised generation in history makes its way out of preschools and into middle childhood - is how long their turbo-charged immunity will last.

According to immunisation dogma, any "live" vaccine - based on an actual pathogen modified to stop it causing disease - creates a lifelong "memory" in the body, triggering a powerful immune response every time it encounters the real thing.

Experience has taught that this is only partially true, says Booy. Individuals vary in the degree of immune response that vaccines induce, and there is a gradual diminution of response as people age.

Yet another variable is the age at which a vaccine is administered, which also influences the strength of the immune response it provokes.

Australian babies who receive a single meningococcal C jab at age 12 months already have better protection from the disease than British infants, who receive three shots during their first six months of life. But their next time of peak risk will come during their teens, when adolescent socialising puts them back in intimate contact with other people's bugs, and there is no guarantee their immunity will still be sufficient to withstand the onslaught.

"We may get to the point of giving [a booster] at about 12 years, before they start snogging and smoking," Booy says.

Meanwhile, waning immunity to the chicken pox virus varicella - against which children are also now immunised - would pose a separate conundrum because infection takes a different form in older people, in whom it often appears as the phenomenally painful neurological condition shingles. Varicella vaccines for the elderly to prevent the shingles manifestation are under development.

For Peter Collignon, the director of infectious diseases at the Canberra Hospital, it is a question of proportion.

The organisms we vaccinate against are a relatively small slice of microbial life in the throat, and immunisation has proven extremely efficient at combating serious diseases they cause. The only other available option - treating disease after it occurs - may knock out many more bugs than just the culprit.

"I think we've got to keep a practical perspective," Collignon says. "If you take an antibiotic it's like napalming your throat."