TV drama stirs up vaccine controversy

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In the premiere episode of ABC's Eli Stone, a lot happens.

The title character, a lawyer, switches sides in a major lawsuit thanks to a vision of George Michael singing "Faith". The defendant, Stone's former client, is a vaccine manufacturer called Beutel. The plaintiff is Beth Keller, the attractive, smart, determined mother of a child with autism. Keller believes that a vaccine containing a preservative called mercuritol caused her son's illness. A few visions later, Stone wins the case and a cool $5.2 million settlement.

Gripping TV, perhaps, but as so often with television, the science is, well, questionable. In fact, the American Academy of Pediatrics (AAP) went so far as to call for the premiere to be cancelled. "A television show that perpetuates the myth that vaccines cause autism is the height of reckless irresponsibility," said the organization's president, Dr. Renee Jenkins.

A minor frenzy of news articles, opinion columns, blog posts, and online discussions ensued. Some supported the AAP, while others felt the organization had done its cause more harm than good. The show's co-producer, Greg Berlanti, told ABC News that "It was never the intent of the show- for anyone to take away that children shouldn't be vaccinated. It's not the message of the show."

Beutel is a fictional company, and mercuritol is a fictional substance. But the episode draws loosely on the real history and controversy of thimerosal, a mercury-based preservative that is used in tiny quantities to prevent bacteria and fungi from growing in vials that contain multiple doses of vaccine.

"It's been such a thorny issue for so many years," says Dr. Wendy Roberts, a paediatrician and co-director of the Autism Research Unit at The Hospital for Sick Children (SickKids). "And just when you think it's been put to rest, something stirs it up again."

Thimerosal and mercury

In May 1999, scientists at the U.S. Food and Drug Administration found that babies following the standard immunization schedule could theoretically be exposed to a total of 187.5 micrograms (millionths of a gram) of mercury by 6 months of age. At the time, little was known about what quantity of ethyl mercury, the form of mercury found in thimerosal, was safe. But based on one set of safety guidelines for a chemically different form, methyl mercury, experts from various agencies were concerned that some babies could potentially be exposed to too much mercury from vaccines.

There is no question that exposure to too much mercury is dangerous, especially for children. Methyl mercury, the organic form of mercury found in fish, can easily enter the brain and build up in the body.

In children, high levels of methyl mercury can cause neurological problems such as impaired intellectual functioning, delays in walking and talking, movement disorders, nerve damage, and seizures. After some consideration, the U.S. Centers for Disease Control and Prevention and the AAP decided it was best to err on the side of caution. In July 1999, two months after the initial finding, they asked pharmaceutical companies to remove thimerosal from vaccines as quickly as possible.

Since then, researchers have found that ethyl mercury is metabolized differently from methyl mercury. It appears to be cleared from the body quickly, rather than building up as methyl mercury does. Agencies such as Health Canada continue to recommend removing thimerosal from vaccines if possible, on the principle that reducing exposure to mercury is a good idea regardless of the form it comes in. But the available evidence shows that thimerosal is a safe and effective preservative for vaccines.

Thimerosal and autism

Over the same period, a large number of well-designed studies have tried and failed to find a link between thimerosal and autism or other neurodevelopmental disorders. Studies from various countries, for instance, have found that autism cases continued to increase even after thimerosal was eliminated from most childhood vaccines. Other researchers have pointed out that the symptoms of mercury poisoning are very different from those of autism.

It is not clear when the belief that thimerosal causes autism started. But it hasn't gone away in the face of the evidence. If anything, the precautionary removal of thimerosal from vaccines convinced more people that something had to be wrong with the substance. The Internet teems with conspiracy theories and unscrupulous "experts" who offer plenty of spurious evidence for the thimerosal-autism connection, as well as expensive 'cures' like chelation therapy, which killed a 5-year-old boy in Pittsburgh in the summer of 2005. The lack of evidence also hasn't stopped more than 5000 families of autistic children from filing claims with the U.S. Vaccine Injury Compensation Program (VICP). Other families, like Eli Stone's Beth Keller, have tried to bypass the VICP process and go directly to court.

Ironically, in most developed countries, children are now exposed to almost no thimerosal in their regular vaccine schedule. A few vaccines, like the influenza vaccine, contain thimerosal as a preservative or in trace amounts from manufacturing. For most vaccines, though, companies have largely switched to single-dose vials which do not need a preservative. Thimerosal still plays an important role in less developed countries.

Looking for a connection

Different children show the signs of autism in different ways. Sometimes, it is clear early on that a child has problems with social skills and communication. Other children develop apparently normally, until they suddenly become withdrawn and lose skills they already had. This change often happens in a child's second year, when many vaccines are also scheduled. Beth Keller tells Eli Stone that her son was a happy, smiling child until he was given Beutel's vaccine; a week later, he was a different child.

"I believe there's a very occasional case where that's true," Roberts says. "I think I've seen two kids- one boy who was happy, he was speaking in phrases, and he developed one of those horrible febrile reactions after vaccination, he went on to develop seizures, he was in the ICU. When he came out he stopped talking." Roberts says occasional cases like this one may help to perpetuate the theory of a link

between vaccines and autism. "But who knows? I've seen anesthetic trigger autism. I've seen it precipitated by post-traumatic stress."

It's natural to look for something out of the ordinary that could have precipitated a sudden change, and vaccines often fit the bill. But "vaccination uptake is really low in families with a diagnosis of developmental disability, especially younger siblings," Roberts says. "And there's still a 20% recurrence rate. Parents come in and say "we didn't vaccinate, and our younger child got [autism] anyway."" Roberts points to a new study by Baird and colleagues, who found no evidence of a differing immunological response to measles vaccine between children with autism and controls.

The causes of autism

We know from twin and family studies that autism has a strong genetic basis. "If you look at identical twins, they have the exact same DNA. So if one twin is autistic, there is a 90% to 92% chance that the second twin will be autistic also," says Dr. Stephen Scherer, director of the Centre for Applied Genomics at SickKids. "And this drops off, if you look at dizygotic twins [who share half of their DNA on average, like any pair of siblings], to about 10% concordance."

Scherer explains that autism spectrum disorder is in fact a group of different conditions that have similar effects: "I hate to use this analogy, but it's like cancer. There are different types of cancer and there are different types of autism."

Over the last 10 years, researchers have started to look closely at DNA to see if specific changes or variants in genes can be associated with autism. "In about 10% of individuals who have this diagnosis called autism, it arises along with another medical, genetic condition," Scherer says. Children with Rett's syndrome or Fragile X syndrome, for example, often have autism.

In another 7% of cases, Scherer's lab has identified chromosomal abnormalities. "And there are other genes that are so-called rare contributors. We now know that in some cases a change in a single gene is sufficient to cause this complex disorder called autism. In the remaining cases, we don't know the answer yet, but it's possible that there are many other genes involved. Sometimes it will be single genes, sometimes genes in combination, sometimes environmental cues. But in most cases there will be a genetic component."

Research is continuing into how various environmental factors may interact with genes in susceptible children to result in autism. But although those environmental factors probably do exist, vaccines and thimerosal don't seem to be among them.

It's still important to vaccinate

Vaccines are widely regarded as the single most important public health intervention of the last 100 years. In the developed world, near-universal childhood vaccination has been so effective at reducing disease that in some ways vaccines are victims of their own success.

"When I was a resident, we used to be so terrified when measles cases came in," Roberts says. "I remember kids dying in the ICU. As long as there was a memory of that, I think, people went ahead and vaccinated. But unless you have that kind of recall, you're more concerned with the immediate risks of

vaccination." Most of us have never known anyone who died of a vaccine-preventable disease, so the rare problems caused by vaccines themselves become the focus of attention.

Other parts of the world are not so lucky. In 2002, according to estimates from the World Health Organization, 4,000 children under five died from diphtheria; 15,000 children died from yellow fever; 198,000 children died from tetanus; 294,000 children died from pertussis; 386,000 children died from Haemophilus influenzae type b; and 540,000 children died from measles. About three-quarters of these 2.5 million deaths were in Africa and south-east Asia, where vaccine coverage is poor. Thanks to an aggressive vaccination campaign, worldwide measles deaths dropped to 242,000 in 2006, the latest year for which figures are available.

In developed countries, even children who are not vaccinated are still protected because most people around them have been vaccinated. "People are relying on herd immunity," Roberts says. But declines in vaccine coverage can and do leave openings for vaccine-preventable diseases to return. In Canada in 2000, nearly 200 people developed measles, most of them in Alberta. The initial cases came from Mexico and Bolivia; they spread mainly to people who had not been vaccinated for religious or philosophical reasons. Because infectious disease is just one plane ride away, it's important to keep vaccine coverage rates high.

"And you do get wild outbreaks," Roberts says. "It doesn't have to be someone coming in on a plane. My daughter got measles in Scarborough [a suburb of Toronto] in the '90s, when the evidence was just coming in that you needed two measles shots, and I hadn't really pushed her to go in and get the second shot."

Vaccines in Canada are very safe. Reactions after immunization do happen, but they are usually mild. "The way I explain it to parents is, the rate of those severe reactions after vaccination is extremely rare," Roberts says. Severe reactions occur after about one in every 10,000 to one million doses of vaccine. "Whereas if you get wild measles, about one in 1000 get encephalitis. So the risk is much higher. I think you're safer to be covered."

The Canadian Immunization Guide has information about the potential side effects of individual vaccines. If your child does have a problem after being immunized, ask your child's doctor, nurse, or pharmacist to fill out an Adverse Events Following Immunization form.

You gotta have faith, but it's better to rely on the evidence

Eli Stone's killer legal strategy in this case boils down to telling the jury, "Forget the lack of evidence. Sometimes you have to take things on faith." Unfortunately, faith without evidence is a poor basis for making medical decisions. It doesn't usually do much in a courtroom either, but that's TV.

Eli Stone is a fun show. Let's hope that, in the words of co-producer Berlanti, viewers won't make medical decisions "based on a show about a guy hallucinating in his bedroom with George Michael." Let's also hope that if future episodes deal with long-standing controversies, they manage to mix a little more scientific reality in with the whimsy.

For more information:

AboutKidsHealth: Autism Spectrum Disorder

Canadian Coalition for Immunization Awareness and Promotion: www.immunize.cpha.ca

Canadian Immunization Guide: www.phac-aspc.gc.ca/publicat/cig-gci/index-eng.php

Geneva Centre for Autism: www.autism.net

Health Canada: Autism: www.hc-sc.gc.ca/hc-ps/dc-ma/autism-eng.php

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