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## Just-so Stories: Vaccines, Autism, and the Single-bullet Disorder

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When should we believe in science, especially in scientific explanations of the causes of health, ill or otherwise? One line of argumentation is that scientific evidence based in robust ecological data, supported by previously tested animal or biological models or double-blinded randomized control trials trumps intuition or just plain “common sense.” Another line of argumentation suggests that common sense is a powerful heuristic. For example, we pretty much know that parachutes work to cushion jumps from highflying planes even though there has not yet been a randomized control (RC) double blind study to support this intuition (however, see Smith and Pell [2003] for a counter opinion). Likewise, thousands of people think that Kipling’s (1912) explanation of why camels have humps makes a lot of sense. Recall that Kipling argues that the camel’s summary refusal to be a beast of burden—his “hmmphh”—led God to give him (and all other camels) a hump. Yet the weight of scientific opinion suggests otherwise perhaps because the “hmmphh” hypothesis lacks a plausible animal model or biological mechanism (not to mention support from a RC double-blind study). Who needs such models when the phenomenological reality of camels is precisely centered on their orneriness?

How far should we trust just-so, common sense accounts of complex phenomena? Why are scientists and ordinary people so driven to embrace single-bullet explanations? What does all this say about trust in science? These are the questions considered in this essay, focusing on the purported relationship between autism and vaccines.

### VACCINES AND AUTISM

The basic picture is simple: Despite overwhelming scientific consensus that measles, mumps, and rubella (hereafter, MMR) vaccines do not cause autism (Shwed and Bearman 2010), many people believe otherwise. Cautious physicians confronted with widespread fear of vaccines may encourage parents to split immunization sequences, leading to multiple visits, therefore leading to repeated opportunities for reactions to occur, and long periods of susceptibility to childhood diseases, the eradication of which—in the Western world—was rightly hailed as the crowning achievement of public health policy of the last century.

It would not matter if a few parents here and there decided not to vaccinate their children, but it is not just a few, and they are not just here and there. In fact, there are increasing numbers and they tend to cluster in specific neighborhoods.<sup>1</sup> But now, whole new clusters of parents—purposive “vaccine refusers”—can be identified (King and Bearman 2010). In California, where vaccine exemption is as easy as signing a form, the nonvaccinated are no longer only the poor or poorly educated. Exemption clusters are also found in wealthier

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His current work is focused on understanding the increased prevalence of autism.

<sup>1</sup>Some spatial clustering of the nonvaccinated is observable among those without health insurance or adequate postnatal care, those fearful that their immigrant status will lead to deportation should their children come under the gaze of the public health system, and those without the resources necessary to find a clinic for routine vaccination—in short, those who live in our nations’ poorest areas.

neighborhoods. Because social influence operates on the decision to not vaccinate, 1 in 11 elementary schools in California are at risk to a loss of herd immunity for childhood diseases arising from vaccine exempting parents (Lin and Poindexter 2009).

## VACCINE EXEMPTION AND THE TRAGEDY OF THE COMMONS

One might be tempted to say: Well, those who decide not to vaccinate their children are like drivers who refuse to wear seatbelts and we should just let them be. But the problem with this argument is that the externalities are not just more severe accidents. When a large enough portion of the population is vaccinated, herd immunity provides protection for the entire population, including children too young to be vaccinated or persons with compromised immune systems. As the number of nonvaccinated persons in a community increases, herd immunity is lost and the risk of vaccine-preventable diseases rises among the vaccinated (Salmon et al. 1999). The loss of herd immunity puts everyone at additional risk—those who are vaccinated because vaccines are not 100 percent effective, and those who cannot be vaccinated for other health reasons.

One could argue that the vaccine refusers are rational calculators and that it is not their problem if individual rationality leads to a tragedy of the commons—they are just making the safe, logical decision for their kids. They would rather risk a childhood disease than autism. They make their decision on the basis of three facts that they can easily see. First, the incidence of death from childhood disease is modest in developed countries—specifically 1 in 1,000 cases; second, the incidence of autism spectrum disorders is reported to be as high as 1 in 58 (for males) and 1 in 100 overall; and third, the increased prevalence of autism is temporally associated with vaccination schedules.

## DOUBT

The refusers have something else going for them as well: distrust. What many see when they look out at science is a vast conspiracy that interlocks government agencies (worldwide) with big pharma, whose reckless pursuit of profit leads them to leave the lives of their children in ruins. The distrust of big pharma could arise from the fact that pharmaceutical companies' advertising budgets are roughly 2.5 times their budgets for research and development, and 1.5 times greater than their profits, which are higher than any other industrial sector (Avorn 2004). But who knew that, and anyway, who needs such a complex foundation for mistrust of health-related science when history abounds? Wasn't it science that associated autism with refrigerator moms, that refused to tell African-American men with syphilis that there was a treatment available, or that told pregnant women with nausea to take thalidomide only to find that many of their children were born with serious birth defects as a result?

Those with doubts about science have historically been those with the least education, those furthest removed from the world of effete intellectual snobs (the Universities) in which science is nurtured. This has changed even if the old enemies of science remain, for example, the state legislature of Utah has weighed in against climate change; in Texas the board of education upheld teaching evolution in a *split vote*, and so on. But elite distrust of science is newer, and coincides with the Bush administration's effective demonstration that science was corruptible through the repression of findings, and its support of "junk" science. The sophisticated (elite) public that rejected the abstinence-only "science" and the falsified climate change data were nevertheless taught that doubt of government scientific agency statements was reasonable. One cannot help but wonder whether spillover from other revealed falsehoods—for example, the claims linking Iraq to Osama Bin Laden and weapons of mass destruction—contributed to this loss of confidence.

Just to be clear about the facts, there are *no* studies that show a clear relationship between MMR vaccines and autism, aside from the 1998 *Lancet* article by Wakefield, now retracted. The retraction achieved nothing, of course. The whole trial—to those who believe that vaccines cause autism—looked like a kangaroo court. The only thing that was missing was the confession. Despite the retraction, numerous organizations and celebrities believe that Wakefield was silenced either to stop the publication of a paper on Rhesus monkeys supportive of his findings (McCarthy and Carrey 2010)<sup>2</sup> or to continue to allow big pharma companies to reap profits from the manufacturing of vaccines. So parents pursuing vaccine exemptions could simply say, just calculate the odds: 1 in 1,000 for dying from measles versus 1 in 100 for descending into autism. The puzzle for scientists is the robustness of the belief in the fact that vaccines cause the heterogeneous disorders that make up the autism spectrum. Ecological study after ecological study has rejected the association—now more than two-dozen in total (Taylor et al. 1999). Hornig et al. have shown that the Wakefield hypothesis is not correct (Hornig et al. 2008). Animal models do not provide support. Orthodox science is of one voice.

On the other hand, those who advance ecological studies as the final word should be wary of overconfidence. Historically, local knowledge has often trumped received scientific wisdom (Coburn 2005) to reveal things once considered safe to be otherwise. From lead poisoning to asthma, lay experts—parents and community members—have often identified tangible risks ignored or unidentified by professional health researchers whose detection tools, while significant, are not immune to missing the real story. So it should not be surprising that many parents of children with autism doubt the science.

## TEMPORAL CONFUSIONS

Distrust of science is one reason why ecological studies are rejected. Temporal confusion is another. And the two are related. Time should be, but is often not, on the side of understanding. Two kinds of temporal confusions dominate the discourse on autism and vaccines. One problem arises from the search for single-bullet explanations. All single-bullet theories have one thing in common—deep down, they confuse correlated time series with cause. This leads to the first temporal confusion. The drive to publish, or less charitably the drive to publicity, creates the opportunity for scientists to trot out the new autism risk factor: ambient mercury, school lunches, PCBs, etc. The list is exhausting, and for most so-called risk factors, another study shows that it has “no effect,” or is “protective.” The half-life of risk factors is short. It is true that frozen yogurt consumption has increased over the past two decades, that emo music is on the rise, that kids spend more time in supervised play indoors, and that there is probably more electricity buzzing around wires. But these things do not cause autism, even if their increase is simultaneous to the increase in autism. The idea that vaccines cause autism because vaccine intake has increased over the past two decades is of the same order. Autism is a complex disorder. Looking for the single-bullet explanation is not going to be very successful. But the way the search has been conducted by scientists has produced a veritable Frankenstein. Why should we be surprised that parents adopt a single-bullet theory when scientists are in the business of identifying new global risk factors, even if they know that spatial and temporal heterogeneity necessarily influences our understanding of cause and reject, *prima facie*, such accounts?

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<sup>2</sup>Specifically, the Generation Rescue webpage of Feb 7, 2010 features a letter by McCarthy and Carrey that states: “Dr. Andrew Wakefield is being discredited to prevent an historic study from being published that for the first time looks at vaccinated versus unvaccinated primates and compares health outcomes, with potentially devastating consequences for vaccine makers and public health officials.”

When those arguing for a vaccine-autism link leave ecological studies behind and focus on actual lived experience, something changes. For some children with autism, the temporal correlation of vaccination and onset is reported to be strong, sudden, and dramatic. Here we see another kind of temporality at work in assisting causal explanation—the just-so story with which we began. It helps to recall that many sociological explanations rest fundamentally on some kind of just-so story—for example, this or that conflict started because this or that idiosyncratic event occurred in the context of this or that macro structure. Stories predominate, and just-so stories in particular, when science fails to provide plausible mechanisms for observed outcomes.

Reading parents' testimonials, skeptics point to the selective operation of memory as explanation. They argue that parents fearful of vaccines look more carefully at their children following a vaccine, and only then notice that something has gone awry. Selection on the dependent variable can be costly in terms of making the right causal inferences. Alternatively, experts argue that parents and children are often out of sync. Parents routinely have to catch up with their kids, whose developmental trajectory is more rapid than they experience on a day-to-day basis. In the same manner, parents may also need to catch up with developmental declines; declines underway are dated from the vaccine, but were really present earlier. Finally, cynics harbor the belief that parents' need for explanation locks them into support of the vaccine theory in just the same way that scientists' drive for publication of new results locks them into arguing too forcefully for their favorite toxicant or diver, be it diagnostic change or PCBs.

These kinds of comments only go so far. It is a weak social psychology that rejects the phenomenological reality of people as a byproduct of slight distortions of memory or wishful thinking. Social psychologists need to study the interactions, social dynamics, and cognitive mechanisms that produce this disconnect. This will amount to something more than simply repeating the Thomas and Thomas (1929) dictum: "If individuals define situations as real, they are real in their consequences." It will require paying attention to parents and their experiences to understand how their reality becomes true for them. There is no reason why both realities—the ecological reality of epidemiologists and the experiential reality of parents—cannot be simultaneously true. They are.

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