

Dear Senators Mullin and Campbell,

I am emailing you to show my support for S.87. As a member of a community in which only 43% of us vaccinate our children, I am increasingly concerned with the anti-science mentality that is driving this issue. I am well read on both sides of the vaccine debate, and I find the anti-vaccine research to be seriously flawed in both methodology and interpretation.

To give a brief but illustrative example, the anti-vaxxers claim that measles was on its way out all on its own, and that the introduction of the vaccine did not play any part in this, and is therefore ineffective. However, a close look at the graph they use to make this point references the number of deaths from measles per 100,000, not *the number of cases of measles*. In other words, we did get better at keeping people with measles alive, but we did not reduce the number of measles cases -- until the vaccine was introduced. Furthermore, the close to zero deaths from measles per 100,000 people still adds up to 400-500 deaths per year, and does not include those who suffer brain damage or other debilitating effects. That is a lot of children to lose to a disease that is preventable by a vaccine with a 99.999% safety rating.

Every claim the anti-vaxxers make turns out to be a case of misinterpreting the data, considering the data out of context, leaving out other highly relevant information, or blatantly refusing to accept modern science.

As I see it, the bottom line is this: yes, vaccines do carry risks, but the risks associated with the diseases themselves are far more frequent and more severe than those associated with the vaccines.

I am also attaching the draft of an article that I am co-authoring with a local pediatrician. There is much more to be said on the topic, but this article presents the approach of weighing the risks versus the stakes.

Again, I fully support this bill.

Thank you for your hard work and time.

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## Low risk, high stakes: A logical look at the vaccine debate

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The right to opt out of vaccinating one's children is an emotionally charged topic that has garnered increasing amounts of publicity from both sides, especially as outbreaks of measles are spiking among the unvaccinated. Opinion pieces and research-based articles frequent the Facebook pages of advocates pro and con, news segments are investigating the facts and fears, and books, such as Eula Biss' *On Immunity: An Inoculation*, explore the deeper societal issues driving this debate.

In order to make an informed decision about whether or not to vaccinate, one must weigh the risks against the stakes. For example, going for a walk in the summer without bug spray creates a high risk – low stakes scenario. The risk of getting mosquito bites is high, but the stakes – itchy bug bites - are low. Alternatively, riding in a car without a seat belt is a low risk – high stakes scenario. Chances are you won't get into a car accident, but if you do and you are not wearing a seat belt, you are very likely to be seriously injured or killed.

We know there is risk associated with vaccines. While dozens of peer-reviewed studies across several countries and over several decades have consistently and irrefutably shown that autism is *not* one of the vaccination risks,<sup>1,2</sup> mild reactions, such as temporary swelling or discomfort at the injection site, and severe reactions, such as seizures or encephalitis, can occur.<sup>3</sup> Neither those in favor of nor those against vaccines can legitimately argue with these findings.

The diseases themselves also come with risks. Measles (rubeola) is highly contagious and can result in debilitating and often fatal neurological complications, such as encephalitis and SSPE (subacute sclerosing panencephalitis). Polio, which no longer exists in the U.S.<sup>4</sup> due to vaccination programs beginning in the 1950s, is transmitted through person-to-person contact and can result in permanent paralysis and death.

The statistical likelihood of the risks – for both vaccinating and not vaccinating – is low. For those who vaccinate against measles, there is only a 5% chance of a temporary, mild

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<sup>1</sup> Herlihy, S. M. & Hagood, E. A. (2012). *Your Baby's Best Shot: Why Vaccines are Safe and Save Lives*. Maryland: Rowman & Littlefield Publishers, Inc.

<sup>2</sup> Institute of Medicine of the National Academies. (2004). *Immunization Safety Review: Vaccines and Autism*. Washington DC: The National Academies Press.

<sup>3</sup> <http://www.cdc.gov/vaccines/parents/vaccine-decision/side-effects.html>

<sup>4</sup> Polio is, however, prevalent in Afghanistan, Pakistan, and some African countries, making it a risk to the U.S. through immigrant populations and military personnel, especially if even a moderate proportion of the U.S. population is unvaccinated against this disease.

reaction to the MMR vaccine, and less than one in a million (.0001%) chance of a severe reaction.<sup>5</sup> The polio vaccine has not been known to cause any serious problems in vaccinated communities.<sup>6</sup>

The risk of an unvaccinated person contracting measles is more difficult to quantify since circumstances such as international travel, proximity to immigrant communities, and epidemics vary among and within communities. When an outbreak of measles occurs, however, the unvaccinated have a 90% chance of contracting measles if they come into contact with a person who has measles,<sup>7</sup> compared to the 5% chance of those who are vaccinated.<sup>8</sup> Because the vaccine program has eradicated polio from the U.S., there is, currently, no risk of contracting the disease.

The stakes, like the risks, for those who vaccinate and those who do not are low *in most cases*. Among the small percentage who do react to the MMR vaccination, the most common reactions are temporary mild swelling, discomfort, and low grade fever. Among those who contract measles, the most common symptoms are fever, runny nose, cough, and rash. In the rare instance of a severe reaction to the vaccine, symptoms may include deafness, long-term seizures, and permanent brain damage. In the rare instance of a severe case of measles, symptoms include debilitating and often fatal neurological complications. If one were to contract polio, flu-like symptoms are most common; meningitis, paralysis, and death are among the adverse consequences of the disease.

Overall, both vaccinating and not vaccinating typically fall under the similar low risk, low stakes scenario, though both options do carry a chance of severe outcomes.

The question then becomes: are severe reactions to the vaccine more or less likely than severe cases of the disease?

Across the diseases for which people typically receive vaccines, severe reactions to the vaccine are *less likely* than severe cases of the disease. There is a .0001%, or one in a million, chance of a severe reaction to the MMR vaccine, but a .15%, or one to two in a thousand, chance of death from measles itself.<sup>9</sup> Similarly, there is a .00002% risk of a severe reaction to the polio vaccine (and even less in well vaccinated areas), but a .5% risk of permanent paralysis and .001% chance of death from the disease itself.<sup>10</sup>

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<sup>5</sup> [www.cdc.gov/vaccines/vac-gen/side-effects.htm](http://www.cdc.gov/vaccines/vac-gen/side-effects.htm)

<sup>6</sup> In under vaccinated communities, there does exist a miniscule risk (655 cases out of 3 billion vaccinated children worldwide, or, .00002%) of the virus mutating and circulating. However, instances of cVDPV (circulating vaccine-derived poliovirus) are rapidly and effectively stopped by immunizing the under-vaccinated community.

<sup>7</sup> <http://www.cdc.gov/measles/about/transmission.html>

<sup>8</sup> <http://www.cdc.gov/vaccines/vpd-vac/measles/fags-dis-vac-risks.htm>

<sup>9</sup> <http://www.cdc.gov/measles/about/complications.html>

<sup>10</sup> <http://www.who.int/mediacentre/factsheets/fs114/en/>

To put those numbers in perspective, in the 1950s, before the polio vaccine program began, 35,000 people in the U.S. *each year* were crippled by polio<sup>11</sup> and in 1952 alone, over 3,000 died,<sup>12</sup> compared to the *one person (total)* in the U.S. who died in 1999 from a form of the vaccine that is no longer used. The only other adverse reaction is anaphylaxis, often due to the small amounts of antibiotics present in the vaccine, but that risk has been documented at less than one case per million doses of the vaccine.<sup>13</sup>

Before the measles vaccine, 3-4 million cases of measles occurred each year, 48,000 of those resulted in hospitalization, 4,000 developed encephalitis, and 400-500 died— *each year*.<sup>14</sup> According to the CDC, “...more than 240 million doses of measles vaccine were distributed in the United States from 1963 through 1993... Central nervous system (CNS) conditions, including encephalitis and encephalopathy, have been reported with a frequency of less than one per million doses administered.”<sup>15</sup> That means that fewer than 240 people have developed encephalitis and encephalopathy as a result of the vaccine over a thirty-year period, compared to the 400-500 people who died each year from measles before the vaccine.

Therefore, weighting the risks against the stakes indicates that the safest decision is to vaccinate. However, this discussion is not complete without including the concept of herd immunity. Herd immunity occurs when a critical portion of the population is immunized against a contagious disease, creating, in effect, a wall that minimizes the spread of an outbreak, and thus providing protection to the small percent of the population who are not immune, such as infants, pregnant women, and immunocompromised individuals. Also, because most vaccines do not provide complete protection on their own, herd immunity increases the effectiveness of any vaccine program. It is estimated that 95% of the population must be immunized in order to achieve herd immunity.

Anti-vaccine advocates, however, often argue that the diseases themselves offer the best immunity, without the added risk associated with vaccines. The Vaccine Council, whose self-stated purpose is to counter the notion that vaccines are safe, states that, “Before vaccines, outbreaks of measles were observed in 2-3 year cycles, and 95% of the population developed immunity by the age of fifteen”.<sup>16</sup> But this natural immunity came at a cost, as evidenced by the 48,000 people who were hospitalized, 4,000 who

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<sup>11</sup> <http://www.cdc.gov/polio/about/index.htm>

<sup>12</sup> <http://www.npr.org/blogs/health/2012/10/16/162670836/wiping-out-polio-how-the-u-s-snuffed-out-a-killer>

<sup>13</sup> <http://www.ncbi.nlm.nih.gov/pubmed/14523172>

<sup>14</sup> <http://www.cdc.gov/vaccines/pubs/pinkbook/index.html>

<sup>15</sup> <http://www.cdc.gov/mmwr/preview/mmwrhtml/00046738.htm>

<sup>16</sup> <http://www.vaccinationcouncil.org/2012/07/05/herd-immunity-the-flawed-science-and-failures-of-mass-vaccination-suzanne-humphries-md-3/>

developed encephalitis, and 400-500 who died each year prior to the vaccine.<sup>17</sup> After the MMR vaccine was developed, the cases of measles have dropped drastically, and until the recent outbreaks in unvaccinated communities, there was an estimated <1 case per million people per year, typically attributed to international importation,<sup>18</sup> which averaged out to roughly 100 cases per year.<sup>19</sup> These statistics not only prove that the MMR vaccine protects against the measles, but also confirm the effectiveness of herd immunity.

Herd immunity significantly changes the risk/stakes equation in that the risk of not vaccinating affects the entire community, while the risk of vaccinating does not. In other words, one child experiencing adverse effects of the MMR vaccine does not increase the risk of adverse effects for any other child; but for each child beyond the 5% who are not vaccinated with MMR, the risk of measles increases for the entire community. If diseases such as measles and polio hit a community without herd immunity, the unvaccinated are completely unprotected, the risk to the already vaccinated increases, and an epidemic ensues. With a large percent of the population likely to contract the disease, the percentage of people who suffer severe cases also increases accordingly. Now, the originally low risk – low stakes scenario of opting out of vaccinating has created a high risk – potentially high stakes scenario for an entire community.

Despite the social pressure to vaccinate ensured by the concept of herd immunity, many non-vaccinators remain unconvinced. Perhaps they still believe the risks are low enough, even without herd immunity, to warrant exposing so many people to such high stakes. But the recent increase in measles outbreaks is proof that the risk is not actually all that low once a large enough segment of the community opts out of vaccinating. The incidence of measles continues to increase at an alarming rate, with over 600 cases reported in 2014, and nearly 100 cases already reported in January of 2015.<sup>20</sup>, compared to the typical 100 cases per year.

Perhaps non-vaccinators simply don't believe the stakes of the diseases in question are as high as the medical profession makes them out to be. After all, people did survive these diseases with no lasting negative effects, and there are currently (thanks to vaccines) very few people who are very sick with them. Non-vaccinators do not feel they should have to put their child at risk in order to prevent another child from contracting a mild case of the measles. This is understandable to some degree, considering that most parents are more likely to hear of or witness a reaction to a vaccine than a severe case of the disease itself (again, thanks to the vaccines that have made the diseases extremely rare). In other words, vaccines have become a victim of their own success.

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<sup>17</sup> <http://www.cdc.gov/vaccines/pubs/pinkbook/index.html>

<sup>18</sup> [http://jid.oxfordjournals.org/content/189/Supplement\\_1/S1.long](http://jid.oxfordjournals.org/content/189/Supplement_1/S1.long)

<sup>19</sup> <http://www.cdc.gov/measles/cases-outbreaks.html>

<sup>20</sup> <http://www.cnn.com/2015/01/28/health/california-measles-outbreak/>

But the generations before us remember the reality of these diseases. Our grandparents all knew neighborhood children who died of or suffered from a wide range of irreversible neurological, muscular, and cognitive deficits due to these diseases. People living in countries without access to vaccines continue to die from these diseases. The diseases and their lasting effects do exist, and they are coming *back* to this country solely because a growing number of people are refusing to vaccinate.

Regardless, the non-vaccinating movement persists, indicating that some other issue must be at play in this debate. Our notoriously fear-based culture, the libertarian opposition to government regulation and mandates, and a general distrust of modern medicine and scientific research have all been cited as playing a role in fueling the anti-vaccine movement.

At a more individual level, non-vaccinating parents don't want to expose their children to the perceived risk. They know someone who suffered side effects, or who was vaccinated and contracted the disease anyway, they don't trust the vaccine manufacturers, or maybe their naturopath or herbalist advices against it. These personal sentiments outweigh the statistically proven reality that it is far safer for everyone to vaccinate. Of course, many parenting decisions are based on emotions and anecdotes.

An example of this type of thinking is a parent with an 18-month-old who, when strapped into his rear-facing car seat, screams for the duration of the car ride. The parent is much more likely to switch the car seat to forward-facing. The risk of a car accident is low, but the stakes are considerably higher if the 18-month-old is forward-facing. In fact, children under age two are 75% more likely to die or sustain serious injury in the event of a car crash if they are in a forward-facing car seat.<sup>21</sup> Yet the parent still switches the car seat to forward facing because the immediate, emotional stress on the parent and child trumps the potential, future consequences.

Similarly, parents who opt out of vaccinating their children may well be making a decision based on the immediate, emotional fear rather than the statistical reality of the future. There is no doubt that intentionally exposing your child to an immediate risk instinctively feels worse than unintentionally exposing your child to a future risk, even though the immediate risk is actually less of a risk than the future one.

Moreover, the perceived risk of vaccinating is often unfounded due to the common but faulty post-hoc ergo propter hoc (after this, therefore because of this) attribution of health problems to vaccines. For example, consider two children who wander down to a stream and find a patch of wild watermelons. They eat the watermelon, and soon after they develop severe fevers. The parents attribute the illness to the watermelon and forbid their children from eating it again. Furthermore, they tell everyone in their town

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<sup>21</sup> Henary, B., Sherwood, C. P., Crandall, J. R., Kent, R. W., Vaca, F. E., Arbogast, K. B. & Bull, M. J. (2007). Car safety seats for children: rear facing for best protection. *Injury Prevention* 2007;13:6 398-402.

that the watermelon made their children sick, and none of the townspeople go down to the stream to eat the watermelon. However, the illness was, in fact, malaria, caused by mosquito bites the children got while eating the watermelon by the stream.

In other words, notwithstanding that dozens of carefully controlled research studies have been unable to establish a connection between vaccines and the many reactions falsely attributed to them, parents desperate for an explanation for their children's health or behavioral problems incorrectly blame vaccines. The end result is that personal belief based on anecdotal evidence persists in the face of abundant contrary scientific evidence.

Parents who opt out of vaccinating their children are also typically those who follow the natural parenting movement (please note this does not state that proponents of natural parenting opt out of vaccinating their children; rather, parents who opt out of vaccinating their children tend to be proponents of natural parenting). That is, they are conscientious about what goes into their children's bodies, preferring breast milk to formula, organic, whole foods to non-organic, processed ones, free range meat to high density, farmed meat, and herbal remedies to more traditional, Western medicine. For many parents of this mindset (though again, not all), the naturally occurring disease is instinctively preferable to an injection of a synthetic product that is mass-produced by a for-profit company.

Finally, there exists a layer of community judgment. Admitting to a community of non-vaccinating parents that you do in fact vaccinate your children often elicits disapproval, sometimes even an outright accusation along the lines of: *you willingly put your child at risk by pumping scary, disease-causing microorganisms into his/her little body?! This type of peer pressure from a health conscious crowd is powerful and difficult to resist, especially when not vaccinating a child is statistically the safest option in a community in which 95% of the people do vaccinate their children.*

However, with the increasing numbers of non-vaccinators, the herd immunity that protects the non-vaccinated is disappearing. A parent can no longer opt out of vaccinating his or her child without increasing the risk for that child *and for every other child*. The social consequences of this choice are very real.

In addition to increasing the risk for vaccinated children, people who have weakened or underdeveloped immune systems are denied protection against preventable diseases. For example, a child with cancer contracts the measles from a vaccinated sibling who, unfortunately, attends a school in which less than 95% of the population is vaccinated. Measles in a child with cancer is likely to be fatal. Premature babies who are unable to be vaccinated for the first several weeks or even months of life are also at greater risk, as are full term newborns, especially those who are not able to be breastfed, and also the elderly. All of the people whose lives rely on herd immunity are put at risk. That

number is far greater than the <.0001% of vaccinators who experience the severe effects associated with any of the vaccines.

The reality of society without herd immunity is not a speculative, hypothetical state. It existed a mere 60 years ago, and the risk-stakes scenario of the pre-vaccine era was far worse than the risk-stakes scenario of the past several decades. But aside from the increased risk for the entire community, opting out of vaccinating against the measles puts the non-vaccinated individual at a greater risk for contracting the disease, and *the disease itself carries a greater risk for an adverse outcome than the vaccines.*

It is difficult to imagine a family would opt out of the one in a million chance of an adverse reaction to the measles vaccine in exchange for the one in a thousand chance of adverse outcome to measles itself, or even the one in a million chance of death from measles. It is even more unfathomable that a family would opt out of vaccinating knowing that contracting and spreading even a mild case of measles will result in permanent brain damage in 1-3 children out of every thousand, and all but guarantee the death of an immunocompromised child in the community.

Let's hope it does not take the severe illness or death of a child in close proximity to or within non-vaccinating families to alert them to what it means to live with these preventable diseases; because we know from history that an increase in child morbidity and mortality is exactly what will happen if the anti-vaccine community continues to opt out of vaccinating.