



WPLab

Acetaminophen and Autism

A review for parents
and guardians

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SUMMARY



Based on the scientific evidence we have been able to conclude without a reasonable doubt that exposure of susceptible babies and children to acetaminophen causes many if not most cases autism.

Hearing that acetaminophen (the main ingredient in Tylenol) use in susceptible babies and children causes autism spectrum disorder (autism) can be very alarming for many parents and guardians. There is much to consider, like how do we know, how much autism, which babies and children are susceptible, and what do we do without acetaminophen?

These questions, and more, can all be addressed through the dozens of scientific reports, thousands of hours of research, and the many independent scientists and laboratories that found significant evidence that led to the singular conclusion that acetaminophen causes many if not most cases of autism.

Yet for the average individual, that kind of writing, time, or even reading dense medical jargon can be difficult. We want to make this information as clear and friendly as possible. Let's talk about the full range of "how we know" and what society can do to make a difference when it comes to the total number of cases of autism.

All scientific studies will be cited throughout this white paper and linked at the end for your own review.

Science vs Conspiracy

Conspiracy theories usually pop up overnight and include alleged facts that may be difficult to verify and are linked together by fragile chains of logic.

Scientific theories take years to develop and are built by independent lines of evidence that point toward one single conclusion.

We now have more than 20 lines of evidence that acetaminophen causes autism. It's a scientific, not conspiracy, theory.



OVERVIEW



Based on recent reviews of 20 lines of evidence, we have concluded without reasonable doubt that acetaminophen administration causes many, if not most, cases of autism as well as other brain development problems. [1, 2]

Let's break down some of these terms:

Acetaminophen: Acetaminophen has many names such as paracetamol (in Europe), and is in many popular over the counter drugs such as Tylenol in the United States. It is a chemical that is primarily used to treat pain and fevers.

Lines of evidence:

Each line of evidence is a scientific experiment or observation that potentially points to a conclusion. In science, it often takes many lines of evidence before a conclusion can confidently be reached.

Concluded without reasonable doubt:

There are enough lines of evidence to draw a firm conclusion, which makes it a fact of science.

Categories of Evidence

All of the evidence can be bucketed into 6 general categories:

- 1** Studies in laboratory animal models
- 2** Connections between autism, acetaminophen, and human activities such as vaccination and circumcision
- 3** Understanding how acetaminophen actually works within the body, and the pathways or mechanisms with which it works and causes damage
- 4** Associations between acetaminophen administration and ASD during the later stages of pregnancy and in early childhood
- 5** Associations between acetaminophen use and ASD through time
- 6** Miscellaneous evidence that doesn't fit neatly in another category

20 LINES OF EVIDENCE



In total, there are more than 20 lines of evidence that point toward a connection between the use of acetaminophen and autism and the dangerous impact it has on susceptible babies and children.

Here they are, briefly described. You can find the link to all of these at the end of the white paper for your own full review.

1	Animal Studies	Laboratory mice and rats develop long-term brain damage and behavioral changes when given acetaminophen when very young [3-7]
2	Animal Studies	Acetaminophen and related drugs have greater effect on the male brain [6]
3	Animal Studies	Acetaminophen kills nerve cells in the brain in adult lab animals [8]
4	Miscellaneous	Acetaminophen has never been proven to be safe for children [9]
5	Associations with human activities	Circumcised males have a 2 times greater chance of getting infantile autism than uncircumcised males [10]
6	Associations with human activities	An unexpectedly high prevalence of autism identified when acetaminophen products for children were repeatedly found to have too much active ingredient [11-13]
7	Associations with human activities	Orthodox Jews, who do not traditionally use acetaminophen, have a substantially lower prevalence of autism [14]
8	Pre- and Post- Natal Associations	Babies associated with acetaminophen exposure after birth were found to be 30% more likely to have autism [15], although later analysis shows this may be a vast underestimate [1]
9	Associations in time	Ratio of regressive to infantile autism rose at the same time acetaminophen replaced aspirin in the pediatric market [16, 17]
10	Associations in time	Autism increased at the same time that acetaminophen started replacing aspirin in the market
11	Associations in time	As direct-to-consumer advertising increased [18], use of acetaminophen [2] and autism [16] also rose in prevalence
12	Pre- and Post-Natal Associations	Use of acetaminophen during pregnancy is connected to long-term effects such as lower IQ, ADHD, and autism [15, 19-31]
13	Pre- and Post-Natal Associations	Higher levels of acetaminophen in the baby's umbilical cord at the time of birth are strongly associated with autism [23]
14	Associations with human activities	Acetaminophen given with a vaccine is connected to autism, but vaccination alone is not [32]
15	Associations with human activities	Up to 50% of parents who have a child with autism believe that vaccines were involved in the induction of their child's autism. This can be explained by the simultaneous administration of acetaminophen with vaccines [33, 34]
16	Pre- and Post-Natal Associations	Acetaminophen use during childhood is connected to a 20-times increase in regressive autism [32]
17	Miscellaneous	Multiple studies show acetaminophen affects the social function of the brain in adults [35-37]
18	Mechanisms of action	Individuals with cystic fibrosis have metabolism that effectively deals with acetaminophen [38, 39], which makes the drug much less toxic, and they are apparently not prone to have autism [16]
19	Mechanisms of action	Children with autism cannot metabolize acetaminophen well [40], which makes the drug much more toxic
20	Mechanisms of action	Acetaminophen is known to be highly toxic in the presence of oxidative stress (when there's too many things for the body to "burn" or clean out), and factors that cause oxidative stress are associated with autism [16, 40, 41]
21*	Animal Studies	Low doses of acetaminophen are lethal in cats because they are deficient in a key enzyme [42, 43] that is also deficient in babies [44, 45]

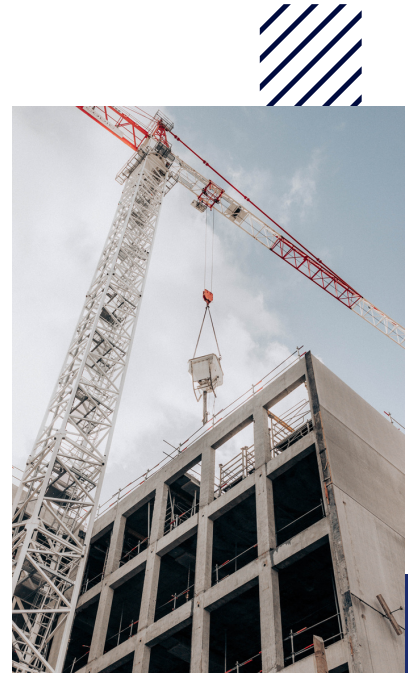
*Cats have been known since the 1980s to be very sensitive to acetaminophen, but it was only recently realized that this was important for understanding autism! Therefore, this factor has not been listed in our previous publications.

OXIDATIVE STRESS

What makes a baby or child susceptible?

Let's talk a bit about oxidative stress.

The cells in our body need energy to do their jobs, and they get this energy by breaking down the food we eat. Cells also break down toxins and drugs that they are exposed to. This all happens by the cells "burning" these things, or the more scientific term "oxidation." When cells burn things, it's usually safe, but in the process, they create tiny little messes. These messes are typically cleaned up by our body's antioxidants, or little superheroes inside the cell that keep everything tidy. But sometimes, there can be too many messes and not enough superheroes, and that's when we have "oxidative stress." This stress can make our cells a little sick and sometimes can even make them not work so well. So, it's important to eat healthy foods, exercise, and get lots of rest to help our superheroes keep our cells happy and healthy.



Imagine this like an equation:

preexisting factors + added risks = oxidative stress

Preexisting Factors

Examples: Genetics, increased age of parents, diabetes, autoimmune conditions, obesity, preterm birth, etc.

+

Added Risks

Examples: Infection, cigarette smoke, vitamin D deficiency, antibiotic use, environmental toxins, etc.

=

Oxidative Stress / Inflammation

OXIDATIVE STRESS



Summary

- Oxidation simply means something is burning.
- Controlled oxidation is necessary, normal, and healthy for the human body.
- Oxidative stress occurs when you have both genetic factors and external factors deplete your capacity (antioxidant superheroes) to keep up with the normal burning process.
- Oxidative stress is not normal, but unfortunately common.
- Oxidative stress can have a significant impact throughout your body, causing impaired immune function. Sometimes oxidative stress even sends chemicals down dangerous pathways for processing.

Autism is often seen as a very complex condition, in part because so many different factors are associated with it. By realizing these factors cause oxidative stress, the complexity is explained.

The reason why we are so interested in oxidative stress is because the amount of oxidative stress determines how a baby or child processes acetaminophen, which we will discuss in the next section.



Autism and Acetaminophen



What actually causes autism?

It's not oxidative stress alone that causes autism. As you've already gathered, there's a significant piece for acetaminophen to play in this [16]. Where exactly does that come in?

The simplest way to start is to continue our equation from earlier to show how this comes together: oxidative stress + susceptible babies and children + trigger (aka acetaminophen) = autism (ASD)

$$\text{Oxidative Stress} + \text{Susceptible babies and children} + \text{Trigger (Acetaminophen)} = \text{Autism}$$

Acetaminophen, when given to an adult, affects the liver. But when acetaminophen is given to a baby or child, it is not the liver but the brain that is most affected if anything goes wrong. Since the liver is not nearly as active in babies and small children, more of the chemical is processed in the brain, and when the brain is still developing it is very sensitive to chemicals. This is why, in the presence of oxidative stress (not oxidation) acetaminophen can be very toxic to the brain.

This is how acetaminophen causes many, if not most, cases of autism in susceptible babies and children [16].



BY THE NUMBERS



How much autism is caused by acetaminophen exposure in susceptible individuals during early brain development?

Sadly, nobody knows, and nobody will know with certainty until we stop using the drug during early brain development.

However, we can make an educated guess. The strong associations between autism and a number of factors, including acetaminophen levels at the time of birth, circumcision, and acetaminophen use with vaccination, are very informative.



This information combined with the trends in the rise of autism over the past 40 years and the very specific way that acetaminophen targets social function tells us that it's entirely possible that the vast majority of autism, more than 90% of all cases, is caused by acetaminophen exposure.

The Bottom Line – It's Hard to Know How Much

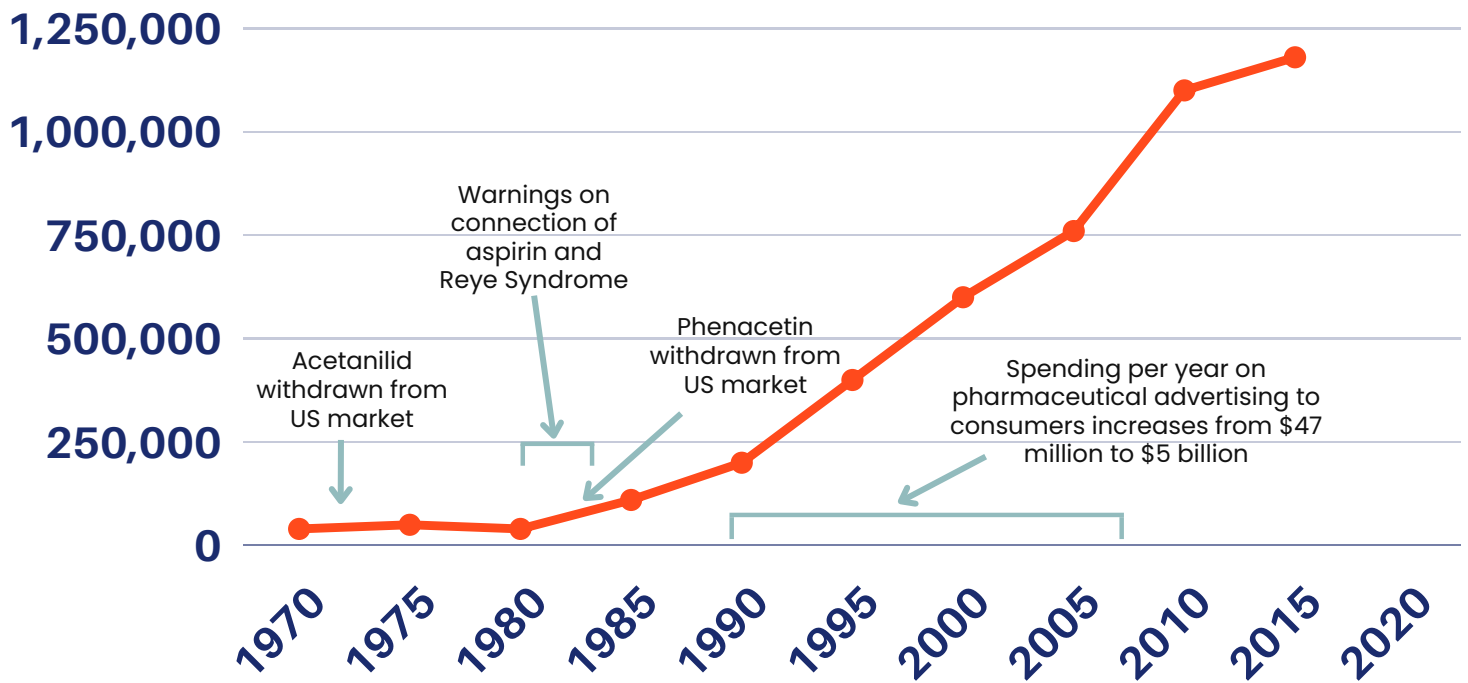
Despite not knowing the exact number of cases of autism caused by acetaminophen, it is possible to make an estimate. Given all the information we've shared so far, we estimate that eliminating exposure to acetaminophen during early brain development could plausibly result in a greater than 90% decrease in the prevalence of ASD.

There is a lot more information here, and we would recommend you [read this other resource in full](#), if you would like to understand the numbers, nuances, and even some uncertainty about just how many cases would be avoided.

SOME HISTORICAL CONTEXT

It could be argued that acetaminophen cannot possibly cause all cases of autism since autism was discovered in the 1940s, when acetaminophen was not used until the 1950s. However, there were two other drugs, perhaps even more dangerous than acetaminophen, on the market before acetaminophen was officially available. Phenacetin and acetanilid, which are both converted into acetaminophen by the human body [46, 47], were introduced in Germany in the 1880s and widely used as pain relievers [47, 48] until they were determined to be toxic to the human body [47, 49].

Acetanilid was banned in the US in the 1970s, and phenacetin was withdrawn from the US market in 1983, approximately the same time that aspirin was removed from market for its own harmful effects and acetaminophen was beginning to rise in popularity. With this in mind, it is possible that some of the earliest known cases of ASD reported in the 1940s in Germany [50] and in the US [51] were induced by acetaminophen as a result of exposure to acetanilid or to phenacetin.



Increase of Autism Over Time

PAIN AND FEVERS

If it's harmful, why do people use acetaminophen?

There are two main reasons that acetaminophen is given to babies and children; pain and fevers. It is common practice for a doctor to recommend acetaminophen as part of the parental toolkit to assist in providing comfort or relief to babies and children.

Scientifically speaking, **acetaminophen has never been proven to provide any long-term benefits to children.**

For many, this will be very surprising. So let's break down what the research says about pain and fevers, the two main reasons it's administered.

Pain

Acetaminophen treats some, but not all, pain effectively. We've even seen some types of common pain for children not be treated by acetaminophen at all.

For example, acetaminophen does not effectively treat the pain of circumcision [52]. Additionally, the World Health Organization does not recommend use of acetaminophen (typically administered to preemptively assist with discomfort at the injection site or possible side effects like fevers) with vaccination because it has not been proven to work and it may diminish the intended effect of the vaccine itself [53, 54].



PAIN AND FEVERS



Fevers

There's no research or evidence that treating a fever is beneficial [55-59]. In fact, there's one study that showed treating a fever did not positively affect outcomes in adult patients [60]. In babies and children, studies show that acetaminophen use at home does not prevent seizures from fevers [61, 62]. More importantly, as the American Academy of Pediatrics points out [63], there are no long-term adverse effects of having a simple febrile seizure. Contrary to popular belief, having a febrile seizure does NOT put your child at risk from death or even loss of intelligence.



While some severe fevers are associated with brain damage, there's no conclusive evidence that the actual fever is the real threat, and there is no evidence that acetaminophen treats those life-threatening fevers associated with life-threatening things such as brain infections or head trauma.

Fevers themselves are protective [55-59]. It's not a part of the problem, but part of your body's natural immune response aimed at solving the problem. Basically, it's a sign that the body is doing its job to protect against infection.

Summary

Current research shows that the benefit to acetaminophen to block or reduce fevers is unproven or possibly non-existent, but the risk to brain development in babies and children is considerable. This does leave parents and guardians with difficult decisions.

AND NOW WHAT

What should be done, now that we know acetaminophen can be so dangerous?

We cannot give medical advice, but acetaminophen has never been shown to save a single human life, nor has it ever been shown to be safe for babies and children by any test or experiment.

There are two main ways that you can do something right now: *make a plan, and take action.*



1. Make a Plan

The best advice we can give is for parents and guardians to make a plan in advance.

This may seem simple, but those critical moments where you or a loved one must see a child suffer, are the times when we react out of emotion, not based on our knowledge or convictions. Making an action plan for what you will do to mitigate pain and fevers will be a critical tool in your arsenal.

Here are some questions to ask, answer, write down, and keep close by when those stressful times happen:

- What will we do when my baby/child has a fever? What temperature will we call our doctor? What methods will we use to bring down the fever? What methods will we use to make them comfortable?
- What will we do when my baby/child is in pain? What types of pain might they experience (ex: teething, papercut, constipation, etc.) and what will I do in these instances to help them feel better (solutions may vary per situation)?
- What will I say to my doctor about my approach to giving my child medication?
- What instructions will I give to those that watch my baby/child (ex: family members, babysitters, etc.) as it relates to these critical moments?
- Who will I call when I get overwhelmed and need support?

We can not give medical advice, so we have compiled [a list from other sources of alternative ways to treat pain and fevers](#), for your own educational convenience.

AND NOW WHAT



2. Take Action

The greatest way that you can take action is by not letting your new knowledge stop with you. Here are three things you can do to take action right away:

LEARN

Being informed is one of the most important parts of making change.

We've assembled lots of different kinds of resources, from [our own research](#) to other sources weighing in on [alternative options to acetaminophen](#). We even have several social media channels that you can like and follow for ongoing information. This can all be found at the end of this white paper, or at [wplab weighing in](#)

SHARE

Amplifying the information you learn about the connection between acetaminophen and autism is a key way to get the word out about how we can decrease the prevalence of autism.

Share the message with other parents and guardians to let them make educated decisions on administering acetaminophen to their babies and children. This could be word-of-mouth, at regular parent-meetups, on social media, or other places that you frequent. Don't underestimate the power you have within your own network.

DO

Participate in the cause by taking personal action, whether posting on social media, calling your local representatives, and participating in other initiatives.

This is a constantly evolving process, with more lines of evidence being uncovered and more outreach being done regularly. By staying connected to the community and the cause, you can stay informed on other actions to take and information to share.

With your help, we can significantly decrease the rate of autism.

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More about WPLab Inc.

WPLab is a not-for-profit company that conducts research and education related to immune system dysfunction in high-income countries. A current focus is the interaction between the immune system and acetaminophen (paracetamol) early in life, and how that interaction affects brain development. We are currently conducting laboratory work, and, at the same time, work with social media and other venues to educate caregivers about what is known regarding the impact of acetaminophen (paracetamol) on the developing brain. For more information about WPLab, please see our website at www.WPLaboratory.org.