Autism prevalence time trends, risk factors & prenatal ultrasound

A unifying hypothesis in four parts

By Caroline Rodgers
Temperature & Pregnancy
Unifying hypothesis

Thermal intrusions on the fetal environment of any kind increase the risk of autism

Prenatal ultrasound produces heat when the sound waves it generates are absorbed by tissue

The constantly expanding application of ultrasound to prenatal care is driving the autism epidemic
Fetal temperature regulation is critical to proper neurological development

Hot tubs – neural tube defects
Fever during labor – cerebral palsy

Maternal heat-related events that increase autism risk

• Fevers
• Infections
• Fever-producing viruses
• Drugs that disrupt the thermoregulatory system
AUTISM PREVALENCE & PRENATAL ULTRASOUND TIME TRENDS

Two data sets under consideration:

- Centers for Disease Control (CDC) autism prevalence figures from ADDM Network, 2000-2008
- Prenatal ultrasound time trends between 1995-2006

To arrive at the year of gestation, prenatal ultrasound exposure is reckoned nine years prior to 8-year-old cohort groups.
AUTISM PREVALENCE INCREASES

Up 78% between 2002-2008

Identified Prevalence of Autism Spectrum Disorders
ADDM Network 2000-2008
Combining Data from All Sites

<table>
<thead>
<tr>
<th>Surveillance Year</th>
<th>Birth Year</th>
<th>Number of ADDM Sites Reporting</th>
<th>Prevalence per 1,000 Children (Range)</th>
<th>This is about 1 in X children...</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>1992</td>
<td>6</td>
<td>6.7 (4.5-9.9)</td>
<td>1 in 150</td>
</tr>
<tr>
<td>2002</td>
<td>1994</td>
<td>14</td>
<td>6.6 (3.3-10.6)</td>
<td>1 in 150</td>
</tr>
<tr>
<td>2004</td>
<td>1996</td>
<td>8</td>
<td>8.0 (4.6-9.8)</td>
<td>1 in 125</td>
</tr>
<tr>
<td>2006</td>
<td>1998</td>
<td>11</td>
<td>9.0 (4.2-12.1)</td>
<td>1 in 110</td>
</tr>
<tr>
<td>2008</td>
<td>2000</td>
<td>14</td>
<td>11.3 (4.8-21.2)</td>
<td>1 in 88</td>
</tr>
</tbody>
</table>

http://www.cdc.gov/Features/CountingAutism
PRENATAL ULTRASOUND TIME TRENDS

Average number of scans per pregnancy increased 80% over 10 years

High risk pregnancies
From 2.2 scans to 4.4

Low risk pregnancies
From 1.3 scans to 2.1

Increase in number of prenatal ultrasound scans in low-risk & high-risk mothers.
Effect of ultrasound increases beyond 1999 will not be evident until data are available for 8-year-old cohorts from 2009 to 2015.
Increase in % of women undergoing ultrasound

Increased from just under a half to a majority during the 1990s. 

Figure 5. Percent of births that included electronic fetal monitoring (EFM), ultrasound, induction, or stimulation of labor: United States, 1989 and 1997

If there is a correlation between prenatal ultrasound and autism, autism prevalence will increase much more sharply in the cohorts in gestation from 2000 through 2006.
AUTISM RISK FACTORS: MATERNAL OBESITY

- Childhood Autism Risk Factors from Genetics and Environment (CHARGE) Study found that obese mothers were 67% more likely to have a child diagnosed with autism than controls.
- In the U.S. about 1/3 women of childbearing age are obese.
South Korea Autism World’s Highest 1 in 38\textsuperscript{13}

South Korea Obesity Tied\textsuperscript{1} for Last Place at 3.2%

U.S. World Highest Adult Obesity 30.6\%\textsuperscript{12}

U.S. Autism 1 in 88 \textsuperscript{8}

Chart from: http://www.nationmaster.com/graph/hea_obe-health-obesity
U.S. FEMALE ADULT OBESITY & AUTISM PREVALENCE BY ETHNIC GROUPS

What could explain the U.S. obesity-autism association and South Korea’s high autism rate?
Types of prenatal ultrasound equipment

- **Transabdominal transducer** (standard)
  - Glides over belly
  - Transmits sound waves through abdominal wall
  - Produces image with frequencies in the range of 3-5 MHz\(^{15}\)
  - Used primarily in second and third trimester

- **Transvaginal probe**
  - Inserted in vagina
  - Transducer is physically closer to embryo/fetus
  - Ultrasound beam is unobstructed by abdominal wall
  - Produces better resolution images with frequencies in the range of 5-10 MHz\(^{15}\)
  - Used primarily in first trimester and with obese women
**Fact & conjecture**

- **FACT:** Pregnancies of obese mothers are classified as high risk and as such, subject to more scans \(^9,\)\(^{16}\)
- **FACT:** Obese mothers are more likely to be examined with transvaginal ultrasound further into pregnancy \(^{17},\)\(^{18}\)
- **CONJECTURE:** South Korean women are more likely to be exposed to ultrasound scans, including transvaginal ultrasound, because:
  - **FACT:** Transvaginal ultrasound produces higher resolution images \(^{17}\) and South Korea has positioned itself on the cutting edge of medical imaging technology \(^{19}\)
  - **FACT:** Medical specialist, who are more likely to order tests, make up more than 80% of South Korea’s practicing doctors \(^{20}\)
  - **FACT:** About 90% of Korean medical services are provided by the private sector, which has been found to overuse medical technology \(^{20}\)
Observation

Unless the reason children in South Korea develop autism is completely different from why children in the CHARGE study develop autism, there must be a common denominator.
PART 3  Autism risk factors: fever

- Maternal fevers double the risk of autism \(^3\)
- Fever-lowering medication reduces or eliminates the risk \(^3\)

In conclusion, we did not find an association between maternal influenza infection during pregnancy and either ASD or developmental delay. However, mothers whose children had autism spectrum disorders at ages 2–5 years were more likely to report fever from any cause during pregnancy compared to those of similarly aged children with typical development. This was also true of mothers whose child had developmental delay. Our results additionally suggest that anti-fever medication used to control fever during pregnancy can reduce or eliminate the association we observed between maternal fever and autism.
PART 3 Observation

Fever studies explain the ‘odd uncle’ and other rare cases of autism that occurred naturally before the introduction of man-made thermal intrusions to the fetal environment.
The cause of autism is likely to be simple, not complex. The steady increase in autism argues against a complex etiology because the more factors involved in the disorder, the less likely it would progress in an even curve.

Cumulative increase in autism in U.S. schools 1992-2008

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Steady increase in percentage of U.S. women exposed to prenatal ultrasound

From 1997 through 2002, the percentage of women exposed to ultrasound only increased four points over six years, from 64 to 68% \textsuperscript{10, 22}

1989 47.7% 2002 68%

1989 68.4% 2002 85.2%

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Observation

The many maternal risk factors associated with autism such as fever, infection, viruses and certain drugs – or even pesticides and pollutants – have not increased steadily over time among the general population.

However, prenatal ultrasound use has increased steadily over time in the percentage of women exposed, the number of scans per pregnancy and the gestational window of exposure. During this period of increasingly great exposure, the technology has also changed, exposing fetuses to higher energy frequencies during the critical first trimester.
How hypothesis fits unexplained autism facts

If thermal intrusions on the fetal environment are causing autism.

- The de novo copy number variations associated with autism may be artifacts of heat-related genetic changes.
- It may explain regressive autism, since in utero thermal damage to heat-shock proteins or mitochondria could leave critical cells defenseless during the high fever that sometimes follows vaccinations.
- It may shed light on why some people with autism have a decrease in symptoms during fever episodes.
- Since male and female brains develop in different sequences, it might explain gender-related differences in autism prevalence.
Re-defining autism

Changes in the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5) will not alter the fact that autism has become epidemic. The proof is in the urgent need for new services for children with autism who are aging out of the school system — which Autism Speaks calculates will number half a million over the next 10 years.
Conclusion

Thermal intrusions on the fetal environment of any kind can increase the risk of having a child with autism.

Because the graph created by autism prevalence over time proceeds in an upward curve and does not have peaks and valleys, it is likely that a single thermal factor is driving the autism epidemic.
REFERENCES


Caroline Rodgers -- IACC July 10 2012