# Do Environmental Toxins Increase Autism Rates?

Michelle Camire

# What is Autism?

- 1 of 5 Pervasive developmental disorder (PPD)
- 3rd most common developmental disability
- 75-80% of people with autism also have mental retardation
- Neurological disorder that affects the normal functioning of the brain
- Appears in the first 3 years of life
- Impacts social interactions and communication skills

# Autism Symptoms

- difficulty relating to people, objects, and events
- repetitive movements such as rocking or spinning, head banging
- atypical reactions to touch, sound, taste, pain
- maintain certain routines
- difficulty with change and transitions
- limited or poor eye contact
- impaired communication skills
- use of toys and objects in an unconventional manner
- may have typical or exceptional abilities in specific areas (e.g. putting puzzles to-gether), but lack other basic skills (e.g. can’t follow directions)

# Why Autism Research Is Needed

- 1 out of 150 children are diagnosed with autism.
- 67 Children are diagnosis each day, that is one case every 20 minutes.
- Autism affects boys four times more than girls.
- 1 out of every 94 boys will have autism.
- Autism knows no racial, ethnic or social boundaries.

- No known single cause for autism
- Caused by abnormalities in the brain structure and function
- Brain scans show differences in the shape and structure of the brain
- Early behavioral intervention has shown to improve behavioral problems and skill deficits

# Theories

- Links between heredity, genetics and medical problems
- No gene is known to cause autism
- Are some children born with a susceptibility to autism?  Triggers are not known.
- Viral Infections?
- Metabolic imbalances?
- Environmental chemicals?

# Funding Available

- Private Funding
  - Leukemia (1 in 25,000) gets $310 million
  - Pediatric Aids (1 in 8,000) gets $394 million
  - Diabetes (1 in 500) gets $130 million
  - Autism (1 in 150) gets $42 million
- National Funding
  - NIH budget: 29 billion
  - $80 million to autism research or 0.28% of NIH budget National Funding
- 90% of the costs go to adult care
- The annual cost can be reduced by 2/3 if detected early and intervention

# Methodology

- Hypothesis

To see if there is an increase in the number of Autism Cases in areas that have more environmental toxins present.

- Goal

To take autism numbers for each city or town in Massachusetts will be intersected with Toxic Release data for the state.

- Heavy metals, especially mercury, are naturally occurring elements that are found in the atmosphere.
- Background levels of heavy metals has been increasing since preindustrial times.
- Possible causes of atmospheric heavy metals are medical incinerators, industrial boilers, coal fired utility plants, cement plants and chlorine production plants

# Massachusetts Data

- From MassGIS

  Obtain a shapefile of Massachusetts town and boundaries
- Autism data for Massachusetts

  School districts have to release the # of students that have disabilities for each city or town, when available

- Massachusetts Department of Education provides data from 2002 to 2009 for each reportable disability.
- Data is reported in excel format for each city and town as well as larger private and technical schools.

# Massachusetts Autism Data

| | 02-03 Autism | 02-03 SPED | 02-03 total | 08-09 Autism | 08-09 SPED | 08-09 total |
|---|---|---|---|---|---|---|
| MA | 4,080 | 155,204 | 983,313 | 9,793 | 166,037 | 970,459 |
| Boston | 251 | 12,232 | 61,552 | 493 | 11,534 | 56,308 |
| Lynn | 30 | 2,287 | 15,114 | 96 | 2,230 | 13,446 |
| Salem | 23 | 919 | 5,000 | 60 | 1,104 | 4,531 |
| Worcester | 105 | 4,533 | 25,712 | 247 | 4,782 | 23,512 |
| Nahant | 0 | 26 | 207 | 5 | 32 | 251 |
| Brockton | 50 | 2,121 | 16,700 | 113 | 2,191 | 15,451 |
| Beverly | 36 | 927 | 4,648 | 67 | 946 | 4,323 |
| Lowell | 54 | 1,903 | 15,479 | 155 | 2,146 | 13,498 |
| Dracut | 20 | 455 | 4,259 | 46 | 498 | 4,234 |
| Chelmsford | 38 | 769 | 5,728 | 75 | 875 | 5,629 |

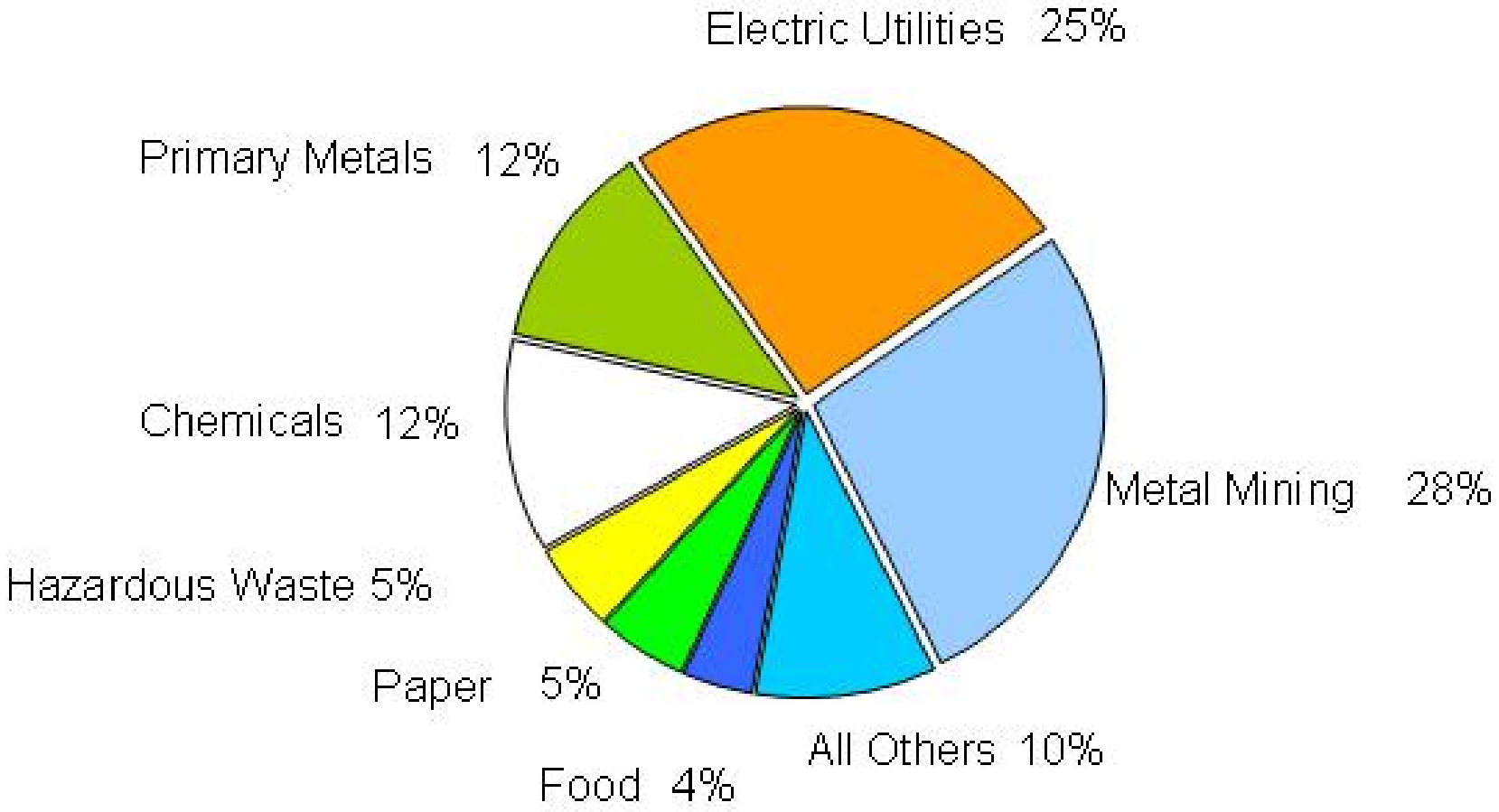
# EPA provided data

- TRI – Toxic Release Inventory
- Emergency Planning and Community Right-to-Know Act (EPCRA) was enacted in 1986.
- inform communities and citizens of chemical hazards in their areas
- Latest list contains 581 chemicals in 30 categories
- http://www.epa.gov/tri/trichemicals/chemical%20lists/RY2006ChemicalList.pdf

- TRI PBT Chemical List, contains 16 PBT's
- Persistent, Bioaccumulative, and Toxic (PBT)

  Lead, mercury, Polychlorinated biphenyl (PCBs), Pentachlorobenzene
- http://www.epa.gov/tri/trichemicals/pbt%20chemicals/pbt_chem_list.htm
- http://www.epa.gov/tri/tridata/tri07/brochure/brochure.htm

**Figure 2: 2007 TRI Total Disposal or Other Releases**
**4.09 billion pounds**



# Table 1: TRI On-site and Off-site Disposal or Other Releases, 2007

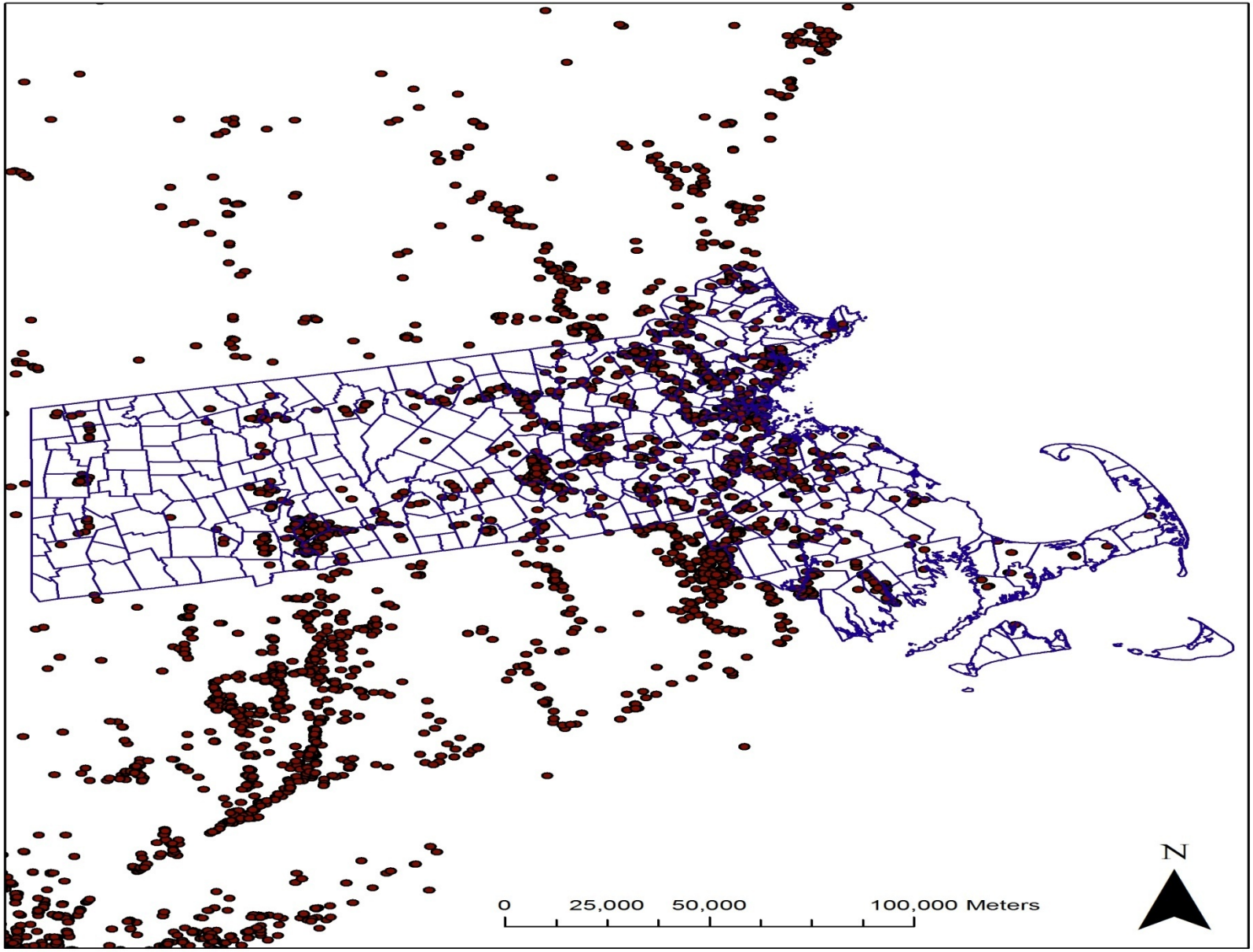
| **On-site Disposal or Other Releases** | **Pounds** | **Percent** |
|---|---|---|
| Air | 1,311,649,055 | 32.1% |
| Water | 232,033,196 | 5.7% |
| Underground Injection | 209,074,579 | 5.1% |
| Land | 1,785,238,608 | 43.7% |
| **Total Onsite Disposal or Other Releases** | **3,537,995,439** | **86.6%** |

| **Off-site Disposal or Other Releases** | **Pounds** | **Percent** |
|---|---|---|
| Underground Injection | 16,256,635 | 0.4% |
| Land | 391,814,217 | 9.6% |
| POTWs and Waste Treatment | 4,625,379 | 0.1% |
| Other | 135,541,303 | 3.3% |
| **Total Off-site Disposal or Other Releases** | **548,237,535** | **13.4 %** |
| **Total On- and Off-site Disposal or Other Releases** | **4,086,232,974** | **100%** |

# ToxMaps.com

- Provides shapefiles with all the locations of facilities that release or produce pollution
- Provide excel spreadsheets that provide data about the facilities in the shapefile
- Over 51,000 facilities in the United States

# Locations of Facilities that release Toxic Substances



# Ultimate Goal

- Use MassGIS and MA DOE to graph and symbolize autism rates for each city/town in Massachusetts
- Map locations of all facilities in Massachusetts that produce toxic chemicals
- Use EPA provide TRI tables to map where the release is occurring
- Intersect the maps to combine data

- Look for a pattern to see if autism rates are higher in areas that have potentially toxic facilities within each city
- If a pattern exists
  - Look at proximity to the facility to see in autism rates decreases at set distances from the facility; 2, 5, 10, 20 miles
  - Potentially look to see what chemicals are being released at the facilities that are located in cities with higher autism rates.

# Further Possibilities

- Using FactFinder with the U.S. Census
  - Look at gender
  - Economic status
  - Race and ethnicity
- U.S. Department of Agriculture
  - Pesticide, agriculture chemical use
  - Land use

  http://www.nass.usda.gov/research/atlas02/index.html

# Previous Study

- Proximity to point of environmental mercury release as a predictor of autism prevalence

  Health & Place 15 (2009) 18-24

  Raymond F. Palmer

- Objective

  To determine if proximity to sources of mercury pollution in 1998 lead to an increase in autism rates in 2002 in Texas.

# Methodology

- Based in Texas from 1998 to 2002
- Mapped 39 coal-fired power plants and 56 industrial facilities
- Mapped each school district
- Gave each location as XY coordinates
- Mercury emissions were attributed to each XY coordinate for the facilities for 1998

# Methodology cont.

- Autism rates for 2002 were obtained from TEA
- Atmospheric mercury levels were used from 1998 and compared to autism rates in 2002 using statistical methods

# Results

- For every 1000 lbs of industrial release, there was a 2.6% increase in autism rates
- There was a 3.7% increase due to power plants
- For every 10 miles further away there was a drop in autism rates by 2.0% and 1.4%