



THE MIND IS A MYSTERY

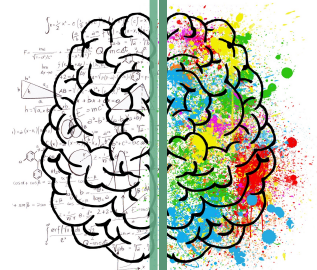
UNLOCKING THE SECRETS OF THE BRAIN

Rachelle Chandler Fertig & Samantha Wanek

A META-ANALYSIS

Rachelle Chandler Fertig

- Experience in data analysis, using Excel, Python, R, and SQL
- Dual Background:
 - Project management, operations, logistics, marketing, communication, business metrics, sales and performance analytics for service and retail sales industries.
 - Craniosacral Therapist specializing in the brain, central nervous system, immune, and endocrine systems with a focus on nutritionally balanced brain/body relationships.
- Proficient with in-office and remote collaboration tools such as Slack, Teams, Microsoft 365, VPN, Trello, Zoom as well as industry-specific proprietary software systems.
- Skilled in data and conceptual visualizations/presentations with the ability to translate intricate details into actionable takeaways.
- Detailed, thorough and methodical work style while working either independently or in team collaboration settings.



Samantha Wanek

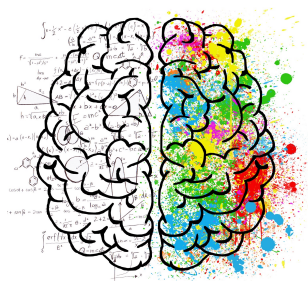
- Experience in data analysis, using Python, R, and SQL.
- Skilled in data visualization/presentation with the ability to concisely communicate complex data insights to non-technical parties.
- Strong understandings of data ethics and privacy considerations, ensuring ethical use of data.
- Ability to effectively collaborate with team members, including providing and actively seeking feedback from others.
- Familiarity with remote collaboration tools, such as Slack, Zoom, and Trello, and the ability to adapt quickly to new tools and technologies.
- Strong time management skills to prioritize tasks, manage competing deadlines, and adapt to changing priorities.

OUR BACKGROUNDS

OUR DATA AND ITS IMPORTANCE

DATA SUMMARY: 105 study participants (47 pairs) were tested across 39 essential elements.

- Our dataset includes urine test results for 20 toxic and 19 essential elements.
- The study focuses on young children with Autism Spectrum Disorder and their mothers, compared to typically developing children and their mothers.
- Most studies use blood tests, but urine measurements offer a different perspective. Urine measurements indicate the amount of a component that is leaving the body.
- Our dataset is important because it provides unique insights into the relationship between toxic and essential elements and Autism Spectrum Disorder.



A META-ANALYSIS OF A URINALYSIS

INITIAL ASSESEMENT OF THE DATASET IN R

Status	Type	Elements (39)
ASD	Child	<data>
TD	Child	<data>
ASD	Mother	<data>
TD	Mother	<data>

Initial Analysis Objective:

- Group by + Summarize functions to create comparison groups
- Evaluate which elements have the greatest influence with ASD and TD groups

Key Observations: The data alpha-organized the elements into two groups to differentiate between **Toxic** and **Essential** elements



A META-ANALYSIS OF A URINALYSIS

ANALYTICAL OBJECTIVES:

Objective One: Is there a predictive relationship between levels of toxic and essential elements and the occurrence of **ASD** in children?

- **Question A** – How well does the data predict **ASD** or **TD** in children?
- **Question B** - Which elements are the greatest predictors of **ASD** or **TD** in children?

Objective Two: From the modeled elements, how does the urine test differ (Toxic vs Essential) for children with **ASD** to **TD** children?

- **Conclusions** – Predictive Elements - Children

Objective Three: Is there a predictive relationship between levels of toxic and essential elements and the occurrence of **ASD** in mothers?

- **Question C** – How well does the data predict **ASD** or **TD** in mothers?
- **Question D** - Which elements are the greatest predictors of **ASD** or **TD** in mothers?

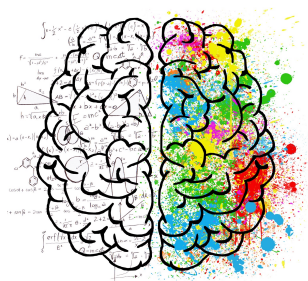
Objective Four: From the modeled elements, how does the urine test differ (Toxic vs Essential) for mothers with **ASD** to **TD** mothers?

- **Conclusions** – Predictive Elements - Mothers

Objective Five: From the modeled elements, how does the urine test differ (Toxic vs Essential) for children with **ASD** to their **ASD** mothers?

Objective Six: From the modeled elements, how does the urine test differ (Toxic vs Essential) for **TD** children to their **TD** mothers?

Meta-Analysis Conclusions



A META-ANALYSIS OF A URINALYSIS

ANALYSIS APPROACH:

Questions & Objectives Setup:

- Clean, Standardize, Subset and Subgroup the data
 - In Subgroup:
 - Create a binary logistics regression model to evaluate the effectiveness of the data to predict the ASD / TD status
 - Run a binary stepwise-regression to evaluate which elements have the greatest influence over predicting ASD or TD
 - Assess multicollinearity by Variance Influence Factor
 - Run descriptive statistics for modeled elements

	SUBSET	SUBGROUP 1	SUBGROUP 2
1	Child	childToxic ASD	childToxic TD
2		childEssential ASD	childEssential TD
3	Mother	motherToxic ASD	motherToxic TD
4		motherEssential ASD	motherEssential TD
5	ID Number	childToxic ASD (paired)	motherToxic ASD
6		childToxic TD (paired)	motherToxic TD

- Compare subgroups to extrapolate meta-analysis
 - Identify highest-influence elements per subgroup
 - Define highest-influence elements for ASD / TD
 - Review elements for developmental influence
 - Understand the impact of these elements on ASD



OBJECTIVE ONE

QUESTION A: How well does the data predict ASD or TD in children?

	SUBSET	SUBGROUPS	SIGNIFICANT ELEMENTS	BORDERLINE SIGNIFICANT	ACCURACY
1	Child	childToxic ASD + childToxic TD	Tungsten		85%
2		childEssential ASD + childEssential TD	Sulfur, Magnesium		87%

QUESTION B: Which elements are the greatest predictors of ASD or TD in children?

	SUBSET	SUBGROUPS	SIGNIFICANT ELEMENTS	BORDERLINE	ACCURACY	OVERALL MODEL
1	Child	childToxic ASD	Gadolinium	Mercury	27%	Significant
2		childToxic TD	Tin	Tungsten		
3		childEssential ASD	Potassium	Boron	45%	Significant
4		childEssential TD	Sulfur	Calcium, Magnesium, Zinc		

CONCLUSIONS – PREDICTIVE RELATIONSHIPS



FROM THE MODELED ELEMENTS, HOW DOES THE URINE TEST DIFFER (TOXIC VS. ESSENTIAL) FOR CHILDREN WITH AUTISM (ASD) COMPARED TO TYPICALLY DEVELOPING (TD) CHILDREN?

OBJECTIVE TWO

CONCLUSIONS – PREDICTIVE ELEMENTS

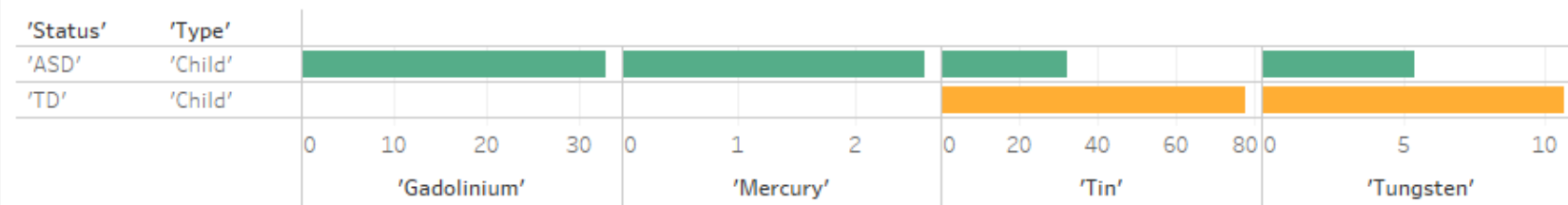
Descriptive Statistics for Subgroup: Means Comparison

childToxic				
Status	Gadolinium	Mercury	Tin	Tungsten
ASD	1.57	0.1240	1.53	.0257
TD	0.00005	0.0002	3.00	0.411

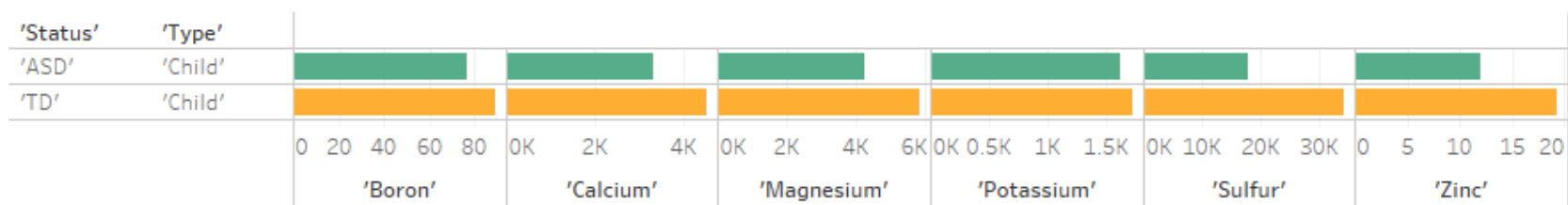
childEssential						
Status	Boron	Calcium	Magnesium	Potassium	Sulfur	Zinc
ASD	3.64	157.09	202.33	77.62	848.57	0.057
TD	3.44	174.19	225.50	66.73	1322.69	0.744

Sum Comparison

childToxic



childEssential



CONCLUSIONS:

MEANS Identifies which elements are predictive for either ASD or TD.

SUM ASD children do in fact have higher toxicity and lower essential elements, except for Tin and Tungsten.



OBJECTIVE THREE

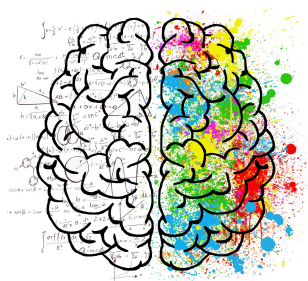
QUESTION A: How well does the data predict ASD or TD in mothers?

	SUBSET	SUBGROUPS	SIGNIFICANT ELEMENTS	BORDERLINE SIGNIFICANT	ACCURACY
1	Mother	motherToxic ASD + motherToxic TD	Lead, Tungsten	Barium, Uranium	78%
2		motherEssential ASD + motherEssential TD	Molybdenum		74%

QUESTION B: Which elements are the greatest predictors of ASD or TD in mothers?

	SUBSET	SUBGROUPS	SIGNIFICANT ELEMENTS	BORDERLINE	ACCURACY	OVERALL MODEL
1	Mother	motherToxic ASD	Cadmium	Uranium	35%	Significant
2		motherToxic TD	Gadolinium, Lead, Thallium	Barium, Beryllium		
3		motherEssential ASD	Molybdenum, Phosphorus		12%	Not-Significant
4		motherEssential TD	Iron			

CONCLUSIONS – PREDICTIVE RELATIONSHIPS



FROM THE MODELED ELEMENTS, HOW DOES THE URINE TEST DIFFER (TOXIC VS. ESSENTIAL) FOR MOTHERS WITH AUTISM (ASD) TO

OBJECTIVE FOUR

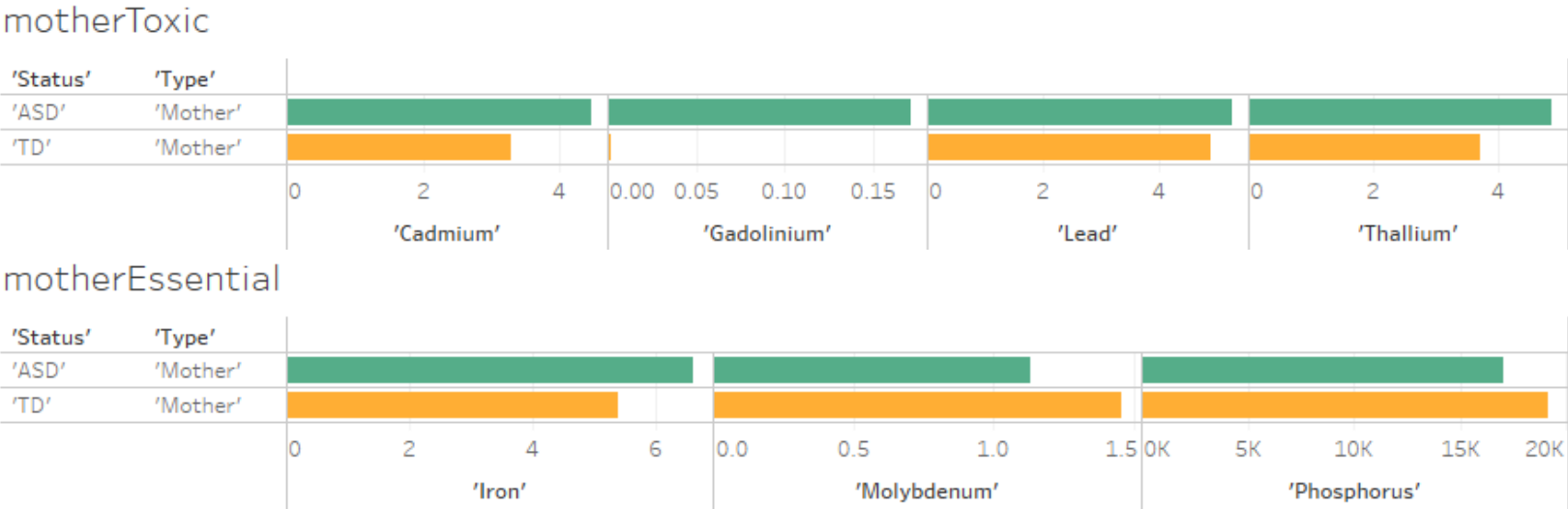
TYPICALLY DEVELOPING (TD) MOTHERS?

CONCLUSIONS – PREDICTIVE ELEMENTS

Descriptive Statistics for Subgroup: Means Comparison

motherToxic					motherEssential			
Status	Cadmium	Gadolinium	Lead	Thallium	Status	Iron	Molybdenum	Phosphorus
ASD	0.56	-0.096	-0.476	-0.240	ASD	-0.152	-0.634	-0.592
TD	0.23	-0.098	-0.508	-0.536	TD	-0.780	-0.429	-0.443

Sum Comparison



CONCLUSIONS:

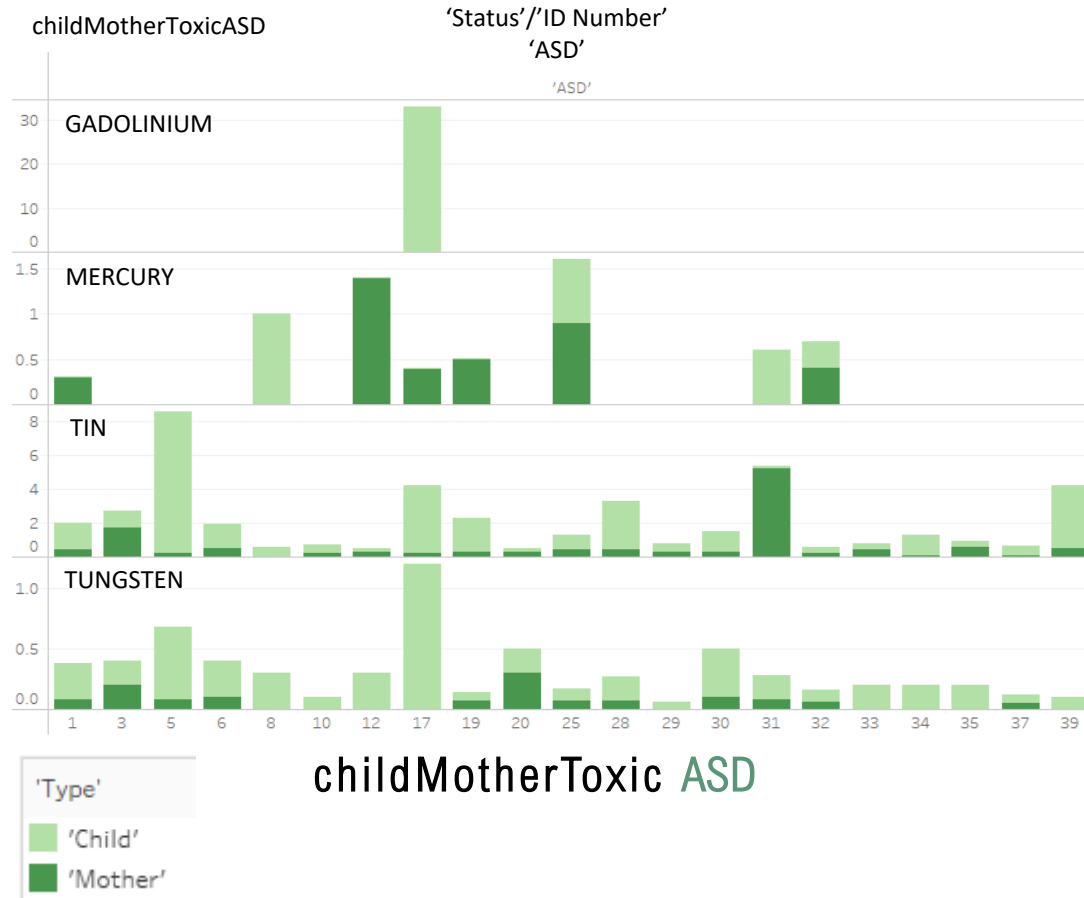
MEANS Identifies which elements are predictive for either ASD or TD.

SUM ASD mothers do in fact have higher toxicity and lower essential elements, except for Iron.

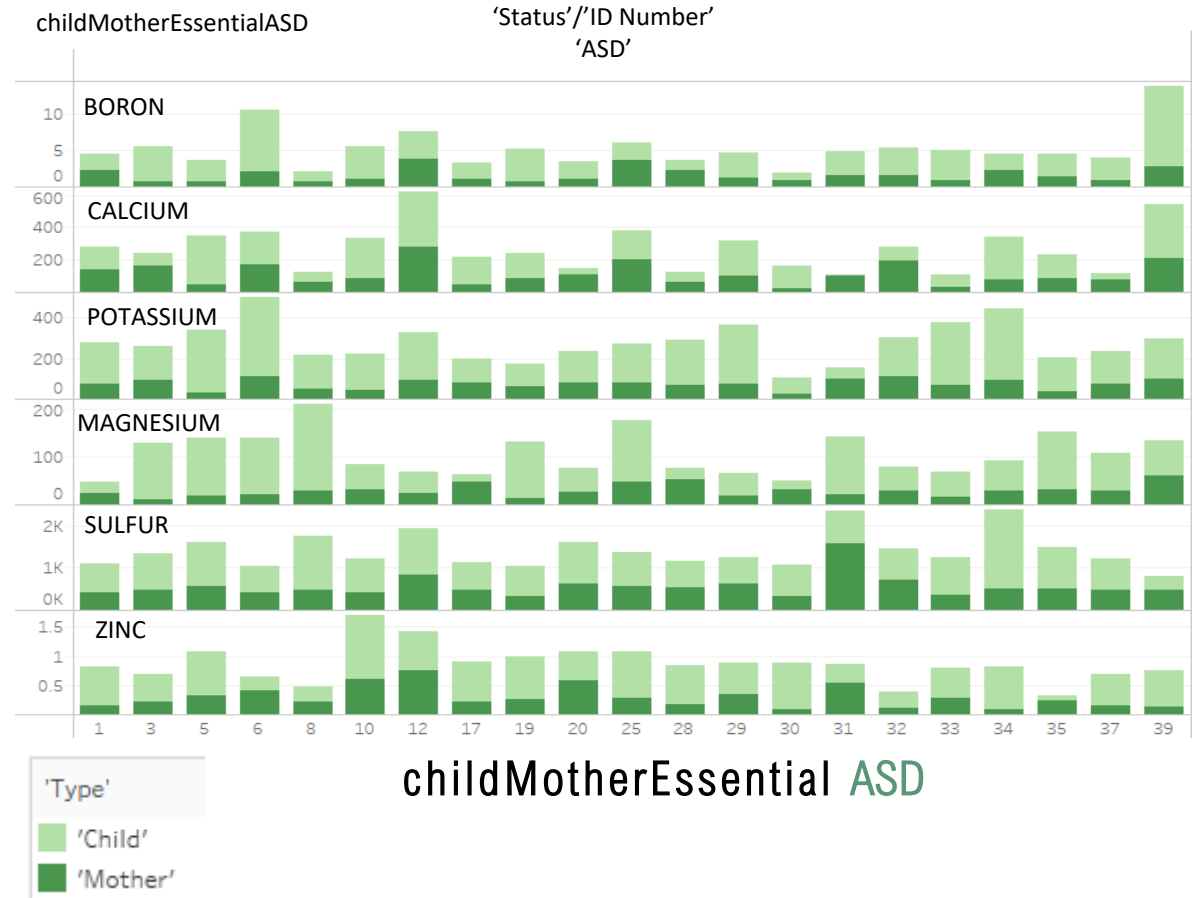


HOW DOES THE URINE TEST DIFFER (TOXIC VS. ESSENTIAL) FOR CHILDREN WITH AUTISM (ASD) TO THEIR MOTHERS WITH AUTISM (ASD)?

OBJECTIVE FIVE



CONCLUSION: Tin and Tungsten mostly influence ASD children. Mercury is present in 8 out of 47 pairs (17%) with uneven distribution between children and mothers. Gadolinium is dominantly present in one child (2%) of the ASD participants.

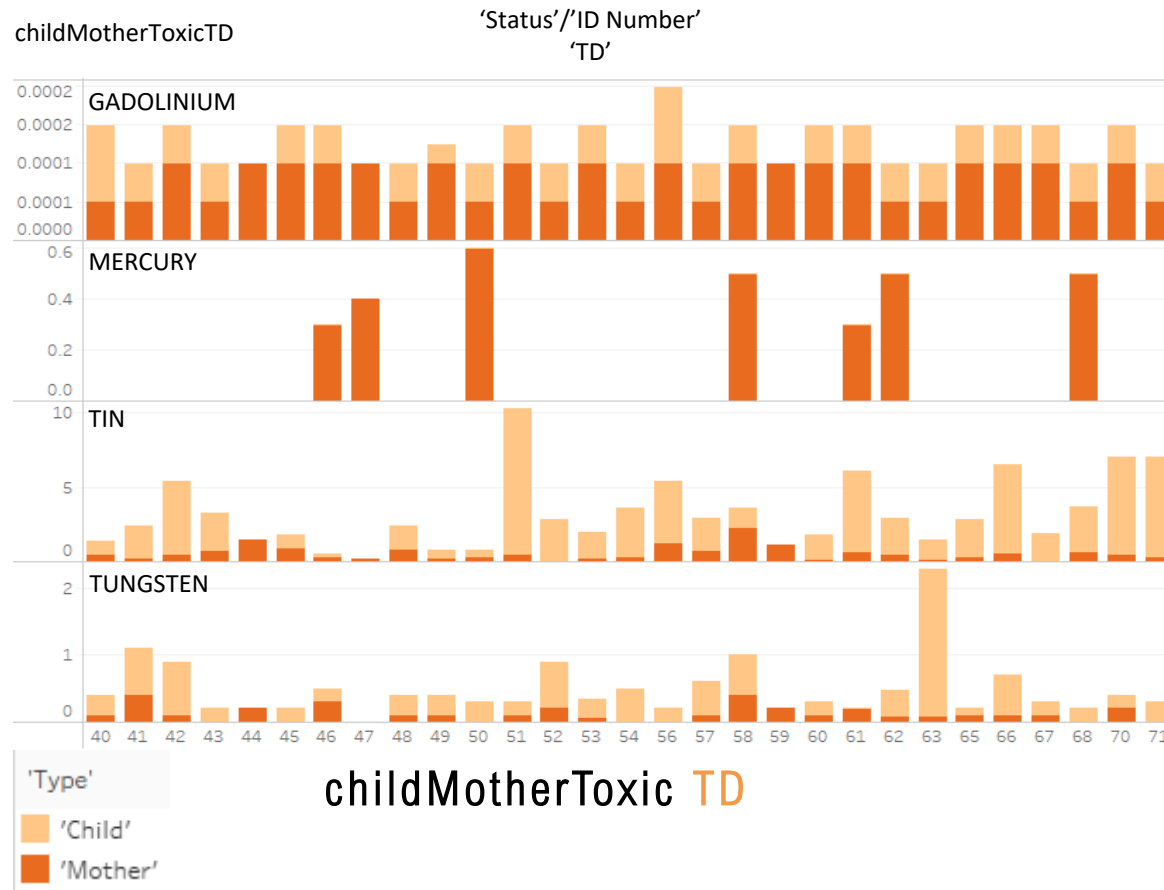


CONCLUSION: Most children have higher amounts of all essential elements compared to their mothers.

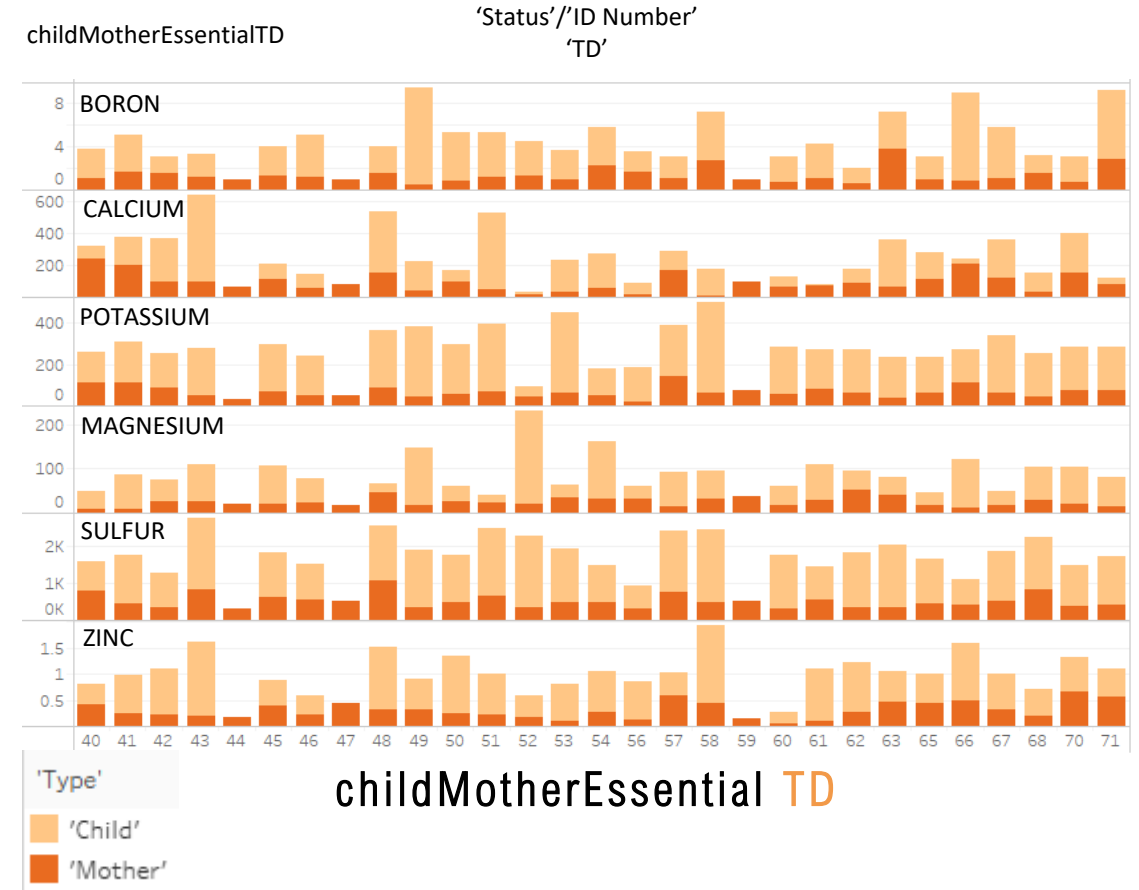


HOW DOES THE URINE TEST DIFFER (TOXIC VS. ESSENTIAL) FOR TYPICALLY DEVELOPING (TD) CHILDREN TO THEIR MOTHERS?

OBJECTIVE SIX



CONCLUSION: Gadolinium influences both TD children and mothers. Tin and Tungsten mostly influence children. Mercury is not present in TD children and is only present in 7 out of 58 mothers (12%).

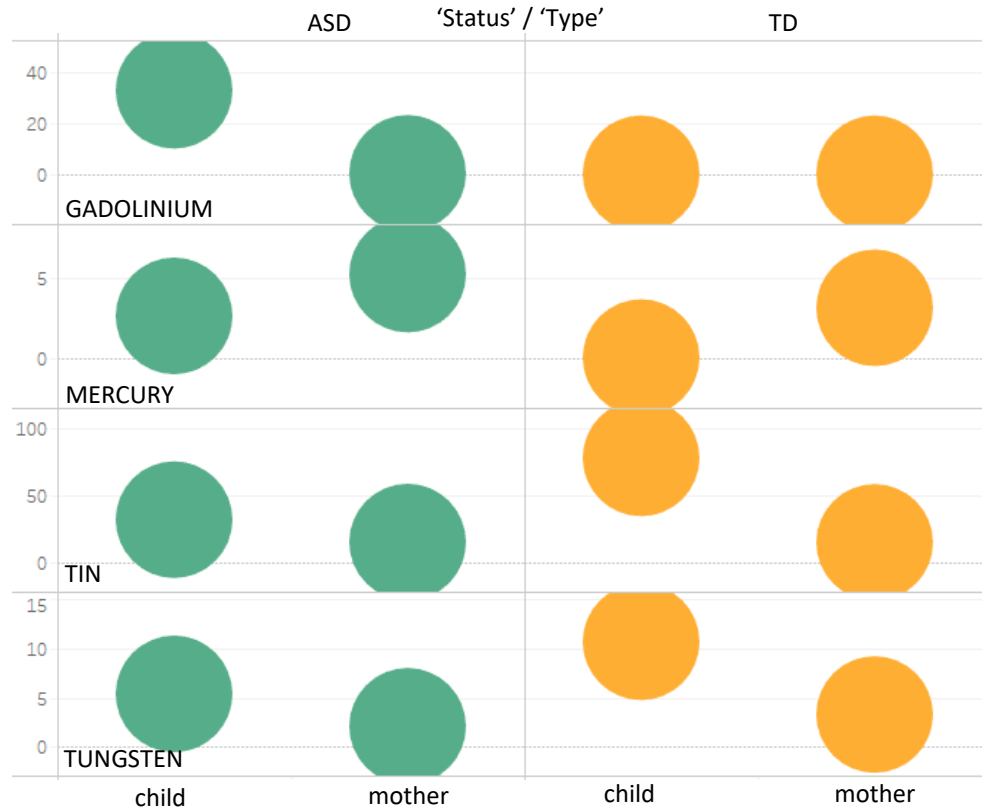


CONCLUSION: Most TD children have higher amounts of all essential elements compared to their mothers. Three TD children are missing all essential elements which might explain the variance in the model accuracy.

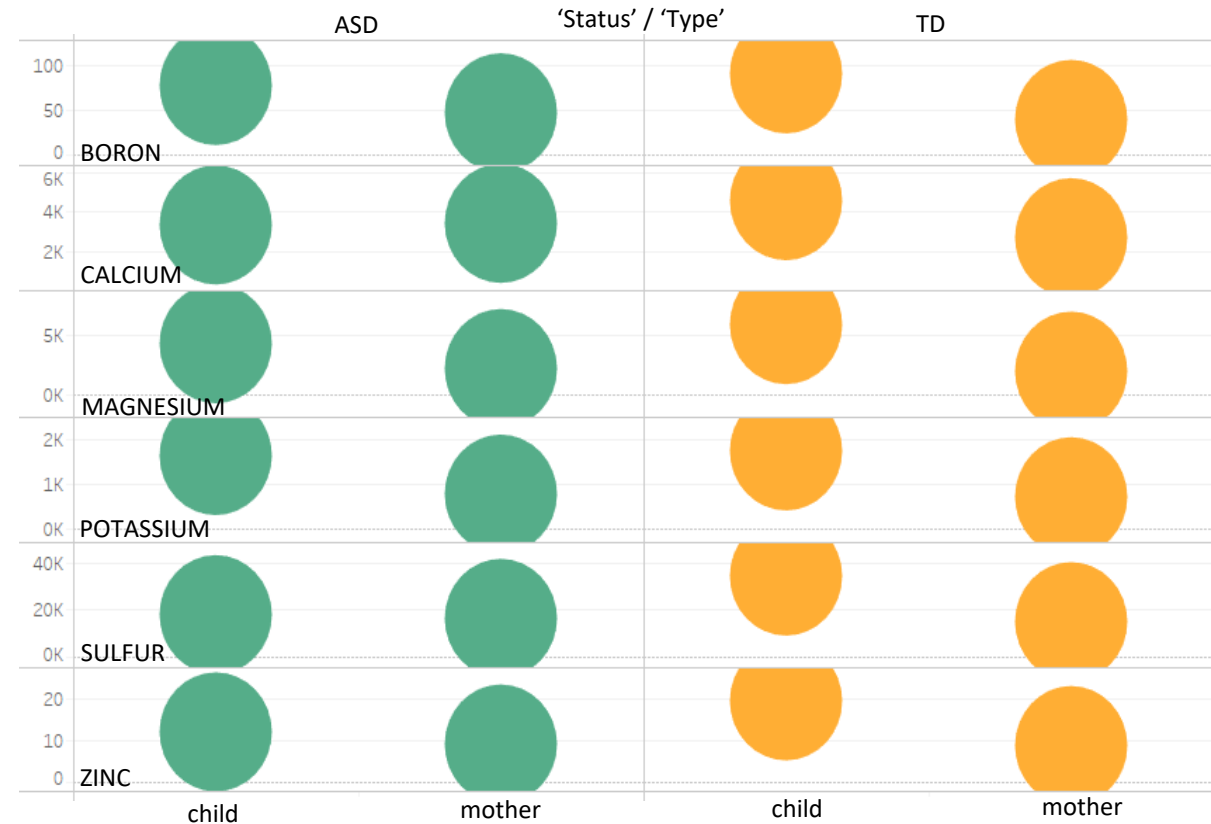


OBJECTIVE SEVEN

childMotherToxic



childMotherEssential

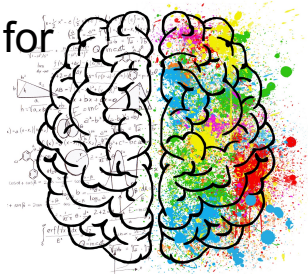


CONCLUSION: ASD and TD children have higher levels of Toxic and Essential Elements except for Mercury, which is higher in both ASD and TD mothers



SUMMARIES & CONCLUSIONS

- The **significant** elements identified for the ***toxic elements*** were **Tungsten** and **Lead** and for the ***essential elements*** they were **Sulfur**, **Magnesium**, and **Molybdenum**.
- Additional elements emerged as **significant predictors** of ASD for both toxic and essential element models in each subgroup, but with **lower model accuracy**.
 - **Children:** Significant predictors in the ***toxic element*** model were **Gadolinium**, **Tin**, and **Mercury**, and in the ***essential element*** model were **Potassium**, **Boron**, **Calcium**, and **Zinc**.
 - **Mothers:** Significant predictors in the ***toxic element*** model were **Cadmium**, **Gadolinium**, **Lead**, and **Thallium**, and in the ***essential element*** model were **Iron**, **Molybdenum**, and **Phosphorus**.
- **Tungsten**, **Sulfur**, and **Magnesium** were ***significant predictor*** elements for **children**, while **Tungsten**, **Lead**, and **Molybdenum** were ***significant*** for **mothers**. *Notably*, **Tungsten** was the only element that was significant in ***both*** groups.
- The ***accuracy*** of the data in ***predicting ASD*** was comparatively higher in **children (85-87%)** than in **mothers (74-78%)**.
- The most ***challenging*** aspect of the project was balancing the need to **subset** the **data** by dependent and independent variables ***without compromising*** the sample size required for predictive and stepwise regression analysis.
- With more time we would compare urinalysis results to recommended levels of toxic and essential elements for children and mothers to identify patterns of nutrient deficiency/sufficiency, as well as investigate the role of individual toxic/essential elements in childhood development to provide actionable feedback for mothers of children with ASD.



CREDITS

We would like to use this space to provide a *special thanks* to the following people who helped us along the way in completing this project:

- Instructor, ***Joseph Raetano*** -
- Data Science Instructor, ***Margaret Martinez*** -
- Data Science Mentors, ***Kendra Rhoades & Julie Boucher***

The source of the brain image is:

- Elisa Riva, Brain Mind, Pixaby, Feb. 13, 2017.

The source of the downloadable dataset is:

- Qureshi, Fatir (2020), “Data for: Urinary Essential Elements of Young Children with Autism Spectrum Disorder and their Mothers”, Mendeley Data, V1, doi: 10.17632/79fk29dvk6.1

The source of the article containing the data is :

- Fatir Qureshi, James Adams, Devon Coleman, David Quig, Juergen Hahn, Urinary essential elements of young children with autism spectrum disorder and their mothers, Research in Autism Spectrum Disorders, Volume 72, 2020, 101518, ISSN 1750-9467, <https://doi.org/10.1016/j.rasd.2020.101518>.



THANK YOU FOR JOINING US TODAY

FLOOR OPEN TO QUESTIONS

DISCUSSION REVIEW