



# Hidden Threats: Heavy Metals and the Cognitive Challenges of Specific Learning Disorders

## Introduction

Neurodevelopmental disorders (NDD) are a group of conditions characterized by defective development and functioning of the nervous system that starts during early childhood. They often involve difficulties in cognition, social interaction, communication, and motor skills. The symptoms vary from specific learning disability to profound impairment of social skills and intelligence. NDDs include intellectual disability, Communication Disorders, Autism Spectrum Disorder, Attention-Deficit Hyperactivity Disorder (ADHD), Neurodevelopmental Motor Disorders, and Specific Learning Disorders. [1]

Specific learning Disorders (SLD) among NDDs affect the intellectual functioning and acquisition of skills like reading and writing. Though such children have average or above average intelligence they suffer to perform specific academic tasks. The prevalence of SLD is 5-15% worldwide and in India, it varies from 3 to 10%. Male children are more affected compared to females. [2]

### Causes and Role of Heavy metals in Neurodevelopmental disorders:

These disorders are caused due to a combination of genetic, psychosocial, and environmental risk factors. Exposure to environmental toxins including heavy metals like lead, mercury, cadmium, manganese, arsenic, pesticides, and industrial chemicals has been associated with an elevated risk of NDD. Cadmium, lead, and mercury are listed by the World Health Organisation as chemicals of major public health concern. It is estimated that nearly 43% of children in low and middle-income countries do not reach their full neurodevelopment due to many factors. [3]

Multiple studies have proved the association of heavy metals like lead and mercury to the development of autistic disorders and ADHD. [4] These studies reported a relationship between perinatal

and childhood exposure and the development of these disorders. The mechanisms by which heavy metals influence specific learning disorders are complex and multifactorial. Oxidative stress, inflammation, and disruption of neural connectivity are among the proposed pathways through which heavy metals exert their neurotoxic effects. [5] Additionally, heavy metals may interfere with the proper functioning of neurotransmitters, impairing synaptic transmission and affecting neuronal plasticity, essential for learning and memory.

Research on children with SLD holds particular importance due to the unique challenges these individuals face in the area of education and cognitive development. To investigate the role of heavy metals in SLD, comprehensive studies are needed, involving detailed assessments of heavy metal exposure levels in individuals with learning difficulties compared to typically developing peers. While extensive research on autism spectrum disorder (ASD) and attention-deficit/hyperactivity disorder (ADHD) has been conducted, focusing on SLD provides insights into a distinct subset of neurodevelopmental disorders with its own set of characteristics and educational implications.


## Conclusion

In conclusion, the relationship between heavy metals and specific learning disorders is a complex and evolving area of research. While evidence suggests that heavy metal exposure may contribute to cognitive challenges in children, more research is needed to establish causation. Also, it is important to consider the impacts of co-exposure to metals particularly when evaluating children who reside close to contaminated areas.

## References

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