

The Effects of Prenatal Polysubstance Exposure on Neurodevelopmental and Mental Health Outcomes

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INTRODUCTION

- The impacts of prenatal alcohol exposure (PAE) have been increasingly recognized as important determinants of lifelong physical and mental health.
- Individuals are diagnosed with Fetal Alcohol Spectrum Disorder when they have been exposed to alcohol during pregnancy and have significant impairment in 3 or more brain domains; FASD is a lifelong disability.
- Nearly 40% of women who report alcohol consumption during pregnancy use other substances.
- Prenatal exposure to substances impacts physical and mental health outcomes and, although common, little is understood about their combined effects.
- Data continue to emerge about the importance of harm reduction approaches/supports for women to optimize outcomes in the complicated context of substance use during pregnancy and the long-term effects on neurodevelopment.
- The objective of this study was to determine the effect of PAE with or without cannabis or nicotine on neurodevelopment and mental health.

METHODS

- This was a retrospective cross-sectional study using secondary analysis of data from Canada’s National Database on PAE (N=2,620), a pan-Canadian neurodevelopmental clinical dataset of individuals with prenatal substance exposures.
- Prenatal exposure data was collected for alcohol, nicotine, cannabis, opiates, methamphetamines, cocaine, prescriptions, and “other” drugs.
- Descriptive statistics were used to characterize demographics and rates of prenatal substance exposure.
- Polysubstance exposure was coded dichotomously. Pearson chi-squared tests, ANOVA, and independent samples t-tests were used to analyze differences between those with and without exposure to nicotine and/or cannabis in addition to alcohol.

SAMPLE CHARACTERISTICS

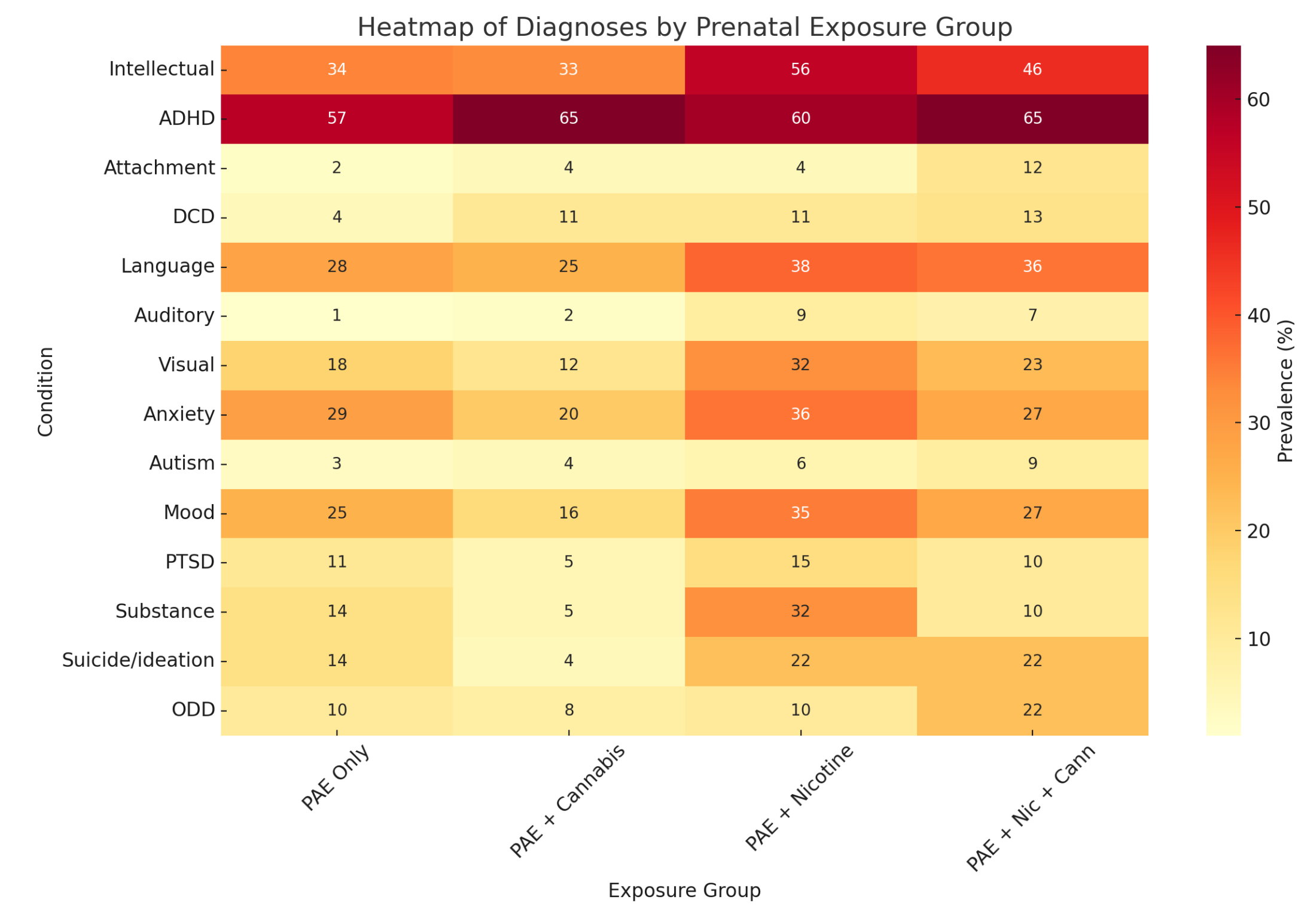
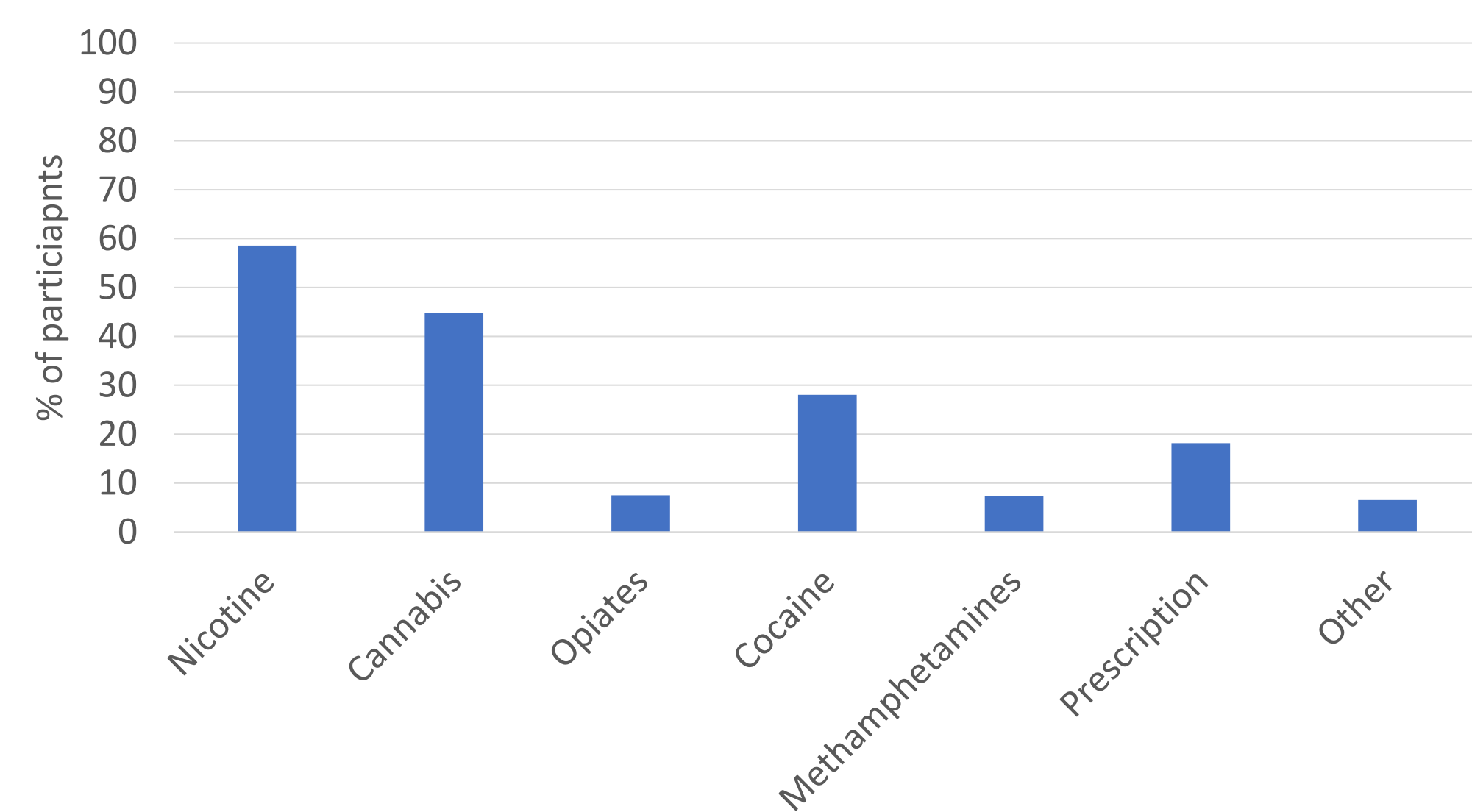
Mean age	14.7 years (range 1 to 61, SD = 9.7)
Female	42.3%
Prenatal exposure to alcohol	100%
Prenatal exposure to alcohol and nicotine	58.5%
Prenatal exposure to alcohol and cannabis	44.8%
Mean number of prenatal exposures	1.86 substances (range 1 to 6, SD = 1.01)

Relative Risk of Prenatal Alcohol Exposure on Brain Domain Impairment and Mental Health in Children and Adults

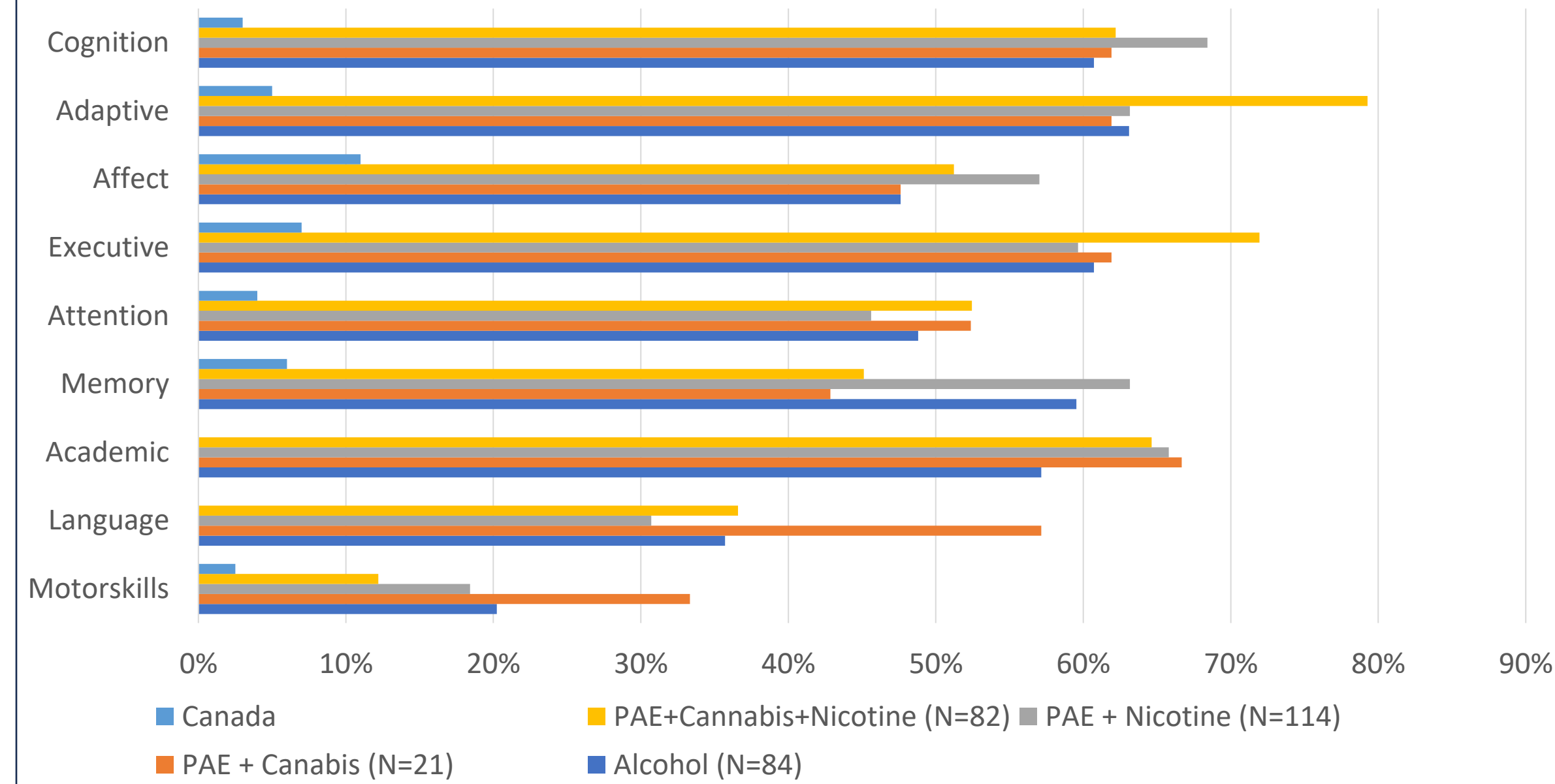
Brain Domain	Age 6-12	Age 18+
	PAE (N=25)	PAE (N=84)
Motorskills	43.6	8
Cognition	1904.8	20.3
Language	450	
Academic Achievement	512	
Memory	6666.7	10
Attention	550	12.2
Executive Function	960	8.7
Adaptive Function	2933.3	12.6
Affect Regulation	2	4.4

Mental Health	Age 6-12	Age 18+
	PAE (N=25)	PAE (N=84)
Intellectual		28
ADHD		52
DCD		0
Language		32
Auditory		0
Visual		0
Anxiety		4
Mood		4
ODD		12
Suicide		6.67
Substance Misuse		1.62

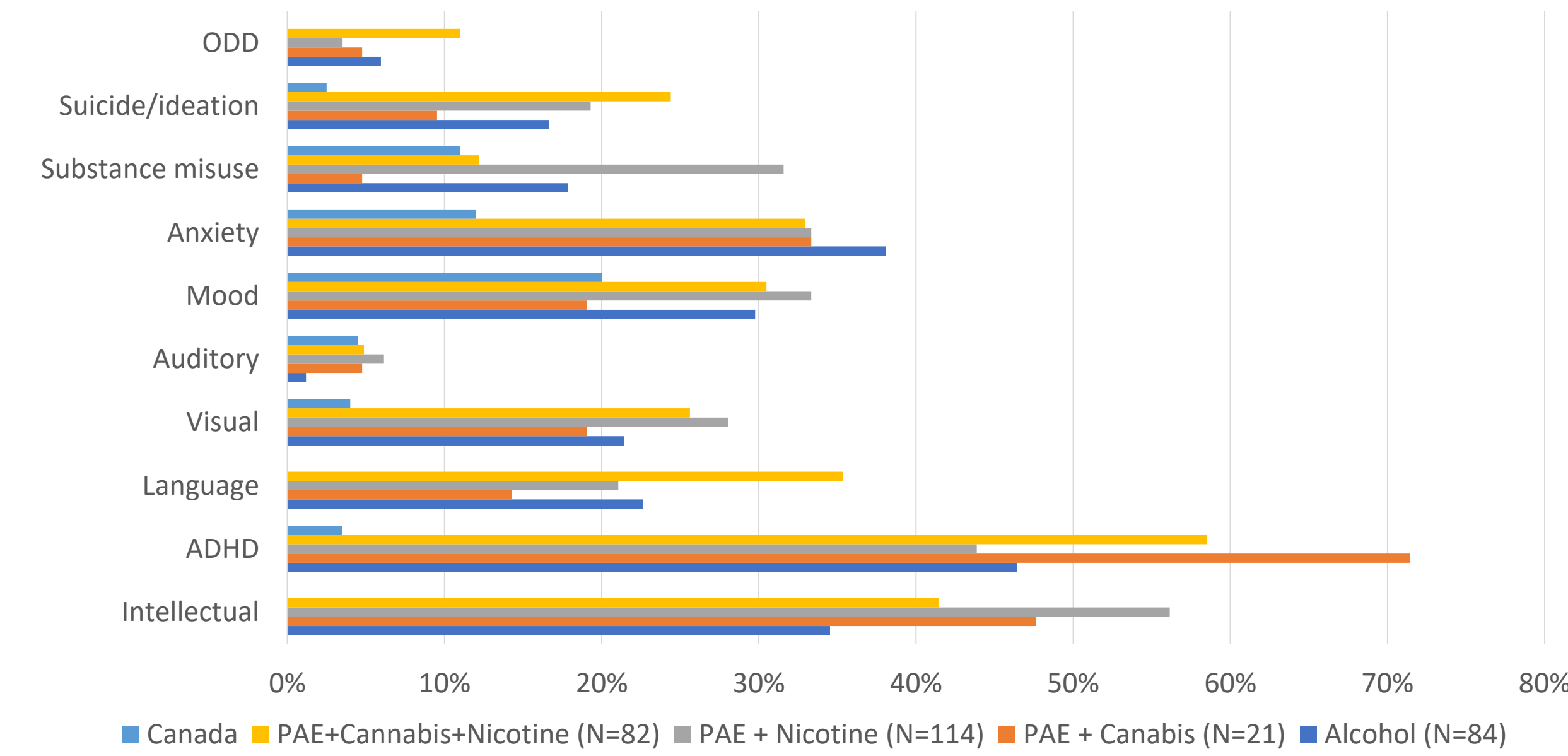
Prenatal Exposures in Addition to Alcohol



Prenatal Exposures and Brain Domain Impairment in Adults



Prenatal Exposures and Mental Health in Adults



KEY FINDINGS

- 36% had confirmed exposure to alcohol plus at least two other substances during the prenatal period; nicotine (41.5%) and cannabis (30.7%) were the most common.
- Individuals exposed to only alcohol during pregnancy (N=209) had a high prevalence of impairment across 10 brain domains as well as increased prevalence of mental health issues; the Relative Risk was extraordinarily high compared to the general Canadian population.
- By adulthood, individuals with PAE were 7x more likely to have experienced suicide attempts/ideation, 1.6X more likely to be misusing substances, 1.5x and 38x more likely to have a mood disorder or ADHD, respectively.
- ADHD is consistently high in all PAE groups (~57–65%), peaking with nicotine and cannabis exposure.
- Substance use and suicidal ideation rates jump sharply with nicotine exposure.
- Attachment and ODD disorders, while lower in PAE alone, spike notably when both nicotine and cannabis are involved.

CONCLUSIONS

- Alcohol is a powerful neurobehavioural teratogen. Nicotine appears to be a key additive risk factor, significantly compounding the effects of PAE. Cannabis alone shows more modest effects, but in combination with nicotine, the impact worsens.
- Individuals with prenatal alcohol exposure—especially when combined with cannabis and/or nicotine—experience dramatically higher rates of neurodevelopmental and functional impairment compared to Canadian norms.
- These findings support enhanced screening and early intervention for children with known prenatal exposures; early screening and diagnostic services are critical, especially in high-risk populations (e.g., those with known prenatal substance exposure).
- Integrated perinatal care that includes substance use prevention, mental health support, and parenting education is essential.
- There is a pressing need to prioritize nicotine exposure prevention in pregnancy alongside alcohol and cannabis.