

In Pregnancy Common Chemical Exposures may be Linked to Early Attention and Memory

A group of researchers examined associations between prenatal exposure to [aromatic amines](#) (AAs) and cotinine and infant cognitive outcomes at 7.5 months in the Environmental Influences on Child Health Outcomes–California and Illinois (ECHO.CA.IL) cohorts.



Study

The analysis included 250 mother-child pairs from the [Illinois Kids Developmental Study](#) (IKIDS) and Chemicals in Our Bodies (CIOB), two prospective birth cohorts merged between 2016 and 2023 to form the ECHO.CA.IL cohort.

The participants had a prenatal urine sample analyzed for AAs and completed the [visual recognition memory](#) (VRM) assessment at 7.5 months. Participants in IKIDS were recruited in Urbana, Illinois, and those in CIOB were recruited through University of California, San Francisco (UCSF) hospitals in the San Francisco Bay Area.

Second-trimester urine samples were analyzed at the Wadsworth Center Human Health Exposure Analysis Resource (HHEAR) laboratory using [high-performance liquid chromatography-tandem mass spectrometry](#).

Five AAs, aniline, o/m-toluidine, 4-chloroaniline, o-anisidine, and 4,4'-methylenedianiline, along with cotinine, were included because they were detected in at least 50% of the samples. Infant cognition was evaluated using infrared [eye-tracking](#) during the VRM task. Outcomes included time to reach familiarization, average run duration, shift rate, and novelty preference.

Linear regression models were used to evaluate associations between exposures and outcomes, adjusting for cohort, maternal age, education, pre-pregnancy [body mass index](#) (BMI), child age, sex, and urinary dilution. Bayesian kernel machine regression (BKMR), a mixture-modeling approach, was used to assess nonlinear exposure-response patterns and possible interactions. Complete data were available for 233 participants.

Findings

A total of 250 participants were included: 186 from IKIDS and 64 from CIOB. The average maternal age was about 32 years, and the mean [pre-pregnancy](#) BMI was approximately 26 kg/m².

Most participants were married or living with a partner (93%), half had a graduate degree, and 55% had one or more previous births. The cohort included 46% male and 54% female infants. AAs were commonly detected in [second-trimester urine](#).

Aniline had the highest individual concentration among the measured AAs, while o-anisidine had the lowest. Concentrations of 4-chloroaniline and o/m-toluidine were higher in IKIDS than in CIOB. Total AA levels were strongly related to [aniline levels](#).

Associations were observed between several prenatal exposures and measures of infant VRM. Higher levels of the molar sum of AAs, o/m-toluidine, and [4,4'-methylenedianiline](#) were linked to longer times to reach familiarization. The authors interpreted longer familiarization times as indicating poorer visual attention, although the estimates were imprecise.

Most AAs were associated with small increases in shift rate, including o/m-toluidine and 4-chloroaniline; higher shift rates indicated greater visual engagement during the task. In addition, 4-chloroaniline, o-anisidine, and 4,4'-methylenedianiline were associated with modest increases in [novelty preference](#), which indicates better memory for the familiar stimulus in this task. No notable associations were observed with average run duration.

Higher cotinine levels were associated with reduced novelty preference, which the authors interpreted as suggesting poorer [working memory](#), although this estimate was also imprecise. Sex-specific analyses suggested that aniline was associated with a longer time to reach familiarization among female infants, but not among male infants. Aniline also showed a different pattern for average run duration among males, while 4-chloroaniline was positively associated with novelty preference only among males. Evidence that these associations differed by sex varied across outcomes.

No three-way interactions among the assessed variables were found. The BKMR analysis showed nonlinear exposure-response patterns involving aniline, cotinine, o/m-toluidine, 4-chloroaniline, and average [run duration](#), but provided little evidence of associations with individual exposures or interactions among them.

Conclusion

The results showed associations between prenatal exposure to AAs and measures of infant cognition at 7.5 months, with a mixed pattern across the VRM outcomes and uncertainty around several central estimates. Higher levels of the molar sum of AAs, o/m-toluidine, and 4,4'-methylenedianiline were associated with longer time to reach familiarization, reflecting poorer visual attention, whereas cotinine showed an [imprecise association](#) with lower novelty preference, reflecting poorer recognition memory.

Other AA estimates pointed toward higher shift rate or novelty preference, measures that indicate greater visual engagement or better memory in this task. Several associations showed [sex-specific patterns](#), although evidence for these differences varied across outcomes.

The use of infrared eye tracking provided measures of attention and memory. Nevertheless, most participants had high levels of educational attainment, and the socioeconomic makeup of the study populations may limit comparability with other groups. Exposure was measured from a single second-trimester urine sample, which may not represent exposure throughout [pregnancy](#) and could have introduced misclassification of exposure.

Further research is needed to clarify effects on [infant cognition](#).

Source:

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