What is the relationship between Antibiotics and Neurodevelopmental and Psychiatric Disorders?

Antibiotics and Neurodevelopmental/Psychiatric Disorders: What Do Studies Show?

Research links antibiotic exposure—especially in pregnancy and early life—to later neurodevelopmental and psychiatric outcomes, largely via effects on the **gut microbiota–brain axis**, but findings are small in size and often inconsistent.

Early-Life Antibiotics and Neurodevelopmental Disorders

- A large systematic review/meta-analysis (30 studies; >7 million participants) found **weak associations** between prenatal/early-childhood antibiotics and later **ASD, ADHD, and MDD** (ORs mostly 1.1–1.3) (Green et al., 2024; Green et al., 2025).
- Crucially, in **sibling-controlled analyses**, associations with ASD and ADHD disappeared, suggesting strong **genetic/familial confounding** (Green et al., 2024; Green et al., 2025).
- A nationwide Korean cohort with sibling analysis found **no meaningful association** between pregnancy or early-infancy antibiotics and ASD, intellectual disability, or language disorder; a modest association remained only for epilepsy and some high-dose/very-early exposures (Choi et al., 2024).
- Other cohorts report modest links between infant antibiotics and **ADHD, autism, and learning disabilities**, sometimes varying by antibiotic class (e.g., cephalosporins) (Aversa et al., 2020; Lavebratt et al., 2019; Kim & Park, 2025).

Examples of Reported Effect Sizes

Exposure window	Main outcomes with small ↑ risk	Notes	Citations
Prenatal / 0–2 yrs	ASD, ADHD, MDD, broad pediatric psychiatric Dx	OR/HR≈1.1–1.5; attenuate in sibling designs	(Green et al., 2024; Green et al., 2025; Lavebratt et al., 2019; Aversa et al., 2020; Choi et al., 2024)
<90 days old	Global developmental delay (motor, cognition, communication)	OR≈1.03–1.09; dose–response with duration	(Kim & Park, 2025)

FIGURE 1 Illustrative effect sizes for early-life antibiotics and later outcomes.

Antibiotics, Mental Health, and the Microbiota–Gut–Brain Axis

- A Finnish registry study found fetal and early-life antibiotics associated with modestly higher risks of **sleep, ADHD/conduct, mood, and anxiety disorders** and psychotropic use (HR increases ~10–50%) (Lavebratt et al., 2019).
- Pediatric primary-care data linked **broad-spectrum antibiotics** with later **anxiety/depression**, especially in boys (Prichett et al., 2022).
- A biomonitoring study in Chinese children found urinary **ciprofloxacin and fluoroquinolones** associated with elevated odds of mental health difficulties (Zhang et al., 2021).
- A narrative review of 15 human studies concluded that **most report positive associations with depression and anxiety**, stronger with higher dose, frequency, broad-spectrum agents, and recent use, but evidence remains limited and heterogeneous (Saha et al., 2025).
- Conversely, a large adult inpatient cohort found **antibiotic exposure associated with *lower* subsequent risk** of mood, anxiety, psychotic disorders, and suicidality, suggesting possible **context- and drug-specific protective effects** (Kerman et al., 2024).

Mechanistic and Animal Evidence

- Reviews and rodent work show that antibiotics can induce **gut dysbiosis**, altering anxiety-/depression-like behavior, cognition, and social behavior, and modulating brain neurotransmitters and immune signaling (Pérez-Morales et al., 2024; Hayer et al., 2023; Socała et al., 2021; Taniya et al., 2022; Huang & Wu, 2021; Dash et al., 2022; Hiergeist et al., 2020).
- These data support biological plausibility but are limited by methodological heterogeneity and species differences (Hayer et al., 2023; Taniya et al., 2022; Huang & Wu, 2021).

Conclusion

Overall, human studies show **small, often inconsistent associations** between antibiotic exposure—especially in early life—and later neurodevelopmental or psychiatric disorders. Stronger designs using sibling controls often reduce associations toward **no effect**, implying major roles for familial/genetic and illness-related confounding. Antibiotics clearly perturb the gut microbiome, and experimental work links such perturbations to brain and behavior, but current human evidence does **not** justify avoiding needed antibiotics for fear of neurodevelopmental or psychiatric harm.

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