Maternal Peripartum Antibiotic Usage and Depressive Symptoms at 1-month Postpartum

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Background

The gut-brain-axis (Figure 1) is a bidirectional signaling pathway between the gut microbiome and stress response systems of the brain, and is increasingly being studied for its role in affecting mood.[1]

Antibiotic exposure can contribute to an abnormal, or dysbiotic, gut microbiome by altering the microbial composition, and this is suggested as a mechanism for the increased risk of depressive symptoms in non-pregnant, non-postpartum persons.[2-3]

The immunological, metabolic, and endocrine changes that occur during pregnancy influence the overall functioning of the gut microbiome and represent a potentially robust pathway for exploring the effect of antibiotic-induced gut dysbiosis as a contributing factor in the development of postpartum depression (PPD).[4]

Antibiotic Exposure and Gut Microbiome Dysbiosis

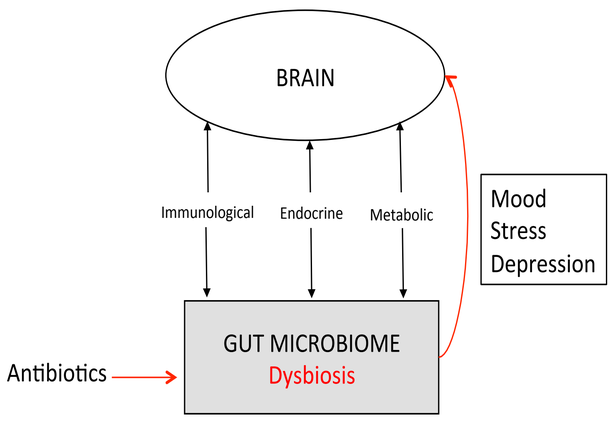

Figure 1. Antibiotic Exposure and Gut Microbiome Dysbiosis. Adapted from Yang, I., Corwin, E.J., Brennan, P.A., Jordan, S., Murphy, J.R., & Dunlop, A. (2016). The Infant Microbiome: Implications for Infant Health and Neurocognitive Development. *Nurs Res, 65*(1), 76-88. doi: 10.1097/NNR. 0000000000000133

Purpose

This study sought to investigate whether maternal antibiotic exposure during the third trimester of pregnancy and through the first 14 days postpartum is associated with depressive symptoms at 1-month postpartum (Figure 2), the time identified in the DSM-V as diagnostic of PPD.[5] This is the first step to defining the more complex relationship between antibiotic exposure, the gut microbiome, and postpartum depression.

Is antibiotic usage during the third trimester of pregnancy through the first 14 days postpartum associated with symptoms of depression at 1-month postpartum?

1. Antibiotics → PPD Symptoms

Figure 2. The proposed mechanism of antibiotic exposure and development of postpartum depressive symptoms.

Methods

A secondary data analysis was conducted on a prospective pregnancy cohort from Denver, Colorado. The original study enrolled 201 women during the prenatal period (Figure 3), with the aim of investigating the psychoneuroimmunology of postpartum depression.[6]

Recruitment Inclusion Criteria

Table 1. Prenatal and postnatal recruitment and inclusion criteria.

Prenatal	• **Pregnant women in the 3rd trimester** • **Age 18-40** • **Anticipated vaginal birth of a singleton infant** • **No chronic illness** • **No pregnancy restrictions** • **No prescribed, OTC or herbal medications** • **Non-smoker**
Postnatal	• Uncomplicated vaginal birth • Singleton infant • Mom and infant discharged together within 72 hours post delivery

Home Visits & Chart Review

Table 2. Data collection time points and measurements.

Time Points	Measures
• Prenatal (32-36 weeks) • Birth - Day 14 postpartum • 1-month postpartum	Demographic Edinburgh Postnatal Depression Scale (EPDS) Perceived Stress Scale (PSS) Hours in Labor Perineal Injury Antibiotics

Statistical Analysis

Table 3. Statistical analysis.

Steps:	1) Descriptive Statistics of Women Based on Antibiotic Use	2) Regression Model
Statistical Test	T-test & Chi-Square	Linear Regression
Variables	• Age • Marital Status • Race • Income • Personal History of Depression • Prenatal-Day 14 Depressive Symptoms • Prenatal- Day 14 Perceived Stress • Hours in labor • Mode of Delivery • Perineal Injury	• Age • Depression History • Perineal Injury • Antibiotics

Results

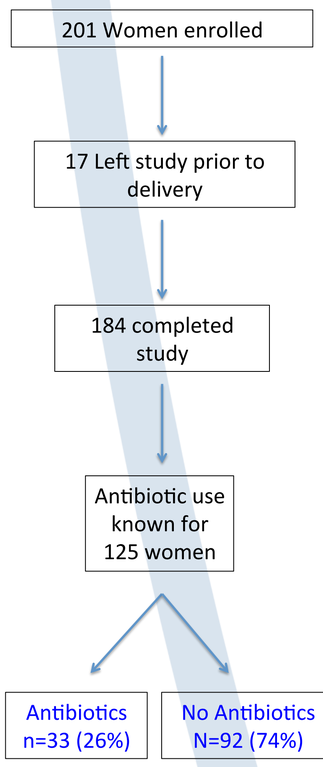

Figure 3. Consort diagram of participants enrolled in the prospective pregnancy cohort from Denver, Colorado.

Table 4. Demographic and Clinical Characteristics of Women Receiving Antibiotics* (n=125)

Demographic and Clinical Characteristics	Antibiotics (n=33)	No Antibiotics (n=92)	P value
Age, mean (SD)	30.5 (4.4)	28.1 (5.5)	.027
Married, n(%)	28 (85)	72 (78)	.417
Caucasian, n(%)	25 (76)	68 (74)	.835
Income, n (%)	6 (18)	25 (27)	.291
Depression History, n(%)	12 (36)	18 (19)	.053
Prenatal EPDS score, mean (SD)	4.8 (3.6)	4.5 (3.5)	.624
Week 1 EPDS score, mean (SD)	4.6 (3.5)	3.8 (3.5)	.310
Week 2 EPDS score, mean (SD)	4.2 (3.4)	3.2 (3.1)	.153
Prenatal PSS score, mean (SD)	21.5 (7.0)	20.1 (6.1)	.308
Week 1 PSS score, mean (SD)	19.1 (6.1)	18.3 (5.0)	.468
Week 2 PSS score, mean (SD)	18.9 (6.8)	17.2 (6.2)	.235
Hours in Labor, mean (SD)	14.8 (14.8)	10.7 (7.4)	.143
Vaginal Delivery n(%)	33 (100)	91 (99)	.548
Perineal Injury, n(%)	14 (42)	26 (28)	.193

Abbreviations: EPDS (Edinburgh Postnatal Depression Scale), PSS (Perceived Stress Scale)
*Antibiotics defined as use of antibiotics during pregnancy or within the first 14 days postpartum.
Income defined as receiving WIC
Perineal injury defined as perineal laceration reported as second degree or more severe.

Results Cont.

Table 5. Final Regression Model

	B	t	P value	95% CI
Constant	2.232	1.393	.166	(-.945, 5.410)
Age	.008	.142	.887	(-.105, .121)
Depression History	-.041	-.059	.953	(-1.396, 1.315)
Perineal Injury	1.617	2.530	.013	(.350, 2.884)
Antibiotics	1.415	2.101	.038	(.080, 2.750)

F Statistic: 3.343 (p=0.013)
R Square .113

Antibiotic exposure is a significant predictor of postpartum depressive symptoms.

Conclusions

1. Antibiotics → PPD Symptoms ✓

Figure 4. The proposed mechanism of antibiotic exposure and development of postpartum depressive symptoms.

With the recent recognition of the contribution of the microbiome gut-brain-axis to mood, and the increase in the use of antibiotics during pregnancy and the postpartum period shown to affect the microbiome, we have demonstrated a need for additional studies to investigate directly the relationship between the gut microbiome, antibiotic exposure, and risk for postpartum depression.

Limitations

- We do not have data on their gut microbiome composition or species diversity.
- Limited sample size

Future Implications

2. Gut Microbiome → PPD
   Antibiotics

3. Antibiotic Overuse & Resistance
   Gut Microbiome Dysbiosis
   Screening & DSM-V criteria

Figure 5. The proposed mechanism linking gut microbiome dysbiosis secondary to antibiotic exposure as contributing to the development of postpartum depression. Clinical recommendations, PPD screening guidelines, and diagnostic criteria should be reassessed as appropriate.

Future work in this area of research will provide new evidence and considerations for modifying clinical practice guidelines for the use of antibiotics during the peripartum period.

References

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