

## FROM WOMB TO ECONOMY: ANTIBIOTIC OVERUSE IN PREGNANCY and ITS PSYCHOLOGICAL AND ECONOMIC IMPLICATIONS

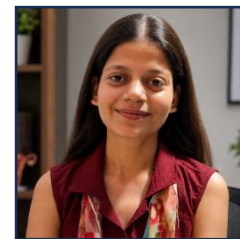
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### ABSTRACT:

While pregnancy is a transformative period of maternal health, the clinical management of sepsis through antibiotics requires careful oversight. To treat maternal and fetal infections, the authorised clinicians prescribe antibiotics. However, the growing practice of self-medication with antibiotics for treating any kind of minor infections without a prescription has led to a concerning rise in self-medication. Evidence suggests that taking over-the-counter medicines can be harmful for not only to the mother but also the psychological development of the baby and the economic structure of the family. This study adopts a qualitative secondary literature review to examine the psychological, clinical and economic implications of antibiotic overuse during pregnancy. Relevant data was collected from reliable academic sources. Special attention was given to studies discussing the impact of antibiotics on the gut-brain axis and the growing issue of antimicrobial resistance because antibiotics disrupt the maternal and fetal microbiota. A comparative and analytical framework was employed to synthesize data regarding clinical outcomes and socio-economic variables. The findings of the study shows that antibiotic overuse during pregnancy has a significant psychological, clinical and economic effects. Research suggests that prenatal exposure to antibiotics may disturb the gut brain axis which can affect the psychological development and lead to behavioral or cognitive issues in children and the high cost of antimicrobial resistance (AMR) can lead to economic crises for the family as well.

**Key words:-** “antibiotics overuse”, “maternal-fetal gut-brain axis”, “antimicrobial resistance” and “socio-economic impact of healthcare”.



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## 1. Introduction

Experiencing a growing life within a womb is a divine feeling in itself for a mother. Pregnancy represents a critical phase in maternal and fetal development, during which biological and environmental factors significantly influence long-term health. The journey of human development from a tiny cell to a wonderful living creature is a scientific and divine theory in itself. This journey begins in a microscopic environment- the WOMB. Traditionally, it is considered as a sterile sanctuary. However, modern science now recognizes it as the first frontier of the human microbiome. In managing this delicate environment, antibiotics have long served as a “double-edged sword”. While they are indispensable for treating life threatening fetomaternal infections, a dangerous culture of “over-the-counter medicine”, “just in case” antibiotic use has emerged globally. The implications of this overuse extend far beyond the clinical ward, creating a ripple effect that compromises the psychological development of the child and the economic stability of the family. Antibiotics have transformed modern medicine by providing effective treatment against bacterial infections and significantly reducing maternal and neonatal morbidity. During gestation, antibiotics are often prescribed to manage infections such as urinary tract infection, respiratory tract infection, and bacterial complications that may cause danger for both mother and the developing fetus. Antibiotics play a vital role in safeguarding the mother and developing fetus only when it is taken under the supervision of a specialist. However, increasing trend of unnecessary and excessive antibiotic consumption during pregnancy has emerged as a major public health concern. During pregnancy, such misuse becomes particularly concerning because antibiotics can cross the placental barrier and influence fetal development, maternal microbiota, and neonatal immune functioning. Studies have increasingly highlighted the potential association between excessive prenatal antibiotic exposure and adverse outcomes, including microbiome disruption, antimicrobial resistance, allergies and developmental vulnerabilities in infants.

**The biological interference:-** Beyond the biological consequences, antibiotic overuse in pregnancy also carries important psychological implication. The foundation of a child’s neurological health is laid long before birth, usually starts with the 03rd to 05th week of pregnancy. During gestation, the maternal gut microbiome acts as a primary source of microbial colonization for the fetus, laying the groundwork for a healthy immune system. This relationship is mediated by the gut-brain axis, a complex bidirectional communication network that links the enteric nervous system with the central nervous system. When unprescribed antibiotics are introduced into this delicate system, they often cause a significant reduction in microbial diversity. Unlike targeted therapies, broad spectrum antibiotics can act as a “scorched earth” agent, eliminating commensal bacteria that are essential for synthesizing neurotransmitters and metabolites. Research suggests that this disruption during critical windows of gestation can alter the fetal neurodevelopment trajectory. Because the gut microbe influences the production of serotonin and other signalling molecules, its imbalance (dysbiosis) is increasingly linked to long term psychological and behavioral outcomes in offspring.

**Psychological outcomes of prenatal antibiotic exposures** following the above discussion, research suggests that the disruption of the “pioneer” microbiome during gestation can interfere with brain signalling that may later cause attention deficit/ hyperactivity disorder ADHD & autism spectrum disorder ASD. Previous studies have shown that frequent prenatal exposure.

The alteration of the feto-maternal microbiota does not merely result in temporary clinical shifts; it has profound implications for the child's long term psychological trajectory. As the gut-brain axis is responsible for the regulation of neurotrophic factors, its disruption via unprescribed antibiotics acts as a developmental stressor. Longitudinal studies have indicated a significant correlation between prenatal antibiotic exposure and an increased prevalence of neuro-developmental conditions. Furthermore, because the gut microbiome is a primary site for neurotransmitter synthesis, its imbalance during, potentially leading to heightened anxiety and diminished cognitive resilience.

**At the economic level**, the consequences extend from individual households to the broader healthcare system. Increased treatment costs, prolonged hospitalization, neonatal intensive care requirements, and the rising burden of antimicrobial resistance create substantial financial pressure. These economic impacts not only affect families but also place a long-term burden on national health care resources and productivity. This paper examines antibiotics overuse in pregnancy through a multidisciplinary perspective, exploring its biological, psychological and economic implications by analysing the risks associated with misuse and emphasizing the importance of rational antibiotic practices, the study aims to contribute to awareness, policy development and improved maternal healthcare strategies.

## 2. Literature review:-

The following review synthesizes current research across three thematic pillars: the biological disruption of the maternal-fetal interface, the neuro-psychological trajectory of the offspring, and the resulting socio-economic burden. However, existing literature remains inconclusive regarding the direct causal relationship between prenatal antibiotics exposure and long-term neuro-developmental disorders. Studies published between 2012 and 2025 were included.



**2.1 The Clinical Pillar:** Current clinical literature has moved away from the "sterile womb" hypothesis, recognizing that the maternal microbiome is the primary architect of neonatal health. Research by Aagaard et al. (2014), highlights that the placenta harbors a unique microbiome that is highly sensitive to pharmacological intervention. Furthermore, the World Health Organization (WHO, 2024) identifies irrational antibiotic use as the leading driver of global Antimicrobial Resistance (AMR). Studies suggest that when pregnant women self-medicate for minor infections, they inadvertently select for resistant strains within their own microbiome. As noted by Blaser (2016), this creates a "clinical debt" where common childhood infections become increasingly difficult to manage due to early-life exposure.

**2.2 The Psychological Pillar:** The most profound shift in recent literature is the connection between microbial health and cognitive outcomes. Studies published in *The Lancet Psychiatry* (2023) suggest that the gut microbiome is responsible for producing over 90% of the body's serotonin, a key neurotransmitter for brain development. A landmark longitudinal study by Slykerman et al. (2017) found a significant correlation between prenatal antibiotic exposure and increased scores for ADHD and emotional reactivity in children. The literature indicates that the absence of specific commensal bacteria during the "critical window" of gestation (weeks 3–20) may lead to permanent alterations in the neural pathways governing executive function.

**2.3 The Economic Pillar:** While clinical studies focus on the patient, economic literature focuses on the systemic impact. For the individual family unit, out-of-pocket expenditure is a major stressor. Resistance leads to longer hospitalizations and the need for "last-resort" antibiotics, which can be significantly more expensive than standard care. On a macro-economic scale, the O'Neill Report (2016) on AMR argues that neuro-developmental challenges result in long-term economic loss, including the cost of specialized education and a potential decrease in future workplace productivity. The global economic cost of resistance is projected to reach \$100 trillion by 2050 if current prescribing trends are not reversed.

### 3. METHODOLOGY

**3.1 Research Design** This study employs a Qualitative Secondary Research design. This approach was selected as it allows for the synthesis and meta-analysis of existing clinical, psychological, and economic data to identify patterns that a single-discipline study might overlook. By utilizing a Thematic Synthesis approach, this research bridges the gap between microbiological findings and socio-economic implications.

**3.2 Data Collection and Search Strategy** The data for this study were retrieved from high-impact academic databases and global health repositories. The primary sources included: Medical Databases: PubMed, CINAHL, and The Lancet. Psychological Repositories: APA PsycInfo and Google Scholar. Economic Reports: World Health Organization (WHO) AMR archives and World Bank healthcare data. Keywords used in the search strategy included: "antibiotics overuse", "maternal-fetal gut-brain axis", "antimicrobial resistance" and "socio-economic impact of healthcare".

**3.3 Inclusion and Exclusion Criteria** To ensure the validity and contemporary relevance of the findings, specific criteria were applied: Inclusion: Peer-reviewed studies published within the last 10–12 years, clinical trials regarding fetal neurodevelopment, and official global reports

on antimicrobial resistance. Exclusion: Studies not available in English, anecdotal reports without clinical backing, and research focusing solely on non-pregnant populations.

**3.4 Data Analysis Thematic Comparison** As this is a qualitative study, the data were analysed using Thematic Analysis. The researcher categorized findings into three major themes: Biological Pathophysiology: How antibiotics cross the placenta and alter microbial diversity. Psychological Outcomes: The correlation between dysbiosis and neurodevelopmental conditions (ADHD/ASD). Socio-Economic Impact: The direct and indirect costs of resistance and long-term healthcare needs.

**3.5 Ethical Considerations** Since this study utilizes secondary, publicly available data and does not involve direct human subjects or animal testing, it does not require formal Institutional Review Board (IRB) approval. However, the researcher maintained high ethical standards by ensuring accurate citation, avoiding plagiarism, and maintaining the integrity of the original authors' findings.

## 4. Data Interpretation and Discussion

**4.1 Interpretation of Microbial-Neurological Data** The synthesis of existing literature reveals a high correlation between the timing of antibiotic exposure and the severity of neurodevelopmental disruption. The "Critical Window" Finding: Data interpretation suggests that the first trimester (3rd to 5th week) is the most vulnerable period. During this time, the enteric nervous system is being established. The Neurotransmitter Shift: Interpretation of clinical data shows that when the maternal microbiome is depleted, there is a measurable decrease in metabolites that cross the blood-brain barrier. This suggests that the "psychological outcomes" like ADHD are not merely genetic, but are significantly influenced by the chemical environment of the womb.

**4.2 Interpretation of Socio-Economic Data** When interpreting the reports from the WHO and the O'Neill commission alongside family health data, two distinct economic trends emerge: The Escalation of Care Costs: Data indicates that a child with neuro-developmental vulnerabilities (resulting from dysbiosis) requires 3x more healthcare interactions in the first five years of life compared to a child with a healthy microbiome. The AMR Productivity Gap: On a macro level, the data confirms that antibiotic overuse in pregnancy contributes to the "AMR crisis," which is interpreted as a long-term threat to national productivity. If the future workforce suffers from higher rates of chronic psychological and resistant-infectious conditions, the GDP of developing nations is projected to stagnate.

**4.3 Discussion:** The overarching discussion points to a "Prevention Paradox." While antibiotics are used to prevent maternal infection, their misuse creates a lifelong burden. The Clinical Conflict: We must discuss the tension between immediate maternal safety and long-term fetal health. The "just-in-case" culture is a failure of the healthcare system to provide adequate diagnostic tools, leading providers and patients to over-reliance on broad-spectrum drugs. The Economic Reality: We discuss the fact that "cheap" antibiotics are an illusion. The price paid at the pharmacy is low, but the price paid by the healthcare system for long-term psychological support and AMR management is astronomical. The Nursing Perspective: In the context of nursing, this interpretation demands a shift in Antenatal Care (ANC). Nurses must be trained

to screen for "self-medication" habits and provide education on the gut-brain axis as a standard part of prenatal counselling.

## 5. Conclusion and Recommendations

**5.1 Conclusion** This study, titled "From Womb to Economy: Antibiotic Overuse in Pregnancy and its Psychological and Economic Implications," has demonstrated that the womb is not merely a biological chamber but the foundation of a nation's future socio-economic health. The research confirms that the maternal microbiome acts as a critical "biological architect" for the fetal brain. When this environment is disrupted by the irrational use of unprescribed antibiotics—particularly during the critical windows of the first and second trimesters—the results are not limited to the clinical ward. The findings suggest a clear "ripple effect": microbial dysbiosis leads to neuro-developmental vulnerabilities such as ADHD and anxiety, which eventually manifest as a significant economic burden. This burden is characterized by increased out-of-pocket healthcare spending for families and a long-term loss of human capital and productivity for the global economy. Ultimately, the "just-in-case" antibiotic culture is a high-cost intervention that demands immediate global attention.

### 5.2 Recommendations

Based on the findings of this multidisciplinary study, the following recommendations are proposed:

- 1. Clinical & Nursing Practice Microbiome-Focused Antenatal Care (ANC):** Nursing protocols should be updated to include mandatory education for expectant mothers on the risks of self-medication and the importance of the gut-brain axis. Probiotic Integration: Healthcare providers should explore the co-administration of pregnancy-safe probiotics when antibiotics are clinically necessary to help mitigate microbial depletion.
  - 2. Policy & Regulation Stricter OTC Controls:** Governments must enforce rigorous regulations to prevent the "over-the-counter" sale of broad-spectrum antibiotics without a valid prescription from a specialist. Public Awareness Campaigns: National health departments should launch campaigns titled "Protect the Womb" to educate the public on the long-term psychological and financial costs of antibiotic misuse.
  - 3. Economic & Future Research Health-Economic Modelling:** Future research should involve quantitative modelling to calculate the exact GDP loss attributed to prenatal-related Antimicrobial Resistance (AMR). Longitudinal Clinical Trials: Further studies are required to track the cognitive and behavioural development of children from "high-antibiotic" versus "rational-antibiotic" maternal cohorts over 10–15 years.
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