*Journal of Mind and Medical Sciences*

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# Socio-economic disparities in prenatal prognosis and intervention accessibility

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ABSTRACT

*Objectives*. This study aimed to assess the impact of socio-economic factors on prenatal care accessibility and outcomes and to evaluate the effectiveness of specialized integrative prenatal care in mitigating these disparities. *Materials and Methods*. A prospective cohort study was conducted between 2020 and 2023 in Bucharest, Romania, involving 100 pregnant women. Participants were equally divided into two groups that received standard and specialized prenatal care. Data were collected through structured interviews, medical record reviews, and standardized questionnaires at multiple time points during pregnancy and postpartum. *Results*. Women receiving integrative care had longer gestation periods (37.8 vs. 37.6 weeks), higher average birth weights (3.3 kg vs. 3.14 kg), and fewer complications during labor (10% vs. 12.5%) compared to the standard care group. Socio-economic status significantly influenced outcomes, with lower income and education levels associated with shorter gestation periods and lower birth weights. Stronger support systems correlated with better mental health and improved pregnancy outcomes. *Conclusions*. Integrative prenatal care, which addresses both medical and psychosocial needs, significantly improves pregnancy outcomes, particularly for women of lower socio-economic status. Targeted interventions are essential to ensure equitable maternal and neonatal health outcomes.

**Category:** Original Research Paper

**Received:** May 14, 2024
**Accepted:** June 21, 2024
**Published:** October 30, 2024

**Keywords:**

socioeconomic status, prenatal care, targeted intervention, birth outcomes

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## Introduction

The capacity of mothers to access high-quality prenatal care is a fundamental determinant of maternal and fetal health outcomes. The awareness that socio-economic factors significantly shape the accessibility and effectiveness of prenatal care underscores persistent disparities that can have long-lasting effects on public health [1]. These disparities often manifest in differential health outcomes that are observable across various socio-economic groups [2]. A body of research highlights the profound influence of socio-economic status on health outcomes, particularly in prenatal care [3-6]. Studies show that during economic downturns, such as the Great Recession, disparities in prenatal care utilization became more visible, reflecting broader socio-economic challenges [7,8]. This period showed a decline in early prenatal care, correlating strongly with areas experiencing significant economic distress.

Despite advancements in medical science improving prenatal care techniques and knowledge, socio-economic disparities continue to pose significant barriers that lead to adverse maternal and fetal outcomes. The disparities are not only influenced by individual socio-economic status but are also reflected in community health resources and systemic structures [9].

**To cite this article**: Iacoban SR, Piron-Dumitrascu M, Bohiltea CL, Suciu ID, Voinea SC, Suciu N. Socio-economic disparities in prenatal prognosis and intervention accessibility. *J Mind Med Sci*. 2024;11(2):402-411. doi:10.22543/2392-7674.1541

Adverse birth outcomes, including low birthweight and preterm birth, represent critical global health challenges that significantly impact neonatal, infant, and long-term outcomes. These conditions are key indicators of maternal and neonatal health and are influenced by genetic, environmental, and socioeconomic factors. A systematic review found that the global preterm birth rate is approximately 11%, translating to an estimated 15 million preterm births each year. Preterm birth rates are the highest in sub-Saharan Africa and South Asia [10]. Compared to their term-born peers, children born prematurely are at a higher risk for a range of health issues such as cerebral palsy, sensory impairments and learning disabilities [11-13]. Low birthweight (below 2500 grams) occurs in nearly 15-20% of babies born worldwide, closely associated with preterm delivery and factors such as maternal health, nutrition, and care during pregnancy [14] and is associated with an increased risk of developing diabetes and cardiovascular diseases later in life [15].

Our research objectives are to dissect and understand the underlying socio-economic factors that influence the disparity in prenatal care access and its quality, to assess the direct and indirect effect of these disparities on prenatal prognosis and outcomes but also to evaluate and propose targeted interventions designed to improve these disparities, ensuring better prenatal care access and outcomes across all socio-economic categories. We hypothesize that socio-economic disadvantages are inversely related to the quality and timeliness of prenatal care, which subsequently influences prenatal and birth outcomes. It is anticipated that interventions tailored to the needs of underprivileged communities could significantly improve access to and the quality of prenatal care, thereby reducing adverse prenatal outcomes. This research aims to highlight the mechanisms through which socio-economic factors influence prenatal care and help design effective interventions through a detailed examination of both direct and community-level socio-economic impacts on prenatal care access and effectiveness, using both qualitative and quantitative data to provide a comprehensive overview of the landscape of prenatal health disparities.

# Materials and Methods

*Study design*

This study utilized a prospective cohort design, conducted between 2020 and 2023 at a tertiary medical center in Bucharest, Romania. A cohort of 100 pregnant women, meeting predefined inclusion and exclusion criteria, was systematically followed from the first trimester through to delivery and the immediate postpartum period. Participants were recruited following a thorough informed consent process to ensure understanding and voluntary participation. To assess the impact of different prenatal care approaches, the cohort was equally divided into two groups with 50 participants in each group: one group received standard prenatal care, while the other group received specialized integrative prenatal care. This specialized care included more frequent and comprehensive consultations that addressed both medical and psychosocial aspects, such as mental health support and assistance with barriers to accessing care.

*Inclusion and exclusion criteria*

Table 1 outlines the specific inclusion and exclusion criteria used to determine participant eligibility for our study, ensuring the selection of a representative and appropriate sample.

**Table 1.** Inclusion and exclusion criteria for selection of participants

| Inclusion criteria | Exclusion criteria |
|---|---|
| Women aged 18-40 years. | Multiple pregnancies (e.g., twins, triplets). |
| Singleton pregnancy confirmed by ultrasound. | Pre-existing chronic conditions unrelated to pregnancy, such as severe cardiovascular disease, active cancer, or other significant medical conditions that could confound the study results. |
| Willingness to participate and provide informed consent. | History of substance abuse, as it could impact pregnancy outcomes independently of the factors being studied. |
| Availability for follow-up throughout the pregnancy and postpartum period. | Inability or unwillingness to comply with the study protocol and follow-up schedule. |

*Ethical approval*

The study protocol was approved by the Institutional Review Board (IRB) of the Alessandrescu-Rusescu National Institute of Mother and Child Health (approval no. 14968/23.09.2019). All participants provided written informed consent before enrollment.

*Data Collection*

Data for this study were collected using a combination of structured interviews, medical record analysis and standardized questionnaires. This multi-method approach ensured comprehensive and accurate data gathering, using both quantitative and qualitative aspects of the participants' experiences and outcomes.

*Structured interviews*

Trained personnel conducted interviews at three key time points: the first trimester (initial visit), second and third trimesters (follow-up visits), and postpartum (immediate postpartum period). The interviews included questions on demographic information, socioeconomic status, mental health, support systems, and barriers to accessing care.

*Medical record analysis*

Detailed review of participants' medical records extracted relevant clinical data. It included gestational age, fetal and maternal heart rates, chronic conditions, history of births and miscarriages, complications during labor/ delivery, and neonatal outcomes (APGAR scores and neonatal intensive care unit admissions).

The specialized care group was provided with comprehensive and specialized prenatal care designed to address the unique challenges found during pregnancy. According to the records, the patients received multidisciplinary care that included frequent consultations with a dedicated team of healthcare professionals. The team comprised obstetricians, midwives, nutritionists, psychologists, and social workers, all working together to provide holistic care. Each visit covered both medical and psychosocial aspects of pregnancy, ensuring that no aspect of maternal and fetal health was overlooked. A key feature of this specialized care was the integration of mental health support. Recognizing the high prevalence of stress, anxiety, and depression in underserved populations, every pregnant woman in the specialized care group received regular assessments using validated tools such as the DASS-21. In addition, the specialized care group had access to advanced diagnostic testing and frequent ultrasound examinations, which allowed for the early detection and management of potential complications. These diagnostic tools were complemented by a robust education program that empowered women with knowledge about the stages of pregnancy, warning signs of complications, and the importance of regular prenatal visits. Through this comprehensive and multidisciplinary approach, the specialized prenatal care received by the specialized care group was not just a series of medical check-ups, but a robust support system aimed at addressing the diverse and complex needs of pregnant women. This model of care represents a significant step toward reducing health disparities and improving pregnancy outcomes in vulnerable populations.

Medical records were accessed with the participants' consent, ensuring confidentiality and adherence to ethical guidelines.

*Questionnaires*

Participants completed standardized questionnaires to capture detailed information on mental health, support systems, and barriers to care.

*Instruments*

For mental health assessment, we used the DASS-21 (Depression Anxiety Stress Scales - 21 Items) questionnaire, which is a widely used, validated instrument for measuring symptoms of depression, anxiety, and stress [16]. Participants rated their experiences over the past week on a 4-point Likert scale (0 = Did not apply to me at all, 3 = Applied to me very much or most of the time). The scores for depression, anxiety, and stress were calculated by summing the relevant items, with higher scores indicating greater levels of distress.

Regarding support systems assessment, we used the Duke-UNC Family and Social Support Questionnaire (FSSQ), a validated tool to assess the perceived availability and quality of support from family, friends, and the community [17]. Participants responded to items on a 5-point Likert scale (1 = Strongly disagree, 5 = Strongly agree). The questions covered emotional support, practical support, and the presence of a reliable support network and the scores were summed to provide an overall measure of support, with higher scores indicating stronger support systems.

*Variables*

In this study, we examined the influence of various independent variables on pregnancy outcomes. These variables were selected based on existing literature and the conceptual framework guiding the study. The comprehensive assessment of these variables allowed for a comprehensive understanding of the factors impacting pregnancy outcomes.

*Independent variables*

- Socioeconomic status (SES):
  - Income was measured as the monthly household income in Romanian Lei (RON) and categorized into four groups: Low income (<2500 RON), Middle income (2500-3500 RON), Upper middle (3500-5000 RON) and High income (>5000 RON).
  - Education level was categorized as Primary education, Secondary education, High school and Higher education and the participants had to mention the highest level of education attained.
  - Employment status required the current employment status and was categorized as Employed (full-time or part-time) and Unemployed.
- Mental health status was assessed using the Depression Anxiety Stress Scales - 21 Items (DASS-21). Each was categorized as Normal, Mild, Moderate, Severe, and Extremely Severe.
- Support systems were assessed using the Duke-UNC Family and Social Support Questionnaire (FSSQ).
  - Emotional support from family, friends, and community and practical support (e.g., help with childcare, household tasks) were rated on a 5-point Likert scale and the scores were summed to provide an overall measure of emotional and practical support, respectively.
  - Overall support: composite score combining emotional and practical support scores, categorized as Low, Moderate, and High support.

*Dependent variables*

- Gestation period was measured in weeks from the last menstrual period (LMP) to the date of delivery and categorized as Preterm (<34 weeks), Late preterm (34-37 weeks), Term (>37 weeks).
- Birth weight refers to the weight of the newborn measured in kilograms at birth and was categorized as Low birth weight (<2 kg), Normal birth weight (2-3 kg, 3-4 kg), and Macrosomia (>4 kg).

- Complications during labor and delivery: the presence of any complications recorded in medical records, such as gestational diabetes, preeclampsia, hemorrhage, or cesarean delivery, or No complications.
- Neonatal outcomes were assessed using APGAR scores at 5 minutes after birth and were categorized as Normal (>8), Intermediate (5-8), and post-delivery neonatal intensive care unit admission (<5).

*Statistical analysis*

Mean, median, and standard deviation were calculated for continuous variables. Frequencies and percentages were calculated for categorical variables. Regression analysis was used to examine the relationship between socioeconomic status, type of prenatal care, mental health status, support systems, and pregnancy outcomes. T-tests were utilized to compare means between groups, and Chi-square tests were applied to assess associations between categorical independent and dependent variables. For non-parametric data or comparisons across multiple groups, the Kruskal-Wallis test was employed. Additionally, categorical variables were converted to numerical codes (indicator variables) to facilitate the computation of correlations. Statistical analysis was performed using SPSS (Statistical Package for the Social Sciences) version 25. To ensure the reliability and validity of the data, all research staff underwent training on data collection procedures and ethical considerations. Also, standardized instruments such as validated questionnaires and assessment tools (e.g., DASS-21, FSSQ) were used. By applying a range of statistical methods and rigorous data analysis techniques, this study provides robust insights into the factors influencing pregnancy outcomes.

# Results

*Demographics*

The study sample consisted of 100 pregnant women who met the inclusion criteria and were followed throughout their pregnancies. The demographic characteristics of these participants were diverse, reflecting a broad cross-section of the population. This diversity allowed for a comprehensive analysis of the impact of various socioeconomic factors on pregnancy outcomes. Table 2 presents a summary of the key demographic data collected.

Table 3 summarizes the mean, median, standard deviation, and range for continuous variables such as age, height, weight, and body mass index (BMI).

The mean age of the participants was 29.46 years, with a standard deviation of 6.08 years, indicating a relatively young cohort. The mean BMI was 27.18 kg/m², with a standard deviation of 3.72 kg/m², reflecting a generally healthy weight distribution among the participants.

**Table 2.** Demographic characteristics of the study participants

| Characteristic | Mean (SD) / Percentage |
|---|---|
| Age (years) | 29.46 (6.08) |
| Height (m) | 1.66 (0.06) |
| Weight (kg) | 75.03 (11.61) |
| BMI (kg/m²) | 27.18 (3.72) |
| Marital Status | |
| - Married | 72% |
| - Single | 26% |
| - Divorced | 2% |
| Residential Location | |
| - Urban | 72% |
| - Rural | 28% |
| Education Level | |
| - Primary | 2% |
| - Secondary | 6% |
| - High school | 56% |
| - Higher education | 36% |
| Employment Status | |
| - Employed | 77% |
| - Unemployed | 23% |
| Income (RON/month) | |
| - Less than 2500 RON | 14% |
| - Between 2500 RON and 3500 RON | 49% |
| - Between 3500 RON and 5000 RON | 24% |
| - Higher than 5000 RON | 13% |
| Health Insurance | |
| - Insured | 95% |
| - Uninsured | 5% |

**Table 3.** Summary of descriptive statistics

| Variable | Mean | Median | SD | Range |
|---|---|---|---|---|
| Age (years) | 29.46 | 30 | 6.08 | 15-44 |
| Height (m) | 1.66 | 1.655 | 0.06 | 1.50-1.82 |
| Weight (kg) | 75.03 | 75.5 | 11.61 | 38-104 |
| BMI (kg/m²) | 27.18 | 27.87 | 3.72 | 15.22-38.28 |

Marital status showed that the majority of the women were married (72%), while 26% were single, and 2% were divorced. This distribution highlights the varying family support structures that could potentially influence pregnancy outcomes. In terms of residential location, 72% of the participants resided in urban areas, while 28% lived in rural settings. This urban-rural mix provided an opportunity to examine the impact of geographical factors on prenatal care access and pregnancy outcomes. Education levels were diverse, with 2% of the women having completed only primary education, 6% having secondary education, 56%

high school level and 36% holding higher education qualifications. This range of educational backgrounds allowed for the assessment of how educational attainment might affect health literacy and prenatal care compliance. Employment status revealed that 77% of the women were employed, either full-time or part-time, whereas 23% were unemployed. The income distribution was categorized into three levels: low income (<2500 RON) constituted 14% of the sample, middle income (2500-5000 RON) made up 73%, and high income (>5000 RON) accounted for 13%. These figures provided a comprehensive view of the socioeconomic diversity within the study population. Health insurance coverage was high among the participants, with 95% having some form of health insurance, while 5% were uninsured. Overall, the demographic data highlighted the diversity in socioeconomic status, educational levels, and residential locations among the study participants.

*Socioeconomic status and pregnancy outcomes*

In analyzing the relationship between socioeconomic status (SES) and pregnancy outcomes, several patterns emerged that underscored the significant impact of income, education, and employment status on maternal and neonatal health.

*Gestation period*

The gestation period, measured from the last menstrual period (LMP) to delivery, showed notable differences across various SES groups. Women with higher incomes and education levels generally experienced longer gestation periods, resulting in fewer preterm births. Women in the high-income group (>5000 RON/month) had an average gestation period of 37.6 weeks, with a preterm birth rate (<37 weeks) of 15.4%, while middle-income women (2000-5000 RON/month) had an average gestation period of 37.9 weeks and a preterm birth rate of 5.5%. In contrast, women in the low-income group (<2000 RON/month) had a significantly shorter average gestation period of 36.4 weeks and a higher preterm birth rate of 42.9%. Participants with tertiary education had the longest average gestation period of 37.7 weeks and a preterm birth rate of 11.1%, while those with secondary education had an average gestation period of 35.5 weeks and a preterm birth rate of 66.7%.

*Birth weight*

Birth weight, a crucial indicator of neonatal health, also showed significant variation with SES. Higher income and education levels were associated with healthier birth weights. The average birth weight in the high-income group was 3.5 kg, with 7.7% of infants classified as low birth weight (<2.5 kg). Middle-income group infants had an average birth weight of 3.2 kg, with 5.5% classified as low birth weight, and low-income group infants had the lowest average birth weight of 2.6 kg, with 35.7% classified as low birth weight. Infants born to mothers with tertiary education had an average birth weight of 3.25 kg, with 11.1% classified as low birth weight. Those born to mothers with secondary education had an average birth weight of 2.5 kg, with 66.7% classified as low birth weight, while infants of mothers with primary education had an average birth weight of 3.0 kg, with 0.0% classified as low birth weight.

*Complications during labor and delivery*

The prevalence of complications during labor and delivery varied significantly across different SES groups. Higher SES was generally associated with fewer complications, reflecting better overall health and access to quality prenatal care. High-income women experienced complications in 15.4% of cases, including issues such as abnormal presentation of the fetus and placenta praevia. Middle-income women had a complication rate of 12.3%, with common issues including shoulder dystocia, abnormal presentation of the fetus, and postpartum hemorrhage. Low-income women had the highest complication rate at 35.7%, with severe complications like abnormal presentation of the fetus and intraamniotic infection. Women with tertiary education experienced complications in 19.4% of cases, primarily minor issues such as abnormal presentation of the fetus and shoulder dystocia. Secondary education level women had a complication rate of 50%, with common complications including abnormal presentation of the fetus and intraamniotic infection.

*Neonatal outcomes*

Neonatal outcomes, including APGAR scores and as neonatal intensive care unit (NICU) admissions, were also influenced by SES. Higher SES was correlated with better neonatal health.

*APGAR scores*

- High-income group infants had an average APGAR score of 8.6 at 5 minutes.
- Middle-income group infants had an average APGAR score of 8.8 at 5 minutes.
- Low-income group infants had lower average APGAR scores of 7.6 at 5 minutes.

*NICU admissions*

- High-income group had a NICU admission rate of 0.0%.
- Middle-income group had a NICU admission rate of 0.0%.
- Low-income group had the highest NICU admission rate at 21.4%.

The analysis clearly demonstrated that higher income and education levels were associated with longer gestation periods, higher birth weights, fewer complications during labor and delivery, and better neonatal outcomes. These findings highlight the critical role of socioeconomic factors in influencing pregnancy outcomes and underscore the importance of targeted interventions to support low-income and less-educated pregnant women.

*Effectiveness of integrative prenatal consultations*

This study aimed to evaluate the effectiveness of integrative prenatal consultations by comparing pregnancy outcomes between women receiving standard care and those receiving specialized integrative care. Integrative prenatal care included more frequent and comprehensive consultations that addressed both medical and psychosocial aspects, such as mental health support and assistance with barriers to accessing care.

*Gestation period*

The gestation period, an essential indicator of pregnancy health, varied between the two groups. The average gestation period for women receiving standard care was 37.6 weeks, and the preterm birth rate (<37 weeks) in this group was 12.5%, while women who received specialized integrative care had slightly better gestational outcomes with an average gestation period of 37.8 weeks and a 10.0% preterm birth rate.

*Birth weight*

Birth weight, a crucial measure of neonatal health, also showed differences between the two groups. The average birth weight for infants born to mothers receiving standard care was 3.14 kg, with an incidence of low birth weight (<2.5 kg) of 10.0%, while the average birth weight for infants in the specialized care group was 3.3 kg, with an identical incidence of low birth weight at 10.0%.

*Complications during labor and delivery*

The frequency and severity of complications during labor and delivery provided further insights into the effectiveness of integrative prenatal consultations. Complications were recorded in 12.5% of the standard care group, with common issues including abnormal presentation of the fetus, postpartum hemorrhage, and shoulder dystocia. The specialized care group had a slightly lower complication rate of 10.0%, with generally minor issues such as induction of labor and mild shoulder dystocia.

*Neonatal outcomes*

Neonatal outcomes, assessed using APGAR scores and NICU admission rates, highlighted the benefits of specialized integrative care. In the standard care group, the average APGAR score at 5 minutes was 8.5, and the NICU admission rate was 3.75%. In the specialized integrative care group, the average APGAR score at 5 minutes was 8.8, with no NICU admissions recorded.

*Mental health and support systems*

The analysis of support systems in relation to mental health status reveals a clear association between higher levels of support and better mental health outcomes. Among women who reported high levels of support from family, partners, or the community, the vast majority (57 cases) were classified as having "Normal" mental health status on the DASS-21 scale. Only a few individuals in this group experienced "Mild" or "Moderate" levels of anxiety, stress, and depression, and none were classified as "Severe."

Conversely, women with lower levels of support exhibited more diverse mental health outcomes. While some were still categorized as having "Normal" mental health status, a significant number were classified as "Mild" or "Moderate," and there was at least one case of "Severe" mental health status. This suggests that lower support systems may contribute to poorer mental health outcomes during pregnancy.

Overall, the data underscores the importance of robust support systems in maintaining good mental health during pregnancy. Women with stronger support networks are more likely to experience lower levels of anxiety, stress, and depression, which are critical for both maternal and neonatal health.

The findings from this study demonstrate the effectiveness of integrative prenatal consultations in improving pregnancy and neonatal outcomes. Women receiving specialized care experienced fewer complications during labor and delivery, better neonatal health as evidenced by higher APGAR scores and lower NICU admission rates, and improved mental health outcomes, contributing to a better overall pregnancy experience.

*Impact of mental health and support systems*

The relationship between mental health status and pregnancy outcomes was a critical focus of this study. Additionally, the role of support systems in mitigating stress and improving pregnancy outcomes was evaluated. The findings demonstrate significant associations between mental health, the quality of support systems, and the overall health of both mothers and their infants.

*Mental health status and pregnancy outcomes*

The mental health status of the participants was assessed using the Depression Anxiety Stress Scales - 21 Items (DASS-21). This evaluation provided insight into how anxiety, stress, and depression levels influenced pregnancy outcomes.

- Normal: Women with normal mental health status had an average gestation period of 37.8 weeks and a preterm birth rate of 8.5%. The average birth weight in this group was 3.18 kg.
- Mild: Participants with mild mental health symptoms had a slightly shorter average gestation period of 37.3 weeks and a higher preterm birth rate of 20.0%. The average birth weight for this group was 3.15 kg.
- Moderate: Those with moderate mental health symptoms experienced an even shorter average gestation period of 36.9 weeks and a preterm birth rate of 28.6%. The average birth weight in this group was 3.21 kg.
- Severe: Women with severe mental health symptoms had the most challenging outcomes, with an average gestation period of just 33.0 weeks and a preterm birth rate of 100.0%. The average birth weight in this group was significantly lower at 2.0 kg.

*The role of support systems*

The analysis of birth outcomes in relation to the level of support systems (family, partner and community support), reveals significant differences in gestation periods, preterm birth rates, and birth weights. Women who reported medium support experienced the most favorable outcomes, with an average gestation period of 38.0 weeks, no recorded preterm births, and the highest average birth weight of 3.35 kg. In contrast, those with low support faced more challenges, with an average gestation period of 36.8 weeks, a high preterm birth rate of 35.3%, and a lower average birth weight of 3.0 kg. Participants with high support also showed relatively positive outcomes, with an average gestation period of 37.7 weeks, a preterm birth rate of 9.5%, and an average birth weight of 3.16 kg. These findings underscore the crucial role of strong support systems in promoting healthier pregnancy outcomes and highlight the risks associated with inadequate support during pregnancy.

*Neonatal outcomes*

The analysis of APGAR scores at 5 minutes reveals a significant interaction between maternal mental health and the level of support systems. Infants born to mothers with normal or mild mental health status and high support systems generally had the highest APGAR scores, with scores reaching up to 9. Conversely, mothers experiencing severe mental health challenges, especially those with low support, had infants with much lower APGAR scores, averaging as low as 4. The absence of data for some combinations, particularly for moderate and severe mental health with medium or high support, suggests that further research might be needed to fully understand these dynamics.

These findings underscore the importance of mental health and robust support systems in ensuring positive neonatal outcomes. The data suggests that improving mental health and enhancing support networks during pregnancy can lead to better APGAR scores, which are critical indicators of neonatal well-being.

This analysis reinforces the need for integrated prenatal care that addresses both mental health and the social support structures available to expectant mothers (Figure 1) (Table 4).

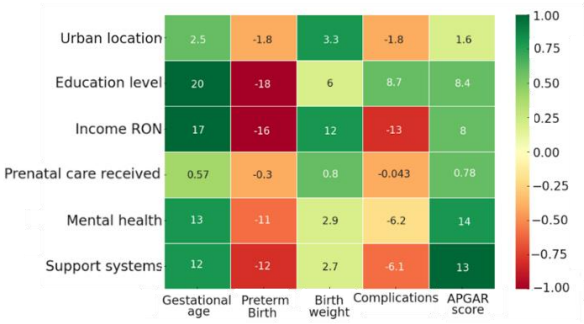


**Figure 1.** Correlation heatmap representing the relationship between key predictors and pregnancy outcomes. The intensity of the colors corresponds to the statistical significance (p-value) of the correlations, with darker shades indicating stronger significance. Positive correlations are represented in green, while negative correlations are shown in red. The correlation coefficients inside each box were computed using a combination of statistical tests: t-tests were employed for comparisons between two groups or binary categorical variables, while Kruskal-Wallis tests were utilized for non-parametric or multi-group comparisons. The p-values derived from these tests determined the intensity of the color shading in the heatmap, reflecting the significance of the correlations.

**Table 4.** Correlation coefficients (cc) and corresponding p-values for various predictors across key pregnancy outcomes. t, t-test, H, Kruskal-Wallis test.

| | Gestational age at delivery | | Preterm Birth | | Birth weight (kg) | | Complications | | APGAR score | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **cc** | **p** | **cc** | **p** | **cc** | **p** | **cc** | **p** | **cc** | **p** |
| **Urban location** | t=2.52 | 0.013 | t=-1.82 | 0.072 | t=3.26 | 0.002 | t=-1.78 | 0.078 | t=1.61 | 0.11 |
| **Education level** | H=19.56 | 0.0002 | H=-18.35 | 0.0004 | H=6.00 | 0.112 | H=8.69 | 0.034 | H=8.39 | 0.039 |
| **Income** | H=16.73 | 0.001 | H=-15.60 | 0.001 | H=12.12 | 0.007 | H=12.77 | 0.005 | H=7.97 | 0.047 |
| **Specialized prenatal care** | t=0.573 | 0.0568 | t=-0.305 | 0.0761 | t=0.797 | 0.0427 | t=-0.043 | 0.0965 | t=0.775 | 0.044 |
| **Mental health** | H=12.53 | 0.006 | H=-10.58 | 0.014 | H=2.87 | 0.413 | H=-6.22 | 0.101 | H=14.48 | 0.002 |
| **Support systems** | H=11.97 | 0.003 | H=-11.71 | 0.003 | H=2.74 | 0.254 | H=-6.11 | 0.047 | H=13.03 | 0.001 |

## Discussions

The findings of this study provide evidence supporting the hypothesis that integrative prenatal consultations significantly improve pregnancy outcomes by addressing both medical and psychosocial needs. The primary objective of this study was to evaluate the effectiveness of integrative prenatal consultations compared to standard prenatal care. The data clearly indicate that integrative care, which includes more frequent and comprehensive consultations, positively impacts several critical pregnancy outcomes. Women receiving specialized integrative care exhibited longer gestation periods, higher birth weights, and fewer complications during labor and delivery

compared to those receiving standard care. Additionally, neonatal outcomes were markedly better, with higher APGAR scores and lower NICU admission rates among infants whose mothers received integrative care. The integrative prenatal consultations provided comprehensive support that went beyond routine medical care. By incorporating mental health assessments and support systems into the care plan, these consultations addressed the psychosocial factors that are often overlooked in standard prenatal care. The results showed that women with lower levels of anxiety, stress, and depression had significantly better pregnancy outcomes. This underscores the importance of integrating mental health support into routine prenatal visits.

We also aimed to explore the relationship between socioeconomic status (SES) and pregnancy outcomes. Consistent with previous research [18-21], higher income and education levels were associated with better pregnancy outcomes, including longer gestation periods and higher birth weights. Similarly, a meta-analysis by Blumenshine et al. concluded that higher income and education levels are associated with reduced risks of preterm birth and low birth weight [22]. These findings emphasize the role of SES in maternal and neonatal health and suggest that targeted interventions are necessary to support low-income and less-educated pregnant women. By providing additional resources and support to these populations, healthcare systems can help mitigate the adverse effects of socioeconomic disparities on pregnancy outcomes.

Another significant finding of this study is the critical role of support systems in improving pregnancy outcomes. Women with strong emotional and practical support systems had better pregnancy outcomes, as evidenced by longer gestation periods, higher birth weights, and better neonatal health. These results align with existing literature that highlights the importance of social support in reducing stress and improving health outcomes [23-26].

Grote et al. found that maternal depression and anxiety are associated with increased risks of preterm birth and low birth weight [27]. The current study supports these findings, showing that lower levels of anxiety, stress, and depression were linked to better pregnancy outcomes. This reinforces the importance of integrating mental health support into prenatal care to improve maternal and neonatal outcomes. The role of support systems in mitigating stress and enhancing pregnancy outcomes has been widely recognized. Research by Elsenbruch et al. demonstrated that strong social support reduces stress levels and is associated with better pregnancy outcomes, such as lower rates of preterm birth and higher birth weights [28]. This highlights the importance of fostering robust support networks for pregnant women, particularly those who may be socially isolated or lacking family support. The impact of barriers to accessing prenatal care on pregnancy outcomes has also been explored in previous research. Grand-Guillaume-Perrenoud et al. have shown that barriers such as transportation issues, work constraints, and healthcare provider availability can adversely affect prenatal care utilization and outcomes [29]. The current study identified similar barriers among participants and demonstrated that addressing these barriers through integrative prenatal consultations led to improved outcomes. This underscores the need for healthcare systems to identify and mitigate barriers to ensure all women receive timely and adequate prenatal care.

The findings of this study have important implications for clinical practice. Integrative prenatal consultations, which address both medical and psychosocial needs, should be considered a standard approach in prenatal care. Healthcare providers should routinely assess mental health and support systems as part of prenatal visits and provide appropriate interventions and referrals. Additionally, addressing socioeconomic disparities through targeted programs and resources can help improve pregnancy outcomes for underserved populations [2]. Previous studies have shown that integrative approaches to prenatal care, which include mental health support and social services, lead to better maternal and neonatal outcomes [30-33]. This study's findings are in line with existing research, reinforcing the importance of integrative prenatal care, socioeconomic status, mental health, and support systems in determining pregnancy outcomes. These results add to the growing body of evidence supporting holistic approaches to prenatal care that address both medical and psychosocial needs. Future research should continue to explore these areas, focusing on long-term outcomes and the development of targeted interventions to support vulnerable populations.

While we highlighted the benefits of integrative prenatal care, there remain numerous avenues for future research that could further elucidate the long-term and broader impacts of these practices. One of the most critical areas for future research is the long-term impact of integrative prenatal care on child development. We have demonstrated the benefits for neonatal outcomes, but it is essential to investigate how these benefits translate into long-term developmental advantages. Future studies should track children born to mothers who received integrative prenatal care and evaluate their physical, cognitive, and emotional development over several years. This longitudinal approach could provide valuable insights into the sustained effects of comprehensive prenatal care. Future research should also focus on the long-term health outcomes for mothers who received integrative prenatal care. This includes examining the incidence of postpartum depression, overall physical health, and the ability to return to pre-pregnancy health status. Understanding these outcomes can help refine prenatal care programs to include more robust postpartum support and

follow-up. Also, how different models of integrative care determine which elements are most effective should also be explored. This could include varying the frequency of consultations, types of mental health interventions, or the involvement of social support services.

While this study provides valuable insights, it is not without limitations. The sample size, although adequate for initial findings, may not capture all the nuances of a larger, more diverse population. Future research should aim to include larger sample sizes and diverse populations to validate these findings. Additionally, longitudinal studies that follow mothers and infants beyond the postpartum period could provide deeper insights into the long-term benefits of integrative prenatal care.

## Conclusions

This study demonstrates that integrative prenatal consultations, which holistically address medical, psychological, and social needs, substantially enhance pregnancy outcomes. These findings show the vital role of high socioeconomic status, strong mental health, and supportive social networks in achieving positive maternal and neonatal health. The evidence suggests that a comprehensive approach to prenatal care, which includes regular mental health assessments and support for overcoming logistical barriers to care, is crucial for improving gestational length, birth weight, and reducing neonatal complications.

Our study underscores the necessity of targeted interventions for the needs of vulnerable populations, ensuring equitable access to integrated prenatal services. Given the significant impact of socioeconomic factors, mental health, and support systems on pregnancy outcomes, future research should focus on developing and refining prenatal care models that optimize the health of mothers and their infants over the long term.

This approach not only confirms existing knowledge but also contributes new insights into the efficacy of integrated prenatal care, emphasizing the importance of a complex strategy in public health practices.

## Highlights

- ✓ Specialized integrative prenatal care significantly improved pregnancy outcomes, including longer gestation periods, higher birth weights, and fewer complications during labor.
- ✓ Socio-economic factors were strongly associated with pregnancy outcomes, with lower income and education levels linked to higher risks of preterm birth and low birth weight.
- ✓ The study emphasizes the need for targeted interventions to address disparities in prenatal care and promote equitable maternal and neonatal health.

## Contributions

SRI and NS contributed to conceptualizing, MPD contributed to the methodology, SRI and IDS contributed to writing the original draft, CLB contributed to editing the manuscript, SRI and MPD contributed to data collection, NS and SCV contributed to data curation and SRI contributed to data analysis.

## Compliance with ethical standards

Any aspect of the work covered in this manuscript has been conducted with the ethical approval of the Alessandrescu-Rusescu National Institute of Mother and Child Health, Bucharest, Romania (approval number/ 14968/23.09.2019). Informed consent was obtained from all subjects involved in the study.

## Conflict of interest disclosure

There are no known conflicts of interest in the publication of this article. The manuscript was read and approved by all authors.

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