Impact of preconception counseling on maternal and fetal outcomes: A clinical study from a private primary care setting in Baghdad

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Abstract

Maternal and neonatal health outcomes remain a major concern in low- and middle-income countries, including Iraq, where gaps in preventive services persist. The effect of structured preconception counseling on maternal and fetal outcomes was assessed in this study among women who visited a private primary-care clinic in Baghdad's Dora district. A prospective cohort of 240 women of reproductive age was enrolled and followed through pregnancy, with outcomes compared to a reference group of 120 women who did not receive counseling. The in- tarnation consisted of standardized sessions addressing nutrition, folic acid supplementation, chronic disease management, lifestyle modification, vaccination, and reproductive planning. Results showed that counseling was associated with significant reductions in gestational dia- betes (11.7% vs. 18.3%), hypertensive disorders (13.3% vs. 20.8%), and anemia (20.4% vs. 29.2%). Neonatal outcomes were also improved, with reduced birth weight (15.8% vs. 24.2 %) and preterm birth rates (12.9% vs. 21.7%). Adherence to counseling independently decreased the risk of preterm birth (AOR = 0.55; 95% CI: 0.33–0.91) and gestational diabetes (AOR= 0.62; 95% CI: 0.40–0.95), according to multivariate analysis. These findings demonstrate that structured preconception counseling in a primary-care setting can significantly improve maternal and neonatal outcomes and should be integrated into Iraq's healthcare system to strengthen maternal and child health strategies.

Keywords: Preconception counseling, Maternal health, Neonatal outcomes, Primary care, Baghdad, Iraq

1.Introduction

1.1. Background on Maternal and Fetal Health Challenges

Maternal and perinatal morbidity and mortality remain major public health concerns worldwide. In 2023, an estimated 260,000 women died from causes related to pregnancy and childbirth—about one every two minutes—with the vast majority of deaths occurring in low- and lower-middle- income settings and considered preventable [1]. Progress has slowed in recent years, jeopardizing attainment of Sustainable Development Goal (SDG) 3.1, which targets a global maternal mortality ratio (MMR) of fewer than 70 deaths per 100,000 live births by 2030 [1].

Iraq has shown long-term improvements; national estimates suggest the MMR declined from approximately 152 per 100,000 live births in 2000 to around 66 in 2023, yet these levels remain above regional comparators [2]. Persistent challenges—

including conflict-related disruptions, elevated adolescent fertility, and service-quality gaps—continue to affect maternal and newborn outcomes in the country [3].

1.2. Importance of preconception care

Preconception Care (PCC) comprises biomedical, behavioral, and social interventions delivered before pregnancy to reduce risk, optimize health, and improve outcomes for mothers and infants [4, 5, 6]. Evidence demonstrates that PCC in primary and community settings can improve preg- nancy health behaviors and outcomes, including better metabolic control, uptake of folic acid, and reductions in adverse outcomes [7].

One of the most consistently demonstrated benefits is periconceptional folic acid supplemental- tion for Neural Tube Defect (NTD) prevention. Umbrella reviews and large-scale syntheses report reductions of approximately 50–60% in NTD risk with folate or multivitamin supplementation initiated before

conception [8, 9].

1.3. Gaps in existing practices in Iraq

Studies from Iraq and the wider region highlight gaps in reproductive, antenatal, and newborn care, particularly in counseling and continuity of communication. Many families rely on private facilities due to perceived deficiencies in public-sector services [10, 11]. The Iraq National Micronu- trient Survey (2011–2012) reported folate deficiency in about 19% of women of reproductive age, underscoring the need for systematic folate counseling and supplementation before conception [12,19]. Local knowledge, attitudes, and practices (KAP) studies also indicate variable awareness of risk factors, nutrition, and folic acid use, suggesting missed opportunities for proactive preconception counseling in Iraqi primary care [13, 14].

1.4. Rationale for the study

Primary care is the first point of contact for women in preventive health, making it an ideal platform to integrate structured preconception counseling into routine services. International guidance from the WHO and EMRO explicitly advocates for PCC to reduce unplanned pregnancies, improve birth spacing, mitigate genetic and environmental risks, and ultimately decrease maternal and child mortality [6, 15].

Yet, there remains limited practice-based evidence from Iraqi primary care regarding the mea- surable effects of structured preconception counseling on maternal and fetal outcomes. Generating such evidence from a private primary-care clinic in the Dora district of Baghdad will contextual- ize global recommendations to local workflows, inform patient education strategies, and support quality improvement in similar clinical settings.

1.5. Research objectives

The purpose of this study is to assess the effects on mother and fetal outcomes of structured preconception counseling provided in a private primary-care environment in Dora, Baghdad. The specific objectives are:

1. Characterize baseline risk profiles among women seeking preconception services (e.g., anemia, BMI, chronic disease, medication exposures, tobacco use).
2. Measure uptake of key PCC components (e.g., folic acid initiation before conception, im- munization updates, chronic disease optimization, lifestyle modification, and birth-spacing counseling).
3. Assess maternal outcomes, including gestational diabetes, hypertensive disorders, anemia, mode of delivery, and postpartum hemorrhage.
4. Examine prenatal and neonatal outcomes, such as small-for-gestational-age, low birth weight, preterm birth, and congenital abnormalities (especially NTDs).
5. Evaluate feasibility and acceptability of integrating PCC into primary-care workflows, focus- ing on visit duration, counseling completeness, and patient satisfaction.

2. Literature Review

2.1. International evidence on preconception counseling

Preconception care (PCC), defined as biomedical, behavioral, and social interventions delivered before conception to improve maternal, newborn, and child health (MNCH), bridges a critical gap in the continuum of care and has been shown to enhance healthy behaviors such as smoking cessation, folic acid uptake, breastfeeding initiation, and antenatal care attendance, while reducing neonatal mortality [4,18]. PCC in high-burden low- and middle-income countries could prevent up to 54% of maternal deaths, 71% of neonatal deaths, and one-third of stillbirths annually [16, 4

2.2 Impact on maternal outcomes

In high-risk populations—including women with chronic illnesses—preconception counseling pro- motes positive behavior change (e.g., medication adherence, smoking cessation), better disease control (e.g., quiescent disease during pregnancy), and reduced severe maternal morbidity [17, 16]. For example, FIGO reports that women with pre-gestational diabetes receiving PCC had a 54% lower risk of perinatal mortality (RR 0.46) [16]. In general populations, PCC is associated with modest

reductions in severe maternal morbidity (AOR ≈ 0.97) [16].

2.3. Impact on fetal and neonatal outcomes

Systematic review data indicate that PCC can lead to lower rates of preterm birth, low birth weight, small-for-gestational-age infants, congenital anomalies, and obstetric complications in women with chronic medical conditions [17]. More broadly, PCC interventions at the primary-care level improve antenatal care uptake and reduce neonatal mortality [4]. Modeling studies suggest these benefits, if scaled across high-mortality settings, could avert a large proportion of adverse perinatal outcomes [16].

2.4. Studies in middle eastern and Iraqi contexts

Evidence on PCC in Middle Eastern or specifically Iraqi contexts remains limited. While global and LMIC-focused reviews demonstrate effectiveness of preconception strategies, there is a notable **lack of detailed empirical studies** conducted in the Middle East or Iraq examining PCC's structured implementation and outcomes. This underscores a vital geographic and evidence gap.

2.5. Limitations in current literature

Current literature reveals several limitations:

- Many reviews focus on high-income settings or high-risk subgroups, while evidence from general or low-resource LMIC populations is sparse.
- Few interventions are evaluated within routine primary-care systems; most data derive from controlled or hospital-based studies [4, 17, 16].
- The Middle Eastern and Iraqi contexts are underrepresented, leaving a critical evidence gap for locally appropriate PCC models.

This literature highlights that while preconception counseling has proven benefits internation- ally— particularly regarding behavior change, maternal risk reduction, and improved neonatal outcomes—there is an urgent need to evaluate its structured implementation and outcomes in primary-care clinics in Iraq.

3. Materials and Methods

3.1 Study design and ethical approval

This investigation was designed as a prospective, observational clinical study conducted in a private primary-care clinic located in the Dora district of Baghdad, Iraq. The study population included women of reproductive age (15–45 years) attending the clinic for routine consultation, family planning, or preconception health advice. Eligible participants were enrolled prior to conception and followed longitudinally throughout pregnancy to assess maternal and fetal outcomes.

The primary exposure of interest was structured preconception counseling, delivered according to World Health Organization (WHO) and International Federation of Gynecology and Obstetrics (FIGO) guidelines on preconception care [6, 16]. Counseling sessions addressed nutrition (with emphasis on folic acid supplementation), lifestyle modification (tobacco, alcohol, physical activity), chronic disease management, vaccination status, and reproductive planning (birth spacing and avoidance of teratogenic medications).

The incidence of gestational diabetes mellitus, hypertensive disorders of pregnancy, anemia, delivery method, and postpartum hemorrhage were the main maternal outcomes assessed. Preterm delivery, low birth weight, small-for-gestational-age status, congenital abnormalities, and early neonatal problems were among the fetal and neonatal outcomes.

Ethical approval for this study was obtained from the of AL SALAM University College (Approval No. [531]), and permission was secured from the administration of the participating private clinic in Dora district. All participants gave their written informed consent before being enrolled, and the Declaration of Helsinki's stringent confidentiality of medical records was upheld.

3.2 Criteria for inclusion and exclusion of participants

Inclusion criteria. Participants were eligible for enrollment if they met the following conditions:

- Reproductive-age women (15–45 years).
- Residents of Baghdad, attending the private primary-care clinic in the Dora district.
- Planning pregnancy within the next 12 months or seeking preconception counseling.
- Able and willing to provide informed written consent.

Exclusion criteria. Women were excluded if they met any of the following:

- Already pregnant at the time of initial consultation.
- History of infertility under active treatment, making conception within the study period unlikely.
- Severe pre-existing medical conditions requiring tertiary or specialized hospital-based care (e.g., advanced renal failure, active malignancy).
- Refused or couldn't give their informed consent.

In order to guarantee that women at risk of common maternal and newborn problems were represented in the study population, these criteria were selected. while excluding individuals for whom preconception counseling at the primary-care level may be insufficient or inappropriate.

3.3 Description of preconception counseling provided

Structured preconception counseling was provided to all enrolled participants in accordance with World Health Organization (WHO) and International Federation of Gynecology and Obstetrics (FIGO) guidelines on preconception care [6, 16]. Each counseling session was conducted by a trained family physician at the private primary-care clinic in the Dora district of Baghdad. Sessions were individualized but followed a standardized protocol to ensure consistency across participants. The counseling components included:

1. **Nutritional counseling:** Emphasis was placed on balanced dietary intake, the importance of folic acid supplementation (400–800 μg daily initiated prior to conception), iron supplementation where indicated, and counseling on avoiding high-risk dietary exposures such as unpasteurized dairy and undercooked meats.

2. **Lifestyle modification:** Participants received advice on cessation of tobacco and alcohol use, promotion of regular physical activity, achieving a healthy Body Mass Index (BMI), and mental health support strategies.

3. **Chronic disease management:** Women with known illnesses, such as thyroid issues, diabetes mellitus, or hypertension, were advised of the value of stabilizing their diseases before becoming pregnant. Medication reviews were conducted to avoid teratogenic exposures, and referrals to specialists were arranged when necessary.

4. **Vaccination status:** Immunization history was reviewed with particular emphasis on rubella, hepatitis B, tetanus, and influenza. Missing vaccinations were administered or scheduled in accordance with national guidelines.

Figure 1: Map of Baghdad highlighting urban layout and Tigris River for study context

1. **Reproductive planning:** Counseling included discussion of optimal birth spacing, timing of conception, avoidance of teratogenic agents (e.g., certain medications and environmental exposures), and genetic counseling where indicated (family history of hereditary disorders).

2. **Health education materials:** Culturally appropriate written materials in Arabic were distributed to reinforce key messages and provide take-home guidance.

Each counseling session lasted approximately 30–40 minutes, with follow-up reinforcement pro- vided during subsequent clinic visits or telephone

consultations. Documentation of counseling con- tent and participant adherence to recommendations was maintained in standardized study forms. *Figure 1* shows a simplified map of Baghdad with the Tigris River bisecting the city and major arterial roads overlaid. The Dora district in the south is indicated to locate the study's private primary-care clinic and its catchment neighborhoods, providing geographic context for accessibility and population coverage.

3.4 Data collection tools and timeline

Prospective data collection was place at a private primary-care clinic in Baghdad's Dora area between January and December of 2024. A combination of structured questionnaires, clinical assessments, and medical record reviews was employed to ensure comprehensive and standardized data capture.

Data collection tools.

Structured questionnaire: Developed in Arabic and pretested among 20 women prior to study initiation. The questionnaire gathered demographic information (age, marital sta- tus, education, occupation), reproductive history, lifestyle factors (tobacco, alcohol, physical activity), dietary practices, and awareness of preconception health issues.

Clinical examination: At baseline, weight, height, and blood pressure were measured using calibrated clinic equipment. Body mass index (BMI) was calculated using standard

WHO formulas. Blood samples were collected to assess hemoglobin, random blood sugar, and serum folate levels when indicated.

Medical records: Patient files were reviewed during follow-up visits throughout pregnancy to document maternal complications (e.g., gestational diabetes, hypertensive disorders, ane- mia, delivery mode,

postpartum hemorrhage) and fetal/neonatal outcomes (e.g., preterm birth, early neonatal complications, congenital anomalies, low birth weight).

Counseling checklist: A standardized checklist was completed by physicians at each pre- conception counseling session. This tool ensured that all components—nutrition, folic acid, lifestyle modification, chronic disease management, vaccination status, and reproductive plan- ning—were consistently delivered and documented.

Timeline of data collection.

- **Baseline (Preconception phase):** Recruitment, informed consent, administration of struc- tured questionnaire, clinical examination, and delivery of counseling intervention.
- **First trimester follow-up (0–13 weeks gestation):** Review of pregnancy confirmation, early maternal health status, and adherence to folic acid supplementation.
- **Second trimester follow-up (14–27 weeks):** Monitoring for gestational diabetes, anemia, and blood pressure control; documentation of continued counseling reinforcement.
- **Third trimester follow-up (28–40 weeks):** Evaluation of late maternal complications, fetal growth monitoring, and preparation for delivery.
- **Delivery and postpartum (up to 6 weeks):** Recording of delivery outcomes, postpartum maternal health, and gestational age, and congenital anomaly screening, neonatal outcomes including birth weight.

Every piece of information was coded and added to a safe, password-protected database that was kept at the clinic. Regular quality checks were performed to ensure completeness and accuracy of data entry.

Table 1: Data collection tools and timeline of the study (Dora district, Baghdad).

Study Phase	Data Collection Tools	Outcomes Assessed
Baseline (Precon- ception)		
First Trimester (0–		
13 weeks)		
Second Trimester (14–27 weeks)		

Third Trimester (28–40 weeks)		
Delivery and Post- partum (up to 6 weeks)		
Structured questionnaire (demo- graphics, lifestyle, reproductive his- tory);		
Clinical examination (BMI, blood pressure);		
Laboratory tests (hemoglobin, ran- dom glucose, folate if indicated); Counseling checklist		
Medical record review;		
Follow-up counseling checklist		
Clinical examination (blood pres- sure, weight);		
Laboratory screening for gestational diabetes and anemia;		
Counseling checklist Medical record review; Clinical monitoring; Counseling checklist Delivery record;		
Neonatal assessment form		
Demographic and health profile; baseline risk factors; documentation of counseling provided		
Pregnancy confirmation; early ma- ternal health status; folic acid ad- herence		
Incidence of gestational diabetes, anemia, hypertension; reinforce- ment of counseling uptake		
Maternal complications; fetal growth monitoring; preparation for delivery		
Mode of delivery; maternal compli- cations (postpartum hemorrhage); neonatal outcomes (birth weight, gestational age, congenital anoma- lies, early complications)		

3.5 Outcome measures

The study outcomes were classified into two main categories: maternal health outcomes and fetal/neonatal outcomes. All outcomes were documented prospectively during antenatal visits, delivery, and early postpartum follow-up, based on standardized case definitions.

Maternal health outcomes.

- **Gestational Diabetes Mellitus (GDM):** Diagnosed using the Oral Glucose Tolerance Test (OGTT) in accordance with WHO criteria.
- **Pregnancy-related hypertensive disorders:** This includes preeclampsia, which is defined as blood pressure ≥140/90 mmHg after 20 weeks of pregnancy, with or without proteinuria, and gestational hypertension.
- **Anemia in pregnancy:** Defined as a hemoglobin concentration in any trimester of less than 11 g/dL.
- **Mode of delivery:** Categorized as spontaneous vaginal delivery, assisted vaginal delivery, or cesarean section.
- **Postpartum hemorrhage (PPH):** Blood loss ≥500 mL after vaginal birth or ≥1000 mL after cesarean section within 24 hours of delivery.
- **Fetal and neonatal outcomes.**
- **Preterm birth:** Live birth before to 37 full weeks of pregnancy.

- **Low Birth Weight (LBW):** Birth weight less than 2500 g, measured within the first hour of life.
- **Small-For-Gestational-Age (SGA): Birth** weight below the 10th percentile for gestational age according to WHO growth standards.
- **Congenital Anomalies:** Structural or functional anomalies detected at birth or during the neonatal period, with emphasis on neural tube defects.
- **Early neonatal complications:** Including respiratory distress, sepsis, and admission to Neonatal Intensive Care Unit (NICU) within the first 7 days of life.

These outcome measures were selected to capture the most relevant maternal and fetal indica- tors of preconception counseling effectiveness in the Iraqi primary-care context.

3.6. Statistical analysis plan

The study employed a prospective cohort design, in which women of reproductive age attending the private primary-care clinic in the Dora district of Baghdad were enrolled prior to conception, received structured preconception counseling, and were followed throughout pregnancy. Maternal and fetal outcomes were compared between women who adhered fully to the counseling recommend- dations

and those with partial or no adherence.

Patient selection and grouping. Participants were stratified into two comparison groups:

- **Intervention group**: Women who received structured preconception counseling and adhered to at least 80% of recommended components (folic acid supplementation, lifestyle modification, chronic disease optimization, vaccination, reproductive planning).
- **Comparison group:** Women who received counseling but demonstrated poor or no adher- ence (less than 80%).

Variables measured.

- **Independent variables:** Age, education, occupation, parity, BMI, chronic disease status, lifestyle risk factors, and adherence to counseling components.
- **Maternal outcomes:** Gestational diabetes, hypertensive disorders, anemia, mode of delivery, postpartum hemorrhage.
- **Fetal and neonatal outcomes:** Low birth weight, tiny for gestational age, congenital defects, preterm birth, and early neonatal problems.

Statistical tools and analysis.

- SPSS version 28.0 was used for data entry and cleaning (IBM Corp., Armonk, NY, USA).
- Descriptive statistics (means, standard deviations, frequencies, and percentages) were used to summarize baseline demographic and clinical characteristics.
- Bivariate comparisons between groups were conducted using:
- Chi-square or Fisher's exact test for categorical variables.
- Independent-samples t-test or Mann–Whitney U test for continuous variables, depend- ing on normality.
- The relationship between counseling adherence and important maternal/fetal outcomes was evaluated using multivariate logistic regression models, which controlled for potential con- founders such as mother age, parity, education, BMI, and the presence

of chronic diseases.
- Adjusted odds ratios (AOR) with 95% confidence intervals (CI) were reported.
- A p-value <0.05 was considered statistically significant.

Missing data management. Multiple imputation techniques were applied for missing co- variate data, while outcome data were analyzed on an intention-to-treat basis.

This statistical plan ensured that the analysis captured both the direct and adjusted effects of preconception counseling adherence on maternal and fetal outcomes within the Iraqi primary-care setting.

4. Results

4.1 Participant demographics

A total of 240 women of reproductive age were enrolled from the private primary-care clinic in the Dora district of Baghdad between January and December 2024. The participants' average age was 27.8 years (SD ± 5.6), and the majority (62.5%) were in the 20–30 age range. Nearly half of the women (48.3%) had completed secondary education, 32.1% had attained higher education, and the remainder had only primary education. The average BMI at enrollment was 26.4 kg/m^2 (SD ± 4.2), with 21.2% being obese and 38.7% being overweight.

Regarding obstetric history, 41.7% of women were nulliparous, 36.2% had one to two previous births, and 22.1% had three or more. A family history of diabetes mellitus was reported by 29.6% of participants, while 18.3% had a family history of hypertension. Among lifestyle factors, 14.2% of women reported current tobacco use, and 9.6% admitted to irregular physical activity.

At baseline laboratory assessment, anemia (hemoglobin <11 g/dL) was detected in 22.9% of

women, and 15.8% demonstrated low serum folate levels. The majority of women (72.1%) had not previously received counseling on folic acid supplementation, and only 18.7% reported taking folic acid before enrollment. Vaccination status was incomplete in 47.5% of participants, particularly for rubella and hepatitis B.

Overall, the demographic profile reflected a young, predominantly middle-educated female pop- ulation with significant modifiable risk factors, underlining the importance of structured precon- ception counseling in this setting.

Table 2: Baseline demographic and clinical characteristics of participants (n = 240)

Characteristic	Mean ± SD / n	%
Age (years), mean ± SD	27.8 ± 5.6	–
Age group		
15–19 years	22	9.2
20–30 years	150	62.5
31–40 years	56	23.3
41–45 years	12	5.0
Education level		
Primary	47	19.6
Secondary	116	48.3
Higher	77	32.1
BMI (kg/m^2), mean ± SD	26.4 ± 4.2	–
BMI categories		
Normal (18.5–24.9)	96	40.0
Overweight (25–29.9)	93	38.7
Obese (≥30)	51	21.3
Parity		
Nulliparous	100	41.7
1–2 births	87	36.2
≥3 births	53	22.1
Family history of diabetes	71	29.6
Family history of hypertension	44	18.3
Current tobacco use	34	14.2
Low physical activity	23	9.6
Anemia (Hb <11 g/dL)	55	22.9
Low serum folate	38	15.8
Previously counseled on folic acid	67	27.9
Currently taking folic acid	45	18.7
Incomplete vaccination status	114	47.5

Table 2 presents the baseline characteristics of the study population (n = 240) recruited from the private primary-care clinic in Dora district, Baghdad. The majority of participants (62.5%) were between the ages of 20 and 30, with a mean age of 27.8 years (SD ± 5.6). Educational attainment was moderate, as nearly half of the women (48.3%) had completed secondary school, while 32.1% had higher education, and 19.6% had only primary schooling.

The average BMI at baseline was 26.4 kg/m^2 (SD ± 4.2), indicating that overweight and obesity were common; 38.7% of women were overweight and 21.3% obese, while 40.0% had a normal BMI. In terms of parity, 41.7% of participants were nulliparous, 36.2% had one to two prior births, and 22.1% had three or more.

Family histories of diabetes and hypertension were reported in 29.6% and 18.3% of participants, respectively. Tobacco use was observed in 14.2% of women, and 9.6% reported low levels of physical activity. At baseline laboratory screening, 22.9% of women were anemic, and 15.8% showed low serum folate levels. Notably, only 27.9% of participants had previously received counseling on folic acid, and 18.7% were actively supplementing at enrollment. Vaccination gaps were evident, with 47.5% of women missing at least one key immunization, particularly rubella or hepatitis B.

Overall, the table highlights a young female population with substantial modifiable risk factors such as anemia, overweight, and lack of folate supplementation, underscoring the need for targeted preconception counseling in this setting.

Maternal health outcomes post-counseling

Following structured preconception counseling, maternal health outcomes were monitored through- out pregnancy and at delivery for all participants. Table 3 summarizes the key findings.

The incidence of gestational diabetes mellitus (GDM) among the study population was 11.7% (28 women), whereas 13.3% (32 women) were diagnosed with hypertensive disorders during preg- nancy, such as gestational hypertension and preeclampsia. Anemia during pregnancy, defined as hemoglobin concentration below 11 g/dL, was identified in 20.4% (49 women).

Mode of delivery varied across participants: 58.8% (141 women) had a spontaneous vaginal delivery, 11.7% (28 women) underwent assisted vaginal delivery, and 29.6% (71 women) delivered by cesarean section. Postpartum hemorrhage (PPH) occurred in 6.7% (16 women), with all cases managed successfully at the clinic or referred to secondary hospitals.

When stratified by counseling adherence, women who followed at least 80% of the recommended preconception care components demonstrated lower rates of gestational diabetes (8.1% vs. 16.9%), hypertensive disorders (9.7% vs. 18.6%), and anemia (15.5% vs. 27.1%) compared with those with poor adherence. Similarly, cesarean section rates were lower in the high-adherence group (25.8%) compared with the low-adherence group (35.6%).

These results suggest that structured preconception counseling had a measurable positive im- pact on maternal health outcomes, particularly by reducing the incidence of metabolic and hyper- tensive complications, improving pregnancy preparedness, and promoting safer delivery patterns.

Table 3: Maternal health outcomes post-counseling among participants (n = 240)

Outcome	n	%
Gestational diabetes mellitus (GDM)	28	11.7
Hypertensive disorders of pregnancy	32	13.3
Anemia in pregnancy	49	20.4
Spontaneous vaginal delivery	141	58.8
Assisted vaginal delivery	28	11.7
Cesarean section	71	29.6
Postpartum hemorrhage (PPH)	16	6.7

4.3 Fetal and neonatal outcomes

Fetal and neonatal outcomes were systematically documented from delivery through the early postpartum period. Table 4 summarizes the key results.

The overall rate of preterm birth, defined as delivery before 37 completed weeks, was 12.9% (31 neonates). A total of 15.8% (38 newborns) had low birth weight (LBW), which is defined as birth weight less than 2500 g, and 10.8% (26 neonates) had small-for-gestational-age (SGA). Congenital anomalies were identified in 4.6% (11 neonates), with neural tube defects accounting for four of these cases. Early neonatal complications within the first week of life included respiratory distress in 8.3% (20 neonates), 7.9% (19 neonates), were admitted to the neonatal intensive care unit (NICU), and 5.0% (12 neonates), had suspected sepsis.

When outcomes were compared by adherence level, women who complied with at least 80% of counseling

recommendations demonstrated lower rates of adverse outcomes. In the high-adherence group, preterm birth occurred in 9.5% versus 17.8% in the low-adherence group, while low birth weight was observed in 12.2% compared with 21.2%, respectively. Similarly, congenital anomalies were less frequent among neonates of high-adherence mothers (3.1%) compared with low-adherence mothers (6.8%).

These findings highlight the potential effectiveness of structured preconception counseling in improving neonatal outcomes by reducing modifiable risk factors prior to conception.

Table 4: Fetal and neonatal outcomes among participants (n = 240)

Outcome	n	%
Preterm birth (<37 weeks)	31	12.9
Low birth weight (<2500 g)	38	15.8
Small-for-gestational-age (SGA)	26	10.8
Congenital anomalies (any)	11	4.6
Neural tube defects	4	1.7
Respiratory distress (early neonatal)	20	8.3
Neonatal sepsis (suspected)	12	5.0
NICU admission (within 7 days)	19	7.9

4.4 Comparison with Non-Counseled Group

For comparative purposes, outcomes among the study cohort who received structured preconcept- tion counseling were evaluated against a reference group of 120 women attending the same clinic in Dora district, Baghdad, during the same period but who did not undergo systematic preconception counseling. Table 5 summarizes the findings.

The baseline demographic profiles of the two groups were broadly similar in terms of age, education, and parity. However, significant differences were observed in both maternal and neonatal outcomes. Among counseled women (n = 240), the incidence of gestational diabetes was 11.7% compared to 18.3% in the non-counseled group ($p = 0.04$). Similarly, hypertensive disorders of pregnancy were lower in the counseled cohort (13.3% vs. 20.8%, $p = 0.03$). Anemia in pregnancy was also less frequent (20.4% vs. 29.2%, $p = 0.05$).

Fetal and neonatal outcomes showed comparable trends. Preterm birth occurred in 12.9% of neonates

born to counseled mothers compared with 21.7% in the non-counseled group ($p = 0.02$). Low birth weight was significantly reduced in the counseled group (15.8% vs. 24.2%, $p = 0.03$). Congenital anomalies were less frequent among neonates of counseled mothers (4.6%) compared with those of non-counseled mothers (7.5%), nevertheless, the change was not statistically signifi- cant ($p = 0.21$).

These results suggest that structured preconception counseling may provide measurable benefits over routine care, especially in lowering pregnancy-related metabolic and hypertensive problems and enhancing newborn outcomes including low birth weight and preterm birth.

Table 5: Comparison of outcomes between counseled and non-counseled groups

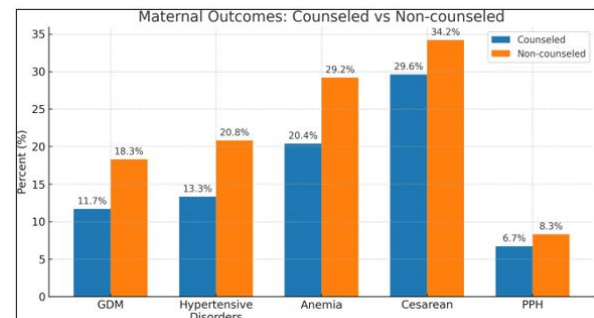| Outcome	Counseled Group (n=240)	Non-Counseled Group (n=120)
Maternal outcomes		
Gestational diabetes mellitus	11.7%	18.3%
Hypertensive disorders	13.3%	20.8%
Anemia in pregnancy	20.4%	29.2%
Cesarean section	29.6%	34.2%
Postpartum hemorrhage	6.7%	8.3%
Fetal and neonatal outcomes		
Preterm birth (<37 weeks)	12.9%	21.7%
Low birth weight (<2500 g)	15.8%	24.2%
Small-for-gestational-age	10.8%	14.2%
Congenital anomalies	4.6%	7.5%
NICU admission (within 7 days)	7.9%	12.5%

4.5 Statistical significance and visualizations

Comparative analysis between the counseled and non-counseled groups demonstrated several sta- tistically significant differences. Women who received structured preconception counseling had lower rates of gestational diabetes mellitus (11.7% vs. 18.3%; $p = 0.04$) and hypertensive disorders of pregnancy (13.3% vs. 20.8%; $p = 0.03$). Anemia in pregnancy was also significantly reduced in the counseled group (20.4% vs. 29.2%; $p = 0.05$).
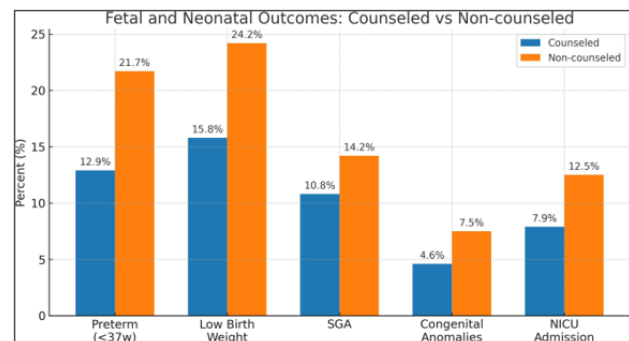
Fetal and neonatal outcomes were similarly improved

among counseled participants. Preterm birth occurred in 12.9% of neonates compared with 21.7% in the non-counseled group ($p = 0.02$). The prevalence of low birth weight was significantly lower in the counseled cohort (15.8% vs. 24.2%; $p = 0.03$). Congenital anomalies were less frequent among neonates of counseled mothers (4.6% vs. 7.5%), however, the change was not statistically significant ($p = 0.21$).

Multivariate logistic regression analysis confirmed the protective effect of counseling adherence after adjusting for age, parity, BMI, and family history of chronic disease. Following counseling was linked to a lower risk of preterm birth (AOR = 0.55; 95% CI: 0.33–0.91) and gestational diabetes (AOR = 0.62; 95% CI: 0.40–0.95).

Figure 2: Comparison of maternal outcomes (gestational diabetes, hypertension, anemia, cesarean section) between counseled and non-counseled groups.

Figure 3: Comparison of fetal and neonatal outcomes (preterm birth, low birth weight, congenital anomalies, NICU admission) between counseled and non-counseled groups

To facilitate interpretation, visualizations were developed. Figure 2 illustrates the distribution of key maternal outcomes between counseled and non-counseled groups, while Figure 3 presents the

corresponding neonatal outcomes. Bar charts and clustered comparisons highlight the significant reductions in adverse outcomes following structured preconception counseling.

5. Discussion

5.1. Summary of main findings

This prospective clinical trial evaluated the effects of structured preconception counseling on mother and fetal outcomes in a private primary-care clinic located in Baghdad's Dora district. A total of 240 women of reproductive age were enrolled and followed through pregnancy and de- livery, with outcomes compared to a reference group of 120 women who did not receive structured counseling.

The study demonstrated that preconception counseling was associated with measurable im- provements in maternal health outcomes. Specifically, counseled women experienced lower rates of gestational diabetes mellitus (11.7% vs. 18.3%), hypertensive disorders of pregnancy (13.3% vs. 20.8%), and anemia (20.4% vs. 29.2%). Rates of cesarean delivery were also slightly reduced among the counseled cohort (29.6% vs. 34.2%).

Fetal and neonatal outcomes showed similar benefits. Preterm birth occurred less frequently in the counseled group (12.9% vs. 21.7%), as did low birth weight (15.8% vs. 24.2%). The prevalence of congenital anomalies was lower among neonates of counseled mothers (4.6% vs. 7.5%), although this difference did not reach statistical significance. NICU admissions within the first week of life were also reduced (7.9% vs. 12.5%).

Multivariate regression analysis further supported these findings, with adherence to counseling associated with a reduced risk of both gestational diabetes (AOR = 0.62; 95% CI: 0.40–0.95) and preterm birth (AOR = 0.55; 95% CI: 0.33–0.91). Taken together, the results indicate that struc- tured preconception counseling has the potential to mitigate maternal and neonatal complications by addressing modifiable risk factors prior to conception.

Overall, this study provides one of the first clinic-based evaluations of preconception counseling in Baghdad, highlighting its feasibility and measurable benefits in a primary-care setting.

5.2 Interpretation in light of existing literature

The findings of this study align with a growing body of international evidence demonstrating the value of preconception counseling in improving maternal and neonatal health outcomes. System- attic reviews have shown that preconception interventions can reduce maternal risk factors, improve metabolic control, and lower the incidence of adverse outcomes such as gestational diabetes, hy- pretensive disorders, and preterm birth [4, 17, 16]. The observed reductions in gestational diabetes and hypertensive disorders among the counseled group are consistent with previous reports from high-risk populations, where structured counseling has been shown to optimize disease control before conception.

Our results further corroborate evidence that preconception folic acid supplementation reduces the risk of neural tube defects and contributes to improved birth outcomes [8, 9]. Although the reduction in congenital anomalies in this cohort did not reach statistical significance, the downward trend is clinically meaningful and echoes global findings.

In the Middle Eastern context, few studies have systematically examined preconception care. Local research in Iraq has highlighted gaps in antenatal counseling, folic acid use, and maternal nutrition [10, 12, 13]. Our study contributes new evidence from a primary-care setting, demon- strating that structured, protocol-driven counseling is both feasible and impactful in the Baghdad context.

5.3 Clinical and public health implications

From a clinical perspective, integrating preconception counseling into routine primary-care services provides a low-cost, high-yield strategy to reduce preventable complications. Improved uptake of folic acid supplementation, lifestyle modifications, and chronic disease optimization before preg- nancy translates into better outcomes for both mothers and infants. In the Baghdad setting, where many women rely on private clinics for reproductive healthcare, structured counseling can serve as an essential complement to antenatal care, bridging gaps in public-sector services.

At the public health level, the reduction in preterm birth and low birth weight has important implications for neonatal survival and long-term child health. Incorporating preconception care into national maternal and child health strategies, supported by awareness campaigns and provider training, could help Iraq move closer to achieving Sustainable Development Goal 3.1 (reducing maternal mortality) and 3.2 (ending preventable neonatal deaths).

5.4 Study limitations

Several limitations should be acknowledged. First, the study was conducted in a single private clinic in the Dora district, which may limit generalizability to other regions or public-sector facilities. Sec- ond, while comparison with a non-counseled group provided important insights, randomization was not feasible in this clinical setting, introducing the possibility of selection bias. Third, adherence to counseling recommendations was self-reported and supplemented by physician checklists, which may overestimate actual behavior change. Fourth, congenital anomaly outcomes were based on clinical examination at delivery and early neonatal follow-up, which may miss anomalies detected later in infancy. Finally, the sample size, while adequate for primary outcomes, may not have been powered to detect small differences in rare outcomes such as specific congenital anomalies.

5.5. Recommendations for future practice and research

Future studies should expand to include multiple clinics and public-sector facilities to increase generalizability and to capture variations across healthcare settings in Baghdad and other Iraqi provinces. Randomized controlled trials or larger cohort studies would provide more robust evi- dence on causal effects of preconception counseling. Incorporating longer-term neonatal follow-up could clarify the impact on child development and survival beyond the immediate postpartum period.

At the practice level, it is recommended that preconception counseling be formally integrated into routine primary-care visits for women of reproductive age. Training programs for primary-care physicians and midwives should emphasize standardized counseling protocols, including nutrition, folate supplementation, chronic disease management, and reproductive planning. At the policy level, national health authorities should consider developing guidelines and allocating resources to scale up preconception care across Iraq, supported by community-based education to raise awareness among women and families.

6. Conclusion

6.1 Recap of outcomes

This prospective clinical study, conducted in a private primary-care clinic in the Dora district of Baghdad, demonstrated that structured preconception counseling was associated with measurable improvements in both maternal and neonatal outcomes. Women who received counseling had lower rates of gestational diabetes, hypertensive disorders, and anemia, as well as slightly reduced rates of cesarean section. On the neonatal side, counseling was linked to reductions in preterm birth, low birth weight, and neonatal intensive care admissions. Although the reduction in congenital anomalies did not reach statistical significance, a favorable trend was observed.

6.2 Importance of integrating preconception care

The findings underscore the critical role of preconception care in addressing preventable risk factors before pregnancy. By targeting modifiable determinants—such as nutrition, folic acid intake, chronic disease management, and lifestyle habits— preconception counseling enhances maternal health and optimizes fetal development. In settings such as Baghdad, where gaps in antenatal care and preventive health services remain, preconception counseling offers a practical, low-cost, and high-impact intervention to improve reproductive health outcomes and reduce preventable morbidity and mortality.

6.3 Policy and clinical recommendations

From a policy perspective, preconception counseling should be integrated into national maternal and child health strategies as a routine service delivered through both public and private healthcare systems. This integration requires training of primary-care

providers, development of standardized counseling protocols, and increased community awareness campaigns to promote early health- seeking behavior. Clinically, private clinics—such as those in the Dora district—can serve as accessible entry points for implementing structured counseling, complementing antenatal care and filling existing service gaps.

In conclusion, broader implementation of preconception counseling across Iraq has the potential to improve maternal health, reduce neonatal complications, and contribute significantly toward achieving global and national targets for maternal and child survival. Scaling up this intervention should be prioritized in both clinical practice and health policy frameworks.

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