Research Article

The Impact Of Preconception Care On Maternal And Fetal Health Outcomes

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ABSTRACT

Background: Preconception care is an important strategy that can reduce different modifiable risks. However, its utilization remains limited, and there is a need to determine its impacts on maternal and fetal outcomes in primary-care populations.

Aim: This study examined the impact of preconception care on maternal and fetal health outcomes among women of reproductive age and identified factors associated with PCC utilization. **Methods:** A cross-sectional descriptive study was carried out in Jordan. A convenience sample of 382 women aged 18–49 years was included in the study. Data collection was done using an electronic, structured questionnaire comprised of socio-demographic characteristics, knowledge of PCC, utilization of PCC, and maternal and fetal outcomes. SPSS version 27 was used for data analysis, with descriptive statistics, chi-square tests, and binary logistic regression, and significance set at $p < .05$.

Results: Participants had high knowledge of preconception care (80.40 ± 18.60%), with 74.1% of participants having previously heard of preconception care. 58.9% had received preconception care before their most recent pregnancy. Most cited barriers to utilization of preconception care among non-users were lack of awareness (54.8%) and the perception that PCC was unnecessary (36.3%). Significant lower rates of anemia, gestational hypertension, gestational diabetes, preterm birth, low birth weight, congenital anomalies, and NICU admission were reported among women who received preconception care compared to women who did not (all $p < .05$). After adjusting for socio-demographic characteristics, receipt of PCC was the strongest independent predictor of maternal complications (AOR = 0.34, 95% CI: 0.21–0.55) and adverse fetal outcomes (AOR = 0.31, 95% CI: 0.19–0.52). PCC utilization was significantly predicted by higher education, employment, urban residence, and higher household income.

Conclusion: Preconception care utilization was significantly associated with better maternal and fetal health outcomes in this population. However, a significant number of women did not utilize these services due to limited awareness. Therefore, strengthening PCC integration into primary healthcare, expanding counseling, and addressing socioeconomic barriers to access could be important in reducing preventable maternal and neonatal complications.

Keywords: preconception care, maternal outcomes, fetal outcomes, pregnancy, preventive healthcare.

Introduction

Preconception care (PCC) is a promising preventive approach to achieve better maternal and fetal health outcomes globally. PCC is defined as the set of biomedical, behavioral, and social interventions that are delivered before conception to identify and mitigate factors that may otherwise jeopardize the course and outcome of pregnancy (Atrash & Jack, 2020; Dean et al., 2014). PCC involves a wide variety of services, including nutrition counselling, folic acid supplementation, screening and management of chronic diseases, immunizations and advice on lifestyle changes (Callegari et al., 2015; Ukoha & Mtshali, 2022). These interventions together are designed to ensure a woman's best health before becoming pregnant and to minimize the potential for complications during pregnancy.

Although significant improvements have been made in maternal health care over the last 20 years, maternal and neonatal complications that can be prevented are still common worldwide (Tanner et al., 2022). Many pregnant women have pre-existing, unmanaged conditions like anemia, diabetes, hypertension or infections that are associated with poor pregnancy outcomes (Saccone et al., 2022; Villar et al., 2021). This is concerning because early organogenesis and development of foetuses start within the first weeks of pregnancy, and the majority of women may not be aware of these complications at that time. Therefore, many of the adverse factors that affect the health of the mother and child in the long term are best addressed before the onset of antenatal care; during the preconception period itself (Dorney et al., 2022)

There is increasing evidence that PCC is effective in improving maternal and fetal outcomes. Women who received preconception counselling and care were found to have a lower risk of developing common pregnancy complications, such as anemia, gestational hypertension and gestational diabetes, than those who did not receive such care (Lassi et al., 2021; Wahabi et al., 2020). PCC has also been associated with better fetal outcomes, such as a decrease in low birth weight (LBW) and preterm birth (Jourabchi et al., 2019; Lassi et al., 2021). One of the significant influences of the timing of intervention on fetal outcomes is the relationship

between folic acid supplementation before conception and reduced neural tube defects (Khekade et al., 2023). However, in many places, the uptake of preconception care services is still low, despite this consistent evidence indicating the benefits of PCC. This is due to various barriers such as limited awareness of women of reproductive age, less integration of PCC into routine primary health care services, and socio-cultural factors that make women less likely to seek care before the confirmation of pregnancy (Callegari et al., 2015; Hussein et al., 2016). These barriers are particularly prevalent in low- and middle-income countries where health care systems are generally designed around antenatal and postnatal care, neglecting the preconception period (Aynalem et al., 2025; Mason et al., 2014). This means that risk factors that can be changed and thus potentially identified and managed before pregnancy are often not discovered until complications have occurred.

This represents a missed opportunity for the prevention of these various complications in maternal healthcare. Antenatal care is vital, but is provided after conception and therefore cannot always help reduce the risk from the first and most sensitive periods of fetal development. A proactive approach to improve integration of preconception services into primary care systems to decrease preventable maternal and neonatal morbidity and mortality has been proposed as an important effort (Dean et al., 2014; Mason et al., 2014). As preconception care has proven to improve maternal and fetal outcomes, and its use remains low, there is a need to investigate how preconception care impacts maternal and fetal outcomes and what factors are associated with women's uptake of preconception care. Thus, this study examined the impact of preconception care on maternal and fetal health outcomes among women of reproductive age.

The study aimed to: (1) evaluate the impact of preconception care on maternal health outcomes including anemia, hypertension and gestational diabetes; (2) examine the effect of preconception care on fetal health outcomes such as birth weight, preterm delivery and congenital anomalies; (3) identify factors associated with the use of preconception care services; and (4) suggest ways to enhance preconception care services.

Methodology

Research Design

A cross-sectional descriptive design was used to examine the impact of PCC on maternal and fetal health outcomes. Data were collected using a convenience sampling technique. The questionnaires were administered electronically via Google Forms, which facilitated broad and efficient reach to eligible participants.

Setting, Population, and Sample Size

The study was carried out in Jordan. The target population included Jordanian women of reproductive age. The participants were included in the study based on an age of 18–49 years and at least one pregnancy experience. The sample size was calculated using the Cochran (1977) formula for estimating a single population proportion:
Where;
n = required sample size,
Z = standard normal deviate at 95% confidence level (1.96)
P = estimated proportion of women utilizing preconception care;
d = margin of error (0.05).
Because there are no recent estimates of utilization of PCC among women of reproductive age in Jordan, a conservative estimate of 50% (P = 0.50) was used to maximize the sample size. Therefore, the sample size was calculated as follows: n= (1.96) ^2 (0.50) (1−0.50) ÷ (0.05)$^{2.}$ Therefore, a minimum sample of 384 was required. However, considering the potential non-response rate, the sample was increased by 10% to 422 participants. After data cleaning, 382 completed questionnaires were retained for statistical data analysis, representing a response rate of 90.5%.

Data Collection Tool

Data were collected using a structured, self-administered questionnaire developed by the researcher. The questionnaire comprised the following five sections: (1) socio-demographic characteristics, (2) knowledge of preconception care, (3) utilization of preconception care, (4) maternal outcomes, and (5) fetal outcomes (See Appendix A).

Sociodemographic Measure: The sociodemographic characteristics collected included age, marital status, educational level, employment status, monthly household income, number of previous pregnancies (gravidity), number of living children, and place of residence.

Knowledge: The knowledge section comprised five questions related to PCC, and each question was scored 1 point for a correct "Agree" response and 0 points for "Disagree" or "Not sure,". The total possible ranged from 0–5. The knowledge scores were categorized based on the modified Bloom's cut-off point, where participants were categorized as having high knowledge (80–100%, 4–5 points), moderate knowledge (60–79%, 3 points), or low knowledge (below 60%, 0–2 points).
Utilization of PCC: The utilization section was scored based on the number of PCC services received.

Maternal outcomes: The maternal outcomes section was scored based on reported maternal complications reported (anemia, gestational hypertension, gestational diabetes, and other complications), and the participants were grouped as having no complications (0), one complication (1), or multiple complications (≥2).

fetal Outcomes: these outcomes were scored as the number of adverse fetal outcomes reported (preterm birth, low birth weight, congenital anomaly, and NICU admission). The participants were grouped as having no adverse outcomes (0), one adverse outcome (1), or multiple adverse outcomes (≥2).

Validity and Reliability
Content validity of the questionnaire was established through expert review. Experts in maternal health and digital health applications evaluated the clarity, relevancy, and comprehensiveness of the questionnaire. Construct validity was assessed using correlation analysis between individual items and their corresponding dimensions. Cronbach's alpha coefficient was used to assess the reliability of the questionnaire. The questionnaire reported an acceptable reliability level across all domains. The overall Cronbach's alpha of the questionnaire was 0.91. Knowledge domain had an alpha coefficient of 0.87, utilization of an alpha of 0.84, and maternal outcomes and fetal outcomes sections had reliability coefficients of 0.81 and 0.79, respectively.

Data Analysis
Data were analyzed using SPSS version 27. Descriptive statistics were used to summarize socio-demographic characteristics and key study variables. The chi-square test was used to examine associations between categorical variables, and logistic regression was used to identify predictors of maternal and fetal outcomes. Statistical significance was set at $p < 0.05$.

Ethical Considerations
This study adhered to all ethical standards required for research involving human participants. Ethical approval was obtained from the Institutional Review Board (IRB) at Al-Balqa Applied University before data collection. Participation was voluntary, and all respondents were fully informed about the study's objectives, procedures, potential risks, and their right to withdraw at any time without penalty. Written informed consent was obtained from all participants to ensure that participation was based on full understanding and free choice.

Results

Socio-demographic Characteristics of Participants
Table 1 presents the sociodemographic characteristics of the participants. A total of 382 participants completed the questionnaire. The age of the participants ranged from 18 to 46 years, with a mean age of 30.9 ± 6.4 years. Most of them were married (72.5%), had a bachelor's degree (40.8%), and lived in urban settings (70.7%). Nearly half of them were employed (47.4%), and approximately one-third of the participants were homemakers (31.7%). Most participants reported two or more pregnancy experiences (52.6%) and having 1-2 living children (55.0%). Approximately half of the participants belonged to the middle-income households (50.3%).

Table 1: Socio-demographic Characteristics of Participants (N = 382)

Variable	Frequency	Percentage
Age (years)		
18–24	68	17.8
25–34	186	48.7
35–49	128	33.5
Marital Status		
Married	277	72.5

Divorced	95	24.9
Widowed	10	2.6
Educational Level		
Secondary or below	92	24.1
Diploma	84	22.0
Bachelor's degree	156	40.8
Postgraduate	50	13.1
Employment Status		
Employed	181	47.4
Homemaker	121	31.7
Student	38	9.9
Unemployed	42	11.0
Monthly Income		
Low	109	28.5
Middle	192	50.3
High	81	21.2
Residence		
Urban	270	70.7
Rural	112	29.3
Gravidity (Number of Previous Pregnancies)		
1 pregnancy	96	25.1
2–3 pregnancies	201	52.6
4 or more pregnancies	85	22.3
Number of Living Children		
0 children	34	8.9
1–2 children	210	55.0
3 or more children	138	36.1

Knowledge of Preconception Care

Table 2 presents the results on knowledge of preconception care. The results revealed that the majority of the participants had heard of preconception care before the survey (74.1%). Knowledge regarding specific aspects of preconception care was also high, especially for management of chronic disease (88.0%) and folic acid supplementation (84.8%). The results indicate that the participants in general had high knowledge of preconception care (mean knowledge score = 4.79 ± 1.02) and a percentage mean score of 80.40 ± 18.60. Half of the participants demonstrated high knowledge levels (50.8%), while 35.1% and 14.1% demonstrated moderate and low knowledge levels, respectively.

Table 2: Knowledge of Preconception Care (N = 382)

Item	Yes/Agree n (%)	No/Disagree/Not Sure n (%)
Heard of preconception care	283 (74.1)	99 (25.9)
PCC should begin before conception	301 (78.8)	81 (21.2)

Folic acid prevents birth defects	324 (84.8)	58 (15.2)
Chronic diseases should be controlled before pregnancy	336 (88.0)	46 (12.0)
Immunizations should be updated before pregnancy	287 (75.1)	95 (24.9)
Screening for infections is recommended before pregnancy	298 (78.0)	84 (22.0)

Overall, Knowledge Level						
Category				**Frequency**	**Percentage**	
Low				54	14.1	
Moderate				134	35.1	
High				194	50.8	
	Total score			**Average Score**	**% score**	
	Min. – Max.	**Mean ± SD.**	**Median**	**Mean ± SD.**	**Min. – Max.**	**Mean ± SD.**
Overall, Knowledge	0.0 – 5.0	4.02 ± 0.93	4.0	0.80 ± 0.19	0.0 – 100.0	80.40 ± 18.60

SD: Standard deviation. Knowledge categorization based on the modified Bloom's cut-off: Good ≥80%, Moderate 60–79%, Poor <60%.

Utilization of Preconception Care

Table 3 presents the results on the utilization of PCC. The results showed that of the 382 participants, 225 (58.9%) had received at least one type of preconception care before their most recent pregnancy, while 157 (41.1%) had not used any preconception care services. Among the participants who had received PCC, folic acid supplementation (82.2%) and nutritional counselling (75.1%) were reported as frequently utilized services. The most common barriers among participants who did not use PCC included lack of awareness (54.8%) and the perception that preconception care was unnecessary (36.3%).

Table 3: Utilization of Preconception Care (N=382)

Variable	Frequency	Percentage
Received preconception care		
Yes	225	58.9%
No	157	41.1%
Services received (n = 225)		
Nutritional counseling	169	75.1%
Folic acid supplementation	185	82.2%
Chronic disease screening	141	62.7%
Immunization assessment	118	52.4%
Lifestyle counseling	133	59.1%
General health check-up	151	67.1%
Barriers to PCC (n = 157)		
Lack of awareness	86	54.8%
Not offered by healthcare providers	52	33.1%

Cost	28	17.8%
Cultural/social barriers	31	19.7%
Did not think PCC was necessary	57	36.3%

Note: PCC = preconception care. Percentages for "Services received" and "Barriers to PCC" are calculated using the respective subgroup denominators shown in parentheses; participants could select more than one option, so percentages do not sum to 100%.

Maternal Health Outcomes

The prevalence of maternal complications was established to be relatively low across the participants (Table 4). The results reveal that anemia was the most frequently reported complication, affecting approximately 79 (20.7%) of participants. Gestational hypertension and gestational diabetes affected approximately 43 (11.3%) and 38 (9.9%) of the participants. Other pregnancy complications were reported by 47 (12.3%) of the participants.

Table 4: Maternal Health Outcomes (N = 382)

Maternal Outcome	Yes n (%)	No n (%)
Anemia	79 (20.7)	303 (79.3)
Gestational hypertension	43 (11.3)	339 (88.7)
Gestational diabetes	38 (9.9)	344 (90.1)
Other pregnancy complications	47 (12.3)	335 (87.7)

Fetal Health Outcomes

The results on fetal outcomes revealed favorable outcomes (Table 5). The results show that most of the births occurred at full term (n=340, 89.0%), while the prevalence of preterm birth was approximately 42 (11.0%). Similarly, most newborns had normal birth weight (n=335, 87.7%) with only 47 (12.3%) classified as low birth weight. Congenital anomalies affected fewer than 4% of infants, and only 10.2% of newborns required admission to the neonatal intensive care unit.

Table 5: Fetal Health Outcomes

Outcome	Frequency	Percentage
Preterm birth (<37 weeks)	42	11.0
Term birth	340	89.0
Low birth weight (<2500 g)	47	12.3
Normal birth weight	335	87.7
Congenital anomalies	15	3.9
No congenital anomaly	367	96.1
NICU admission	39	10.2
No NICU admission	343	89.8

Association Between Preconception Care and Maternal Outcomes

Chi-square analysis was performed to determine the differences in maternal complications based on receipt of preconception care (Table 6). The results revealed that participants who had received preconception care experienced significantly fewer maternal complications compared to those who did not receive such care. The prevalence of anemia was more than twice as high among participants without PCC compared with PCC recipients (31.8% versus 12.9%). Similar results were reported for gestational hypertension and gestational diabetes ($p < .05$).

Table 6: Association Between Preconception Care and Maternal Health Outcomes (N = 382)

Maternal Outcome	PCC (n = 225) n (%)	No PCC (n = 157) n (%)	Total (N = 382) n (%)	df	χ^2	p-value
Anemia	29 (12.9)	50 (31.8)	79 (20.7)	1	20.43	<0.001
Gestational hypertension	16 (7.1)	27 (17.2)	43 (11.3)	1	9.41	0.002
Gestational diabetes	14 (6.2)	24 (15.3)	38 (9.9)	1	8.74	0.003
Other complications	20 (8.9)	27 (17.2)	47 (12.3)	1	5.98	0.014

Note: PCC = preconception care; χ^2 = chi-square statistic, based on Pearson's chi-square test. Statistical significance set at $p < .05$.

Association Between Preconception Care and fetal Outcomes

The results indicated that preconception care utilization had a significant effect on improved fetal outcomes. The results revealed significantly lower rates of preterm birth, low birth weight, congenital anomalies, and NICU admissions among participants who had received PCC compared to those who did not receive PCC ($p < .05$). The largest difference was reported for preterm birth, where its incidence among participants without PCC was more than twice that reported among participants who received preconception care (Table 7).

Table 7: Association Between Preconception Care and fetal Outcomes (N = 382)

Fetal Outcome	PCC (n = 225) n (%)	No PCC (n = 157) n (%)	Total (N = 382) n (%)	df	χ^2	p-value
Preterm birth	16 (7.1)	26 (16.6)	42 (11.0)	1	8.17	0.004
Low birth weight	19 (8.4)	28 (17.8)	47 (12.3)	1	7.58	0.006
Congenital anomalies	5 (2.2)	10 (6.4)	15 (3.9)	1	4.21	0.040
NICU admission	15 (6.7)	24 (15.3)	39 (10.2)	1	7.42	0.006

Note: PCC = preconception care; χ^2 = chi-square statistic, based on Pearson's chi-square test. Statistical significance set at $p < .05$.

Binary Logistic Regression Analysis of Predictors of Maternal Complications

A binary logistic regression analysis was conducted to determine the independent predictors of maternal complications after controlling for age, educational level, residence, household income, and receipt of preconception care. The coding of maternal complications was based on the presence of at least one of the following conditions during pregnancy: anemia, gestational hypertension, gestational diabetes, or other pregnancy-related complications (Table 8). The results show that the overall regression model was statistically significant, $\chi^2(5) = 47.63$, $p < .001$, suggesting that the predictor variables explained a significant proportion of variation in maternal complications. The model correctly classified 78.8% of participants and explained between 16.8% (Cox & Snell R^2) and 24.9% (Nagelkerke R^2) of the variance. The results indicate that receipt of PCC remained the strongest predictor of maternal health outcomes, after adjusting for socio-demographic characteristics. Participants who had received PCC were 66% less likely to experience maternal complications compared to those who did not (AOR = 0.34, 95% CI: 0.21–0.55, $p < .001$). Advanced maternal age (35 years and above) nearly doubled the likelihood of maternal complications (AOR = 1.90). Higher educational attainment and middle-to-high household income significantly reduced the odds of adverse maternal outcomes. Urban residence was not independently associated with maternal complications.

Table 8: Binary Logistic Regression Predicting Maternal Complications (N = 382)

Predictor	B	SE	Wald χ^2	AOR	95% CI	p-value
Received preconception care (Yes)	-1.07	0.24	19.89	0.34	0.21–0.55	<0.001
Age (≥35 years)	0.64	0.22	8.51	1.90	1.24–2.92	0.004
Bachelor's degree or higher	-0.52	0.21	6.08	0.59	0.39–0.90	0.014
Urban residence	-0.28	0.24	1.34	0.76	0.48–1.22	0.247
Middle/High income	-0.49	0.20	5.84	0.61	0.41–0.92	0.016
Constant	-0.92	0.38	5.86	—	—	0.015

Note: B = unstandardized regression coefficient; SE = standard error; Wald χ^2 = Wald chi-square statistic; AOR = adjusted odds ratio; CI = confidence interval. Reference categories: no preconception care, age <35 years, secondary education or below, rural residence, and low income. Statistical significance set at $p < .05$.

Model Summary

Statistic	Value
Model χ^2	47.63
df	5
p-value	< 0.001
Cox & Snell R^2	0.168
Nagelkerke R^2	0.249
Overall classification accuracy	78.8%

Binary Logistic Regression Analysis of Predictors of Adverse fetal Outcomes

A second logistic regression model was used to examine the predictors of adverse fetal outcomes, which were defined as preterm birth, low birth weight, congenital anomalies, or NICU admission (Table 9). The model demonstrated good fit ($\chi^2 = 52.81$, $p < .001$) and correctly classified 81.4% of cases. The explanatory power of the model was moderate, with a Nagelkerke R^2 value of 0.281. The results show receipt of PCC as the strongest predictor of positive fetal outcomes. Participants who had received PCC had 69% lower odds of experiencing adverse fetal outcomes compared to their counterparts. (AOR = 0.31, 95% CI: 0.19–0.52, $p < .001$). The results also showed that maternal age of 35 years or older significantly increased the likelihood of adverse fetal outcomes, while positive protective effects of higher education and higher household income were reported. The place of residence was not independently associated with fetal outcomes.

Table 9: Binary Logistic Regression Predicting Adverse Fetal Outcomes (N = 382)

Predictor	B	SE	Wald χ^2	AOR	95% CI	p-value
Received preconception care	-1.16	0.26	20.32	0.31	0.19–0.52	<0.001
Maternal age ≥35 years	0.57	0.23	6.09	1.77	1.12–2.81	0.014
Bachelor's degree or higher	-0.61	0.23	7.11	0.54	0.35–0.85	0.008
Urban residence	-0.22	0.25	0.78	0.80	0.49–1.31	0.377
Middle/High income	-0.46	0.22	4.32	0.63	0.41–0.97	0.038
Constant	-1.13	0.40	7.92	—	—	0.005

Note: B = unstandardized regression coefficient; SE = standard error; Wald χ^2 = Wald chi-square statistic; AOR = adjusted odds ratio; CI = confidence interval. Reference categories: no preconception care, age <35 years, secondary education or below, rural residence, and low income. Statistical significance set at $p < .05$.

Model Summary

Statistic	Value
Model χ^2	52.81
df	5
p-value	< 0.001
Cox & Snell R^2	0.189
Nagelkerke R^2	0.281
Overall classification accuracy	81.4%

Binary Logistic Regression Analysis of Factors Associated with Utilization of Preconception Care

The final regression analysis was performed to examine the demographic predictors of preconception care utilization. The dependent variable was whether the participant reported receiving any preconception care before her most recent pregnancy. The regression model was statistically significant ($\chi^2 = 61.27$, $p < .001$), with an overall classification accuracy of 76.2%. The results revealed that educational attainment was the strongest predictor of PCC utilization. Participants with a bachelor's degree or higher were approximately 2.6 times more likely to utilize PCC compared to those with lower levels of education. The likelihood of PCC utilization was also increased significantly by employment, higher household income, and urban residence. However, maternal age was not a statistically significant predictor after controlling for the remaining variables.

Table 10: Binary Logistic Regression Predicting Utilization of Preconception Care (N = 382)

Predictor	B	SE	Wald χ^2	AOR	95% CI	p-value
Bachelor's degree or higher	0.95	0.23	17.10	2.59	1.65–4.08	<0.001
Employed	0.74	0.22	11.31	2.09	1.36–3.23	0.001
Middle/High income	0.71	0.23	9.45	2.03	1.30–3.18	0.002
Urban residence	0.55	0.25	4.83	1.73	1.06–2.84	0.028
Age ≥35 years	0.29	0.22	1.76	1.34	0.87–2.08	0.185
Constant	-1.48	0.41	13.04	—	—	<0.001

Note: B = unstandardized regression coefficient; SE = standard error; Wald χ^2 = Wald chi-square statistic; AOR = adjusted odds ratio; CI = confidence interval. Reference categories: secondary education or below, not employed, low income, rural residence, and age <35 years. Statistical significance set at $p < .05$.

Model Summary

Statistic	Value
Model χ^2	61.27
df	5
p-value	< 0.001
Cox & Snell R^2	0.221
Nagelkerke R^2	0.296
Overall classification accuracy	76.2%

DISCUSSION

This study examined the effect of PCC on maternal and fetal health outcomes among 382 women of reproductive age and also examined the factors associated with the use of PCC. The findings of this study showed that women receiving PCC had significantly lower rates of maternal complications and better fetal outcomes compared to those not receiving PCC, and PCC was the strongest independent predictor of both maternal and fetal outcomes, even after adjusting for socio-demographic characteristics.

Participants' knowledge of PCC was high (80.40 %), with the majority of them being aware of the importance of managing chronic disease and folic acid before pregnancy. Over 80% of them correctly identified the significance of managing chronic disease and folic acid before pregnancy. The reported knowledge level in this study is higher compared to that reported in a recent study among women in Malawi. In a cross-sectional study among women of reproductive age in Malawi, it was established that only 72% of the participants had good knowledge of PCC (Munthali et al., 2021). Similarly, the current knowledge level of PCC is higher compared to that reported by a cross-sectional study in Ethiopia, where only 17.1% had good knowledge about PCC. The favorable knowledge among participants in this study is similar to findings by Hussein et al. (2016) that general awareness of preconception health messages is often fairly good despite low levels of service utilization, indicating that levels of knowledge are generally not the biggest barrier to care-seeking among this population.

Though this study established a high knowledge base, the utilization of PCC was more limited. The results showed that only 58.9% of respondents had sought PCC before their last pregnancy. For those who were not recipients, the main reasons for this included lack of awareness (54.8%) and believing that PCC was not needed (36.3%), indicating that although women are aware of the concept, they do not recognize its need. These findings are consistent with the findings of Callegari et al (2015) and Mason et al (2014), who both found that there was a gap between population-level awareness development and uptake of preconception services, including PCC,

when not regularly integrated into routine primary care consultations.

Regarding maternal outcomes, the rates of anemia, gestational hypertension, and gestational diabetes were generally low, and this is comparable to those found in other similar populations (Dude et al., 2022; Gebretsadik et al., 2025). Chi-square analysis revealed that the rates of each complication were significantly lower in women who received PCC. For instance, the results revealed that the rate of anemia was higher in women without PCC (31.8%) compared to women who received PCC (12.9%). This aligns with the established beneficial impact that preconception nutritional counselling and folic acid or iron supplementation have on preventing nutritional deficiencies from worsening during pregnancy (Khekade et al., 2023; Callegari et al., 2015). Furthermore, the considerably lower prevalence of gestational hypertension and gestational diabetes among the PCC recipients is consistent with the findings of Wahabi et al. (2020) and Lassi et al. (2021) that the preconception screening and management of chronic conditions significantly decrease the likelihood of developing these disorders during pregnancy.

fetal outcome results also demonstrated similar patterns. In accordance with the findings of Lassi et al. (2020) and Jourabchi et al. (2019), fetal outcomes such as LBW, NICU admission, congenital anomalies, and preterm birth were significantly less prevalent among infants born to women who received preconception care. This study established that the rate of preterm birth was low among those who received PCC (7.1%) versus those who did not (16.6%), as factors that contribute to preterm birth, such as untreated infection, anemia, and chronic disease, are directly addressed by PCC (Raghuraman & Tuuli, 2021). The lower rates of congenital anomalies are consistent with the protective effect of preconception folic acid supplementation against neural tube defects (Khekade et al.,2023).

The logistic regression models demonstrated that PCC was an independent contributor to maternal and fetal outcomes. The benefits of PCC were statistically and clinically significant, as women who received PCC were 66% less likely to have maternal complications and 69% less likely to have adverse fetal outcomes. The results showed that advanced maternal age (35 years and older) was a significant risk factor, as is known for pregnancy risk, while higher educational level and higher household income were independent protective factors of maternal and fetal outcomes, indicating these factors either work by higher use of PCC or through other pathways, including health literacy and access to good antenatal care. This is consistent with studies that reported the benefits of higher education and income level of utilization of PCC (Du et al., 2021; Okemo et al., 2021). However, this study found that urban residence was not an independent predictor of maternal or fetal outcomes, after controlling for other variables, even though it was significantly associated with PCC utilization. This may suggest that the outcome benefit often associated with living in an urban setting may be primarily mediated through women's access to and uptake of PCC but not through residence itself.

Regarding utilization of PCC, the current study established that educational attainment was the strongest predictor for PCC uptake; women with the highest level of education had high chances of receiving PCC compared to those with the lowest level of education. PCC utilization was also associated with employment, household income, and urban residence. There was no association between maternal age and utilization, suggesting that the gap in awareness and access to utilization that promotes low uptake is not affected by maternal age. These results suggest that the problem is not the lack of evidence on the effectiveness of PCC or general knowledge, but a gap between knowing about PCC, feeling a need for it, and using it, especially among women with lower education, lower income, and rural living.

Implications of the Findings

The results have several implications for practice. Providers should be routinely discussing preconception health with women of reproductive potential, not just when pregnant. Integrating PCC counselling into primary care, family planning, and chronic disease clinics may be an effective way to get to women who may not seek a dedicated preconception visit. At the policy level, the finding that education, employment, income, and urban residence all predicted PCC utilization indicates an access gap to PCC services that is not likely to be bridged by individual-level counselling. Prioritized outreach, free preconception screening packages, and free screening and education campaigns in the community could be considered for health systems and policymakers to reach women with lower levels of education and those living in rural areas, where utilization is likely the lowest.

Limitations

It is important to note several limitations when interpreting the findings. First, the cross-sectional design does not allow causal inferences. Second, a convenience sample and use of online questionnaire may have introduced bias that did not allow for generalisability to women with lower levels of education, who live in rural areas, or who do not have access to the internet;

Conclusion

The findings of this study showed that women of reproductive age in Jordan have high knowledge of PCC. The results revealed that women who received preconception care had significantly lower rates of maternal complications, such as anemia, gestational hypertension and gestational diabetes, as well as significantly better fetal outcomes, such as fewer low birth weights, fewer NICU admissions, fewer congenital anomalies and preterm births. Preconception care was the strongest independent predictor of both outcomes' domains, even after controlling for age, education, place of residence and income. The barriers to utilization of PCC included lack of awareness, low perceived need, and socioeconomic factors such as education, employment, and income PCC utilization.

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Appendix A: Study Questionnaire

Section A: Socio-demographic Characteristics

1. Age (in years):

Age: _____

2. Marital status:

☐ Married ☐ Divorced ☐ Widowed

3. Educational level:

☐ No formal education ☐ Primary ☐ Secondary ☐ Diploma ☐ Bachelor's degree ☐ Postgraduate

4. Employment status:

☐ Employed ☐ Unemployed ☐ Student ☐ Homemaker

5. Monthly household income:

☐ Low ☐ Middle ☐ High

6. Number of previous pregnancies (gravidity):

Number: _____

7. Number of living children:

Number: _____

8. Place of residence:

☐ Urban ☐ Rural

Section B: Knowledge of Preconception Care

9. Have you ever heard of "preconception care"?

☐ Yes ☐ No

10. Preconception care should begin before pregnancy is confirmed.

☐ Agree (1 pt) ☐ Disagree (0 pt) ☐ Not sure (0 pt)

11. Taking folic acid before pregnancy reduces the risk of birth defects.

☐ Agree (1 pt) ☐ Disagree (0 pt) ☐ Not sure (0 pt)

12. Chronic diseases (e.g., diabetes, hypertension) should be controlled before pregnancy.

☐ Agree (1 pt) ☐ Disagree (0 pt) ☐ Not sure (0 pt)

13. Immunization status should be checked before pregnancy.

☐ Agree (1 pt) ☐ Disagree (0 pt) ☐ Not sure (0 pt)

14. A woman's diet and nutritional status before pregnancy can affect her baby's health.

☐ Agree (1 pt) ☐ Disagree (0 pt) ☐ Not sure (0 pt)

Section C: Utilization of Preconception Care

15. Did you receive any preconception counseling or care before your most recent pregnancy?

☐ Yes ☐ No

16 If yes, what services did you receive? (select all that apply; 1 point per service, max 5)

☐ Nutritional counseling (1 pt) ☐ Folic acid supplementation (1 pt) ☐ Chronic disease screening (1 pt) ☐ Immunization (1 pt) ☐ Lifestyle counseling (1 pt) ☐ Other: _____ (not scored)

17. Did you take folic acid supplements before conception?

☐ Yes ☐ No

18. Did you have a general health check-up before conception?

☐ Yes ☐ No

19. If you did not receive preconception care, what prevented you? (select all that apply)

☐ Lack of awareness ☐ Not offered by healthcare provider ☐ Cultural or social barriers ☐ Cost ☐ Did not think it was necessary ☐ Other: _____

Section D: Maternal Outcomes (most recent pregnancy)

20. Were you diagnosed with anemia during pregnancy?

☐ Yes (1 pt) ☐ No (0 pt)

21. Were you diagnosed with gestational hypertension?

☐ Yes (1 pt) ☐ No (0 pt)

22. Were you diagnosed with gestational diabetes?

☐ Yes (1 pt) ☐ No (0 pt)

23. Did you experience any other pregnancy complication?

☐ Yes (1 pt; please specify: _____) ☐ No (0 pt)

Section E: Fetal Outcomes

24. Gestational age at delivery:

☐ Less than 37 weeks (preterm) (1 pt) ☐ 37 weeks or more (term) (0 pt)

25. Birth weight of the baby:

☐ Less than 2500 g (low birth weight) (1 pt) ☐ 2500 g or more (normal weight) (0 pt)

26. Was your baby diagnosed with any congenital anomaly?

☐ Yes (1 pt; please specify: _____) ☐ No (0 pt)

27. Was your baby admitted to the neonatal intensive care unit (NICU) after birth?

☐ Yes (1 pt) ☐ No (0 pt)