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ORIGINAL RESEARCH

Antenatal Care Practices: A Population-Based Multicenter Study from Saudi Arabia

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Background: Antenatal care (ANC) is the care women receive during pregnancy before birth and represents a cornerstone of maternal and child health. Previously, Saudi women faced various barriers to practicing ANC, including challenges related to transportation, low maternal education, poor communication with healthcare centers, and incorrect maternal beliefs. In line with Saudi Vision 2030, this multicenter cross-sectional study aimed to investigate the timing of ANC contact, coverage of service utilization in public hospitals among Saudi mothers, sociodemographic factors and antenatal health care utilization, and beliefs about prenatal vitamins, and supplement use among pregnant Saudi women.

Methods: Data was collected from 1230 pregnant women across 11 Ministry of Health (MOH) facilities. The study assessed the timing of ANC initiation, beliefs about prenatal vitamins, and the use of folic acid, calcium, and iron during pregnancy. Chi-square tests were employed to analyze associations between variables.

Results: The findings revealed that 14.55% of participants initiated ANC within the first 8 weeks of pregnancy, with 85.44% starting later. However, the majority 88.78% received prenatal care during pregnancy, regardless of the timing of ANC initiation. Beliefs about prenatal vitamins varied, with 20.08% agreeing that prenatal vitamins were only indicated for malnourished mothers, 72.35% disagreeing, and 7.56% uncertain. Moreover, 51.30% believed ANC should begin before pregnancy, 29.83% after pregnancy confirmation, and 13.57% during the first trimester, with no significant correlation between beliefs and ANC timing. Regarding prenatal care, 95.20% would recommend starting prenatal care with every pregnancy, regardless of the timing of their own ANC initiation.

Conclusion: This study offers a comprehensive analysis of factors impacting late ANC contact and inadequate ANC contacts among pregnant Saudi women. These findings contribute to the broader understanding of ANC practices among Saudi women and underscore the importance of considering various determinants for tailored interventions and health education programs.

Keywords: antenatal care, pregnancy complications, inadequate ANC, late ANC, prenatal care

Introduction

It is widely recognized that high quality antenatal care (ANC) is a crucial element towards maternal healthcare. ANC is crucial for several reasons. It significantly contributes to reducing perinatal and maternal mortality and morbidity by identifying high-risk pregnancies and intervening early in cases of complications like preeclampsia.[1] In 2016, the World Health Organization (WHO) updated its guidelines for ANC, shifting from recommending at least four ANC visits to a model that emphasizes "antenatal contacts" and raises the minimum required number to at least eight.[2,3] Research indicates a strong correlation between substandard prenatal, intrapartum, and postnatal care and unfavorable pregnancy outcomes.[4] Maternal health, nutrition, the availability, and utilization of healthcare services all contribute to the risk factors for perinatal death.[5] Inadequate ANC, which means having fewer than the recommended number of visits, and late ANC, which begins after 12 weeks of pregnancy, can have significant implications for the health of both mothers and newborns.[6,7] Inadequate antenatal care, defined as starting after the 12th week of pregnancy or having fewer than the recommended number of visits, has significant consequences for the health of mothers, fetuses, and newborns.[8–12]

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Studies have shown varying rates of antenatal care attendance, with some countries reporting high coverage, while others have lower rates.[13–22] Access to quality ANC has far-reaching sociodemographic effects, impacting communities' health and socio-economic status. In developed countries, comprehensive antenatal services are readily available, contributing to reduced maternal and neonatal mortality rates and better overall maternal health. Conversely, in many low- and middle-income nations, access to such care remains a challenge due to various sociodemographic factors, including poverty, limited education, and inadequate healthcare infrastructure. By analyzing data on ANC coverage over the last five years[23] across various countries from different continents and varying sociodemographic indices, it becomes evident that there is considerable variability in ANC coverage. Some countries, such as Finland, the USA, Czechia, Estonia, Australia, and Italy, have consistently achieved high ANC coverage rates, exceeding 90%. These nations have managed to provide comprehensive ANC services to a substantial proportion of their pregnant population (Figure 1). In contrast, other countries, like Nigeria with a coverage rate of 60.4%, and Senegal at 55.4%, struggle with relatively low ANC coverage. These discrepancies can be attributed to several factors, including the availability of public healthcare facilities and the sociodemographic index of the respective countries. It is essential to recognize that the success of ANC programs is closely linked to the capacity of a country's healthcare infrastructure to provide these services and the sociodemographic characteristics of the population. Countries with higher sociodemographic indices tend to have better healthcare access and, consequently, higher ANC coverage rates.

In Saudi Arabia, there has been a scarcity of research conducted on antenatal care, with the majority of studies involving small sample sizes.[24–26] Therefore, this study aimed to assess the proportion and potential determinants of inadequate and late antenatal care and update the prevalence of ANC utilization among pregnant women in 11 Ministry of Health (MOH) pregnancy follow-up centers in Saudi Arabia. This information is crucial for preventing maternal and newborn mortality and guiding healthcare policy in the region.

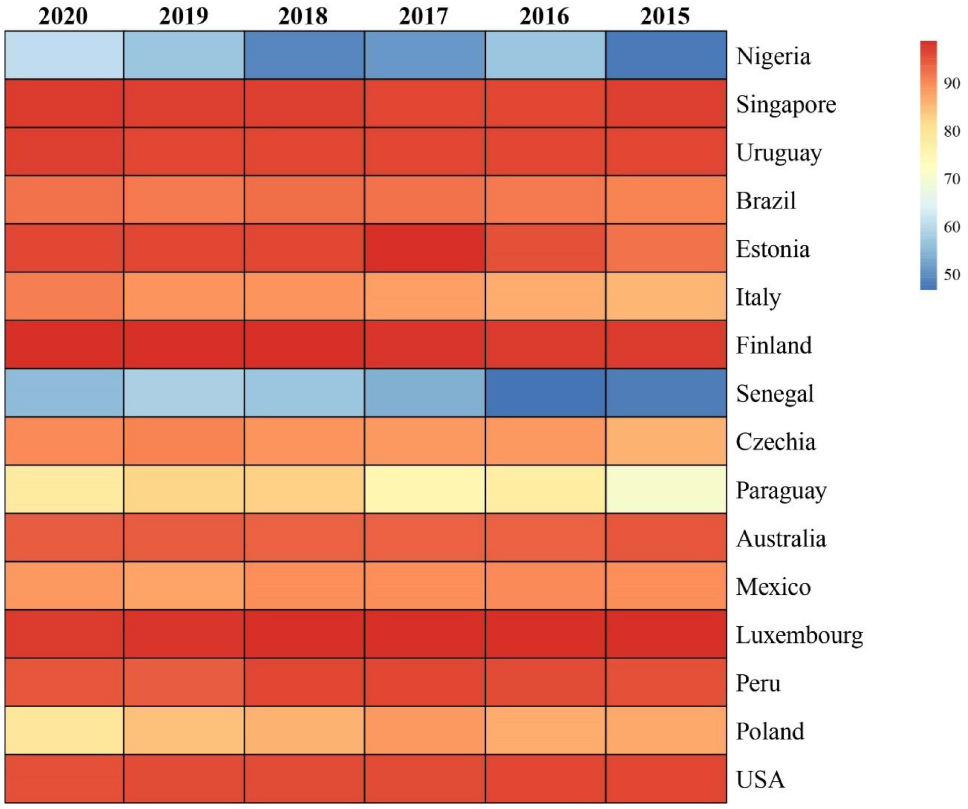

Figure 1 Heatmap depicting the ANC coverage for at least 5 consecutive years for 16 countries from different continents.
Notes: Data from World Health Organization. GHO | By category | Antenatal care coverage - Data by country. 2023. Available at: https://apps.who.int/gho/data/node.main.ANTENATALCARECOVERAGE4.[23]

Materials and Methods

Study Design, Period, and Setting

This is a cross-sectional study of pregnant mothers who followed up at 11 MOH pregnancy follow-up centers across Saudi Arabia between September 2022 through July 2023. Patients are offered periodic pregnancy follow-ups throughout their pregnancy with the frequency depending on the pregnancy status.[25] Follow-up for uncomplicated pregnancies is initiated at one of the aforementioned centers with 8 antenatal contacts offered, at minimum, to pregnant mothers. Follow-up appointments are typically booked through the Sehhaty smartphone application from anywhere in Saudi Arabia.[27] This study data was collected by trained medical and pharmacy interns with the assistance of trained registered nurses in each of the centers.

Terms and Definitions

Participants: Refers to mothers who followed up at 11 MOH pregnancy follow-up centers between September 2022 through July 2023. The sample was collected systemically by targeting every other pregnancy follow-up appointment scheduled to capture 1230 women out of approximately 3600 scheduled appointments in these centers during the study duration.

Inadequate ANC: This term refers to receiving fewer than eight antenatal contacts, as defined by the World Health Organization (WHO).

Late ANC: This phrase indicates that the first antenatal contact occurred after 12 weeks into pregnancy, which is beyond the first trimester.

Interpregnancy interval: This concept pertains to the duration between the conclusion of one pregnancy and the commencement of the subsequent pregnancy. The WHO recommends that this interval should be at least 24 months.

Questionnaire and Data Collection

The validated questionnaire tool used in this study was adapted from previously published protocols.[14,19,24,28,29] An additional construct was added to assess the perception and utilization of prenatal care. The questionnaire was then reviewed by two experts for face and content validity.

The data was collected through face-to-face interviews and includes information related to the timing of antenatal care (ANC) contact, age, education level, number of pregnancies, number of births, history of abortions, planned pregnancies, inter-pregnancy intervals, pre-existing medical conditions, history of premature deliveries, placenta problems during pregnancy, type of delivery, prenatal care perception and utilization, and the frequency of prenatal care.

Sample Size Estimation and Data Statistical Analysis

For sample size estimation, we utilized the Raosoft Sample Size Calculator[30] (accessed on 20 April 2022) based on a margin of error of 5%, a response distribution of 50%, and a confidence level of 90%. The population size is 6673 based on the latest pregnancy and delivery consensus data by the MOH in Saudi Arabia for these centers. The calculated sample size was 364 participants.

Logistic regression was used to analyze the association of time of ANC contacts with the characteristics of the study population. The adjusted model included all potential characteristics and the unadjusted model included only one potential characteristic to calculate the odd ratios and 95% confidence interval. Chi-square statistics was used to analyze the categorical variables of patient response and supportive care with time of ANC contact. A two-tailed p-value less than 0.05 was considered a statistically significant association between the characteristics and time of ANC contact. Statistical Package for Social Sciences (SPSS version 26.0) was used in statistical analysis.

Ethical Approval

The study protocol (Reference No. 00–20211310) was approved by the MOH Research Ethics Committee on October 13, 2021. Participants were briefed on the purpose of the study and the expected duration of the interview, and those who consented to participate were included in the study.

Results

Sociodemographic Factors and Antenatal Health Care Among Pregnant Women

We collected data from 1230 participants (Recent and old mothers) in the age group of 18–50 years. The mean (standard deviation) age was 31.48 (6.52) years. Approximately 14.55% of the participants initiated early ANC contact within the first 8 weeks of pregnancy, while the majority, 85.44%, contacted ANC services after 8 weeks. Furthermore, 64.55% of the pregnant women had adequate ANC contacts, while 35.44% had fewer than 8 ANC contacts. When examining demographic factors, it was observed that 445 pregnant women were under the age of 30, with 117 of them having adequate ANC contacts, whereas 785 women aged 30 or older included 375 with adequate ANC contacts. In terms of education level, 273 women had completed high school education or less, with 42 of them having timely ANC contact. In contrast, among the 957 women who completed undergraduate degrees or higher, only 120 had adequate ANC contacts. Additionally, the analysis considered the number of pregnancies, births, and abortions. A substantial proportion of women, 924, had been pregnant less than five times, with 745 of them having adequate ANC contacts. Conversely, all 306 women with more than five pregnancies had adequate ANC contacts. A similar pattern was observed for the number of births and abortions where 598 women with planned pregnancies had adequate ANC contacts, while 436 of those with unplanned pregnancies had fewer than 8 ANC contacts. Inter-pregnancy intervals played a role as well, with 258 women reporting more than 24 months between pregnancies and 184 of them having adequate ANC contacts (Table 1).

Table 1 Sociodemographic Characteristics of Participants (n=1230) and ANC Contact Frequency

Variable	TotalN (1230)	Time of ANC contact		Number of ANC contacts	
		≤ 8 weeks	> 8 weeks	≥ 8 ANC contacts	< 8 ANC contacts
		179 (14.55%)	1051 (85.44%)	794 (64.55)	436 (35.44%)
Age					
Less than 30 years	445	117	328	375	26
≥ 30 years	785	62	723	419	410
Education level					
Highschool diploma or less	273	42	231	120	153
Undergraduate diploma or higher	957	137	820	674	283
Number of Pregnancies					
Less than 5	924	179	745	794	130
More than 5	306	0	306	0	306
Number of Births					
Less than 5	997	178	819	791	206
More than 5	233	1	232	3	230
Number of abortions					
None	782	144	638	598	184
One	314	31	283	164	150
More than one	134	4	130	32	102
Planned Pregnancies					
Yes	598	179	419	598	0
No	632	0	632	196	436
More than 24 months between Pregnancies					
Yes	376	0	376	258	118
No	502	0	502	184	318
Been pregnant only once	352	179	173	352	0

(*Continued*)

Table 1 (Continued).

Variable	TotalN (1230)	Time of ANC contact		Number of ANC contacts	
		≤ 8 weeks	> 8 weeks	≥ 8 ANC contacts	< 8 ANC contacts
		179 (14.55%)	1051 (85.44%)	794 (64.55)	436 (35.44%)
Pre-existing Conditions					
Yes	304	0	304	122	182
No	926	179	747	672	254
Ever delivered prematurely					
Yes	244	0	244	20	224
No	986	179	807	774	212
Placenta problems during Pregnancy					
Yes	135	118	17	118	17
No	1095	61	1034	676	419
Type of delivery					
Normal	573	179	394	282	291
Caesarean	657	0	657	512	145
Prenatal care use					
Yes	1092	158	934	712	380
No	138	21	117	82	56
Frequency of prenatal vitamins					
Everyday	1069	158	911	702	367
Once a week	53	6	47	27	26
Most days	108	15	93	65	43

Analysis of Factors Associated with Late Antenatal Care (ANC) Contact and Inadequate ANC Contacts Among Pregnant Women

Age initially revealed a significant impact, with pregnant women under 30 having a lower risk of late ANC contact (14.55%) and inadequate ANC contacts (64.55%), but these associations became non-significant after adjusting for other factors (adjusted OR for late ANC: 1.275, p-value: 0.555; adjusted OR for inadequate ANC: 0.478, p-value: 0.260). Education level did not significantly affect late ANC contact (unadjusted OR: 1.088, p-value: 0.659). Still, it was significantly associated with inadequate ANC contacts (42.24%), with graduates showing a lower risk, and this association remained significant after adjustment (adjusted OR: 0.010, p-value: 0.000).

The number of pregnancies significantly impacted late ANC contact (14.55%), with women having fewer than 5 pregnancies showing a lower risk (unadjusted OR: 0.806, p-value: 0.000), which remained unaffected by adjustment. Additionally, the number of pregnancies had a dramatic effect on inadequate ANC contacts, with women having more than 5 pregnancies at a substantially higher risk (unadjusted OR: 3732.019, p-value: 0.000), and this association remained significant after adjustment (adjusted OR: 0.000, p-value: 0.998). The number of births significantly influenced late ANC contact (14.55%), with women having fewer than 5 births exhibiting a lower risk (unadjusted OR: 0.020, p-value: 0.000), and this association was not influenced by adjustment. Moreover, the number of births significantly affected inadequate ANC contacts (14.55%), with women having more than 5 births at higher risk (unadjusted OR: 0.003, p-value: 0.000). After adjustment, this association remained significant (adjusted OR: 0.402, p-value: 1.000). Regarding abortions, women with one abortion had a significantly higher risk of late ANC contact (2.47%) compared to those with no abortions (unadjusted OR: 2.065, p-value: 0.000), and this association remained significant after adjustment (adjusted OR: 4.906E6, p-value: 0.992). A similar pattern was observed for inadequate ANC contacts (2.47%), with women having one abortion at higher risk (unadjusted OR: 2.972, p-value: 0.000), and this association remained significant after adjustment (adjusted OR: 0.538, p-value: 0.489) (Table 2).

Table 2 Unadjusted and Adjusted Odds Ratios for Various Sociodemographic Factors Affecting ANC Contacts Among Participants

Variable	Late ANC contact		Inadequate ANC contacts	
	> 8 weeks		< 8 ANC contacts	
	Unadjusted OR (CI), p value	Adjusted OR (CI), p value	Unadjusted OR (CI), p value	Adjusted OR (CI), p value
Age				
Less than 30 years	0.240 (0.172 to 0.336) **0.000**	1.275 (0.569 to 2.857) 0.555	0.057 (0.037 to 0.086) **0.000**	0.478 (0.132 to 1.728) 0.260
≥ 30 years				
Education				
Highschool diploma or less	1.088 (0.748 to 1.584) 0.659	1.547 (0.000 to 0.000) 1.000	0.329 (0.250 to 0.434) **0.000**	0.010 (0.003 to 0.036) **0.000**
Undergraduate diploma or higher				
Number of pregnancies				
Less than 5	0.806 (0.781 to 0.832) **0.000**	0.000 (0.000 to 0.000) 0.998	3732.019 (231.462 to 60,173.878) **0.000**	0.000 (0.000 to 0.000) 0.995
More than 5				
Number of births				
Less than 5	0.020 (0.003 to 0.142) **0.000**	0.000 (0.000 to 0.000) 0.997	0.003 (0.001 to 0.011) **0.000**	0.402 (0.000 to 0.000) 1.000
More than 5				
Number of abortions				
None	Reference	Reference	Reference	Reference
One	2.065 (1.364 to 3.112) **0.000**	4.906E6 (0.000 to 0.000) 0.992	2.972 (2.255 to 3.918) **0.000**	0.936 (0.173 to 5.057) 0.938
More than one	7.335 (2.668 to 20.165) **0.000**	8.959E6 (0.000 to 0.000) 0.992	10.359 (6.738 to 15.927) **0.000**	0.538 (0.89 to 3.176) 0.489
Planned Pregnancies				
Yes	541.281 (33.632 to 8711.487) **0.000**	1.954 (0.000 to 0.000) 1.000	2658.984 (165.269 to 42,779.875) **0.000**	0.000 (0.000 to 0.000) 0.996
No				
More than 24 months between Pregnancies				
Yes	Reference	Reference	Reference	Reference
No	1.334 (0.026 to 67.420) 0.885	0.753 (0.000 to 0.000) 1.000	3.778 (2.845 to 5.017) **0.000**	4.427 (0.000 to 0.000) 1.000
Been pregnant only once	0.001 (0.0001 to 0.0207) **0.000**	0.000 (0.000 to 0.000) 0.999	0.003 (0.0002 to 0.050) **0.000**	6.950E6 (0.000 to 0.000) 0.990
Pre-existing conditions				
Yes	881.289 (54.733 to 14,190.081) **0.000**	3.034E3 (0.000 to 0.000) 0.999	0.253 (0.193 to 0.332) **0.000**	0.000 (0.000 to 0.000) 0.985
No				
Ever delivered prematurely				
Yes	1185.654 (73.600 to 19,100.147) **0.000**	0.005 (0.000 to 0.000) 1.000	0.024 (0.015 to 0.039) **0.000**	0.002 (0.000 to 0.009) 0.000
No				

Placenta problems during pregnancy Yes No	117.658 (66.520 to 208.111) **0.000**	8.337E13 (0.000 to 0.000) 0.988	4.302 (2.550 to 7.257) **0.000**	0.102 (0.000 to 0.000) 0.999
Type of delivery Normal Caesarean	598.333 (37.174 to 9630.299) **0.000**	8.490E8 (0.000 to 0.000) 0.996	0.274 (0.214 to 0.351) **0.000**	0.016 (0.000 to 0.000) 0.984
Prenatal care use Yes No	0.942 (0.575 to 1.544) 0.814	0.620 (0.202 to 1.897) 0.402	1.279 (0.891 to 1.837) 0.181	0.855 (0.204 to 3.576) 0.830
Frequency of prenatal vitamins Everyday Once a week Most days	 Reference 1.358 (0.571 to 3.230) 0.488 1.075 (0.607 t 1.903) 0.803	 Reference 2.202 (0.709 to 6.836) 0.172 1.913 (0.384 to 9.528) 0.428	 Reference 1.842 (1.059 to 3.202) **0.030** 1.265 (0.843 to 1.898) 0.255	 Reference 0.833 (0.197 to 3.514) 0.803 1.520 (0.208 to 11.113) 0.680

Notes: Bold numbers indicate significant p values (< 0.05).

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Prenatal Care, Prenatal Vitamins, and Attitudes Towards Prenatal Care Among Surveyed Women

Approximately 14.55% of the total respondents-initiated ANC within the first 8 weeks of pregnancy, while 85.44% started ANC after 8 weeks. - 64.55% of the participants had eight or more ANC contacts, whereas 35.44% had less than eight ANC contacts. The majority of respondents (88.78%) reported receiving prenatal care during pregnancy, while 11.21% did not. - Interestingly, the timing of ANC contact did not significantly impact the receipt of prenatal care, as indicated by a non-significant Chi-square value of 0.055. - A larger proportion of those who initiated ANC within 8 weeks reported receiving prenatal care (88.86%), compared to those who started later (11.13%). Regarding beliefs about prenatal vitamins, 20.08% agreed that prenatal vitamins are only indicated for malnourished mothers, while 72.35% disagreed, and 7.56% had no idea. - The Chi-square value of 0.996 indicates that there is no significant association between beliefs about prenatal vitamins and the timing of ANC contact. - Among those who agreed that prenatal vitamins are only for malnourished mothers, 24.54% initiated ANC within 8 weeks, while 66.51% started later (Table 3).

Supplement Usage and Prenatal Vitamin Adoption Among Surveyed Women

Most respondents reported using folic acid (88.13%), calcium (64.63%), iron (77.39%), and prenatal vitamins (25.77%) supplements. The timing of ANC contact did show significant associations with supplement usage, except for folic acid supplements, where those initiating ANC within 8 weeks were slightly more likely to use them (88.39%). In summary, while there are variations in the timing of ANC contact and beliefs about prenatal vitamins and the right time to start prenatal care, the majority of pregnant women received prenatal care and used supplements regardless of when they initiated ANC. However, there are important nuances to consider when promoting early ANC and educating about supplement use during pregnancy (Table 4).

Table 3 Descriptive Statistics and Regression Analysis Between Timing and Frequency of ANC Contacts and Beliefs Regarding the Use of Various Supplements During Pregnancy

Variable	Total (1230) N (%)	Time of ANC Contact		P (Chi-square value)	Number of ANC Contacts		P (Chi-Square value)
		≤ 8 Weeks	> 8 Weeks		≥ 8 ANC Contacts	< 8 ANC Contacts	
		179 (14.55%)	**1051 (85.44%)**		**794 (64.55)**	**436 (35.44%)**	
Have you ever received prenatal care				0.973 (0.055)	712 (89.67%)	380 (87.15%)	0.385 (1.909)
Yes	1092 (88.78%)	158 (88.26%)	934 (88.86%)				
No	138 (11.21%)	21 (11.73%)	117 (11.13%)		82 (10.32%)	56 (12.84%)	
Prenatal vitamins are only indicated for malnourished mothers				0.608 (0.996)			**0.003** (11.589)
Agree	247 (20.08%)	40 (22.34%)	207 (19.69%)		140 (17.63%)	107 (24.54%)	
Disagree	890 (72.35%)	124 (69.27%)	766 (72.88%)		600 (75.56%)	290 (66.51%)	
I do not know	93 (7.56%)	15 (8.37%)	78 (7.42%)		54 (6.80%)	39 (8.94%)	
I think the right time to start using prenatal care is				0.199 (4.648)			0.344 (3.330)
Before pregnancy	631 (51.30%)	79 (44.13%)	552 (52.52%)		405 (51%)	226 (51.83%)	
After confirmation of pregnancy	367 (29.83%)	60 (33.51%)	307 (29.21%)		246 (30.98%)	121 (28.07%)	
During the first trimester	167 (13.57%)	30 (16.75%)	137 (13.03%)		99 (12.46%)	68 (15.59%)	
I do not know	65 (5.28%)	10 (5.58%)	55 (5.23%)		44 (5.54%)	21 (4.81%)	
I would advise mothers to start prenatal care with every pregnancy				0.593 (0.286)			0.090 (2.882)
Yes	1171 (95.20%)	169 (94.41%)	1002 (95.33%)		762 (95.96%)	409 (93.80%)	
No	59 (4.79%)	10 (5.58%)	49 (4.66%)		32 (4.03%)	27 (6.19%)	

Notes: Bold numbers indicate significant p values (< 0.05).

Table 4 The Associations Between the Timing of ANC Contact, the Number of ANC Contacts, and the Use of Different Supplements

Variable	TotalN (1230)	Time of ANC Contact		P (Chi-Square value)	Number of ANC Contacts		P (Chi-Square value)
		≤ 8 Weeks	> 8 Weeks		≥ 8 ANC Contacts	< 8 ANC Contacts	
		179 (14.55%)	1051 (85.44%)		794 (64.55)	436 (35.44%)	
Used folic acid supplement				0.491 (0.474)			
Yes	1084 (88.13%)	155 (86.59%)	929 (88.39%)		708 (89.16%)	376 (86.23%)	0.129 (2.310)
No	146 (11.86%)	24 (13.40%)	122 (11.60%)		86 (10.83%)	60 (13.76%)	
Used calcium supplement				**0.032** (4.610)			**0.002** (9.564)
Yes	795 (64.63%)	103 (57.54%)	692 (65.84%)		538 (67.75%)	257 (58.94%)	
No	435 (35.36%)	76 (42.45%)	359 (34.15%)		256 (32.24%)	179 (41.05%)	
Used iron supplement				**0.015** (5.880)			**0.019** (5.501)
Yes	952 (77.39%)	126 (70.39%)	826 (78.59%)		631 (79.47%)	321 (73.62%)	
No	278 (22.60%)	53 (29.60%)	225 (21.40%)		163 (20.52%)	115 (26.37%)	
Used prenatal vitamins				**0.045** (4.036)			**0.006** (7.705)
Yes	317 (25.77%)	57 (31.84%)	260 (24.73%)		225 (28.33%)	92 (21.10%)	
No	913 (74.22%)	122 (68.15%)	791 (75.26%)		569 (71.66%)	344 (78.89%)	

Notes: Bold numbers indicate significant p values (< 0.05).

Discussion

Adequate and early antenatal care is essential because it increases the likelihood of pregnant women undergoing crucial screening tests, detecting non-communicable diseases, and modifying lifestyle risk factors like malnutrition and smoking, which are most effectively addressed in early pregnancy.[29,31–34]

ANC coverage in Arabic countries, spanning from the 1990s to the most recent available data in 2019 reveals a diverse landscape of ANC services in the region. Some countries, such as Bahrain and the United Arab Emirates (UAE), stand out with exceptional ANC coverage, consistently nearing 100% (Figure 2). These nations have established highly effective ANC programs that provide crucial care to a vast majority of pregnant women. In contrast, several other countries in the Arabic region grapple with lower ANC coverage rates. For instance, Mauritania reported a coverage rate of 52.4%, and Morocco's coverage stood at 60.9%. These data indicate a need for these countries to enhance their ANC services and expand access to reach more expectant mothers (Figure 2). Saudi Arabia, with an ANC coverage rate of 79.9% in 2019, falls in between the countries with outstanding ANC coverage and those with lower rates. While Saudi Arabia has made significant progress in providing ANC services. We decided to conduct a comprehensive study aimed at updating and assessing the coverage of ANC in Saudi Arabia.

Previous studies identified various barriers in Saudi Arabia to attend ANC visits.[35] These barriers were categorized into three themes: physical obstacles (such as transportation issues), low maternal education, and inadequacies in healthcare facilities, including negative staff attitudes and poor communication.

In our study, we investigated ANC initiation and utilization among 1230 pregnant women aged 18 to 50. Our findings shed light on factors related to ANC initiation and contact adequacy, providing a comprehensive view of prenatal healthcare in Saudi Arabia.

Our study unveiled that 14.55% of pregnant women initiated ANC within the first 8 weeks, while the majority (85.44%) started later. Remarkably, a significant proportion (88.78%) received prenatal care, regardless of ANC initiation timing. These findings demonstrate an improvement in ANC coverage compared to previous national studies across various regions of Saudi Arabia.[36,37] In a 2020 study, 34% of participants had inadequate or late ANC.[26]

Regarding perceptions of prenatal care commencement, approximately 51.30% believed it should begin before pregnancy, 29.83% after confirmation, 13.57% during the first trimester, and 5.28% uncertain. Interestingly, these beliefs

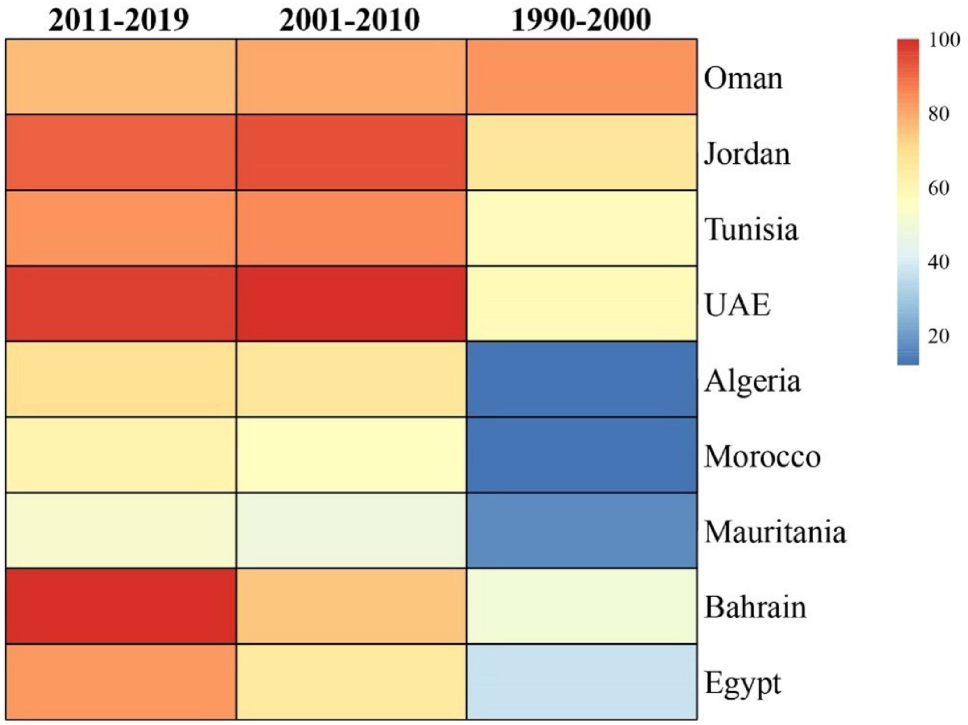

Figure 2 Heatmap depicting the ANC coverage for 9 Arabic countries from Africa and Asia.
Notes: Data from World Health Organization. GHO | By category | Antenatal care coverage - Data by country. 2023. Available at: https://apps.who.int/gho/data/node.main.ANTENATALCARECOVERAGE4.[23]

did not significantly correlate with ANC initiation timing. A noteworthy 95.20% were willing to advise others to start prenatal care with every pregnancy, regardless of their own ANC initiation timing.

Regarding supplement usage, most respondents took folic acid (88.13%), iron (77.39%), calcium (64.63%), and prenatal vitamins (25.77%). ANC initiation timing generally did not significantly affect supplement usage, except for calcium (57.54%) among early initiators. The majority of participants in our study received complementary supplements during pregnancy, which aligns with findings from studies in other countries that have shown significant usage of complementary supplements during pregnancy.[38–41]

In comparison to earlier studies in the Kingdom of Saudi Arabia,[42] which reported that 81.8% of pregnant women received folic acid during antenatal care, our study indicated a notable advancement, with 88.13% of participants receiving folic acid. This suggests a rising level of awareness among pregnant Saudi women and a satisfactory provision of information by healthcare centers.

The study by Al-Wutayd[26] found a significant percentage of participants with inadequate and late antenatal care, where high parity and employment status played a substantial role. Similarly, another study[24] in 2009 explored the impact of employment on prenatal care initiation and visits, indicating that working mothers often initiated care late and attended fewer visits.

Conclusions

The analysis of factors influencing ANC among pregnant Saudi women reveals several key determinants. While age and education were not significant predictors of delayed ANC initiation, higher education levels correlated with improved ANC adequacy. Lower numbers of pregnancies and births were associated with more timely and adequate ANC, while a history of abortions significantly influenced both tardiness and insufficiency of ANC contacts. Planned pregnancies and extended inter-pregnancy intervals were linked to better ANC outcomes. Pre-existing health conditions, a history of

premature deliveries, and placental problems during pregnancy were critical predictors of late and inadequate ANC. The study emphasizes the complex interplay of sociodemographic and health-related factors influencing ANC utilization.

Recommendations

Our study recommends the establishment of public communication teams dedicated to announcing and promoting antenatal care in primary health care centers, targeting both educators and non-educators. Healthcare providers should prioritize the early initiation of antenatal care within the first 8 weeks and address diverse beliefs about prenatal vitamins to optimize maternal and child health outcomes. These insights serve as valuable guidance for interventions aimed at enhancing antenatal health practices among pregnant women in Saudi healthcare centers.

Data Sharing Statement

Data are available upon request from the corresponding author.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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