Italian Journal of
Gynæcology & Obstetrics
June 2020 - Vol. 32 - N. 2 - Quarterly - ISSN 2385 - 0868

The adherence adequacy to antenatal care in alleviating the adverse maternal and neonatal outcomes of Iranian pregnant women: a retrospective-prospective study

M. Yousefi[1], L. Khedmat[2], N. Akbari[1], M. Kashanian[3], M. Moradi Lakeh[4]

[1]Department of Midwifery and Reproductive Health, Iran University of Medical Sciences, Tehran, Iran
[2]Health Management Research Center, Baqiyatallah University of Medical Sciences, Tehran, Iran
[3]Department of Obstetrics and Gynecology, Iran University of Medical Sciences, Tehran, Iran
[4]Department of Community Medicine, Iran University of Medical Sciences, School of Medicine, Tehran, Iran

ABSTRACT

Background. Low adherence of pregnant women to the content of prenatal care guidelines (PCGs) is one of the most significant issues in obstetrics.
Objective. This study aimed to improve the well-being of the mother and fetus by preventing maternal and neonatal complications using the adherence to antenatal care (ANC).
Patients and methods. An integrated retrospective-prospective longitudinal study with participating 604 pregnant women was carried out in the Iranian community. A valid researcher-made tool was used to implement this three-stage research approach. The results of demographic and obstetric characteristics, the adequacy of adherence to PCGS, and pregnancy outcomes were analyzed using multivariate logistic regression to assess the compliance of women with pregnancy outcomes.
Results. 71.36% of the total population had a complete adherence (≥ 80%) to the PCGs. The women with higher education levels substantially showed more adherence to this healthcare program guideline ($p = 0.0001$). In relation to pregnancy outcomes, there was a significant relationship between women's adherence to PCGs and neonatal complications ($p < 0.05$).
Conclusion. The assessment of PCGs content was successful in evaluating ANC quality. The complete adherence to first ANC guidelines could efficiently promote neonatal outcomes, whereas it showed no effect on maternal outcomes.

SOMMARIO

Background. La scarsa aderenza delle donne incinta al contenuto delle linee guida per l'assistenza prenatale (PCG) è una delle questioni più significative dell'ostetricia.
Obiettivo. Questo studio mira a migliorare il benessere della madre e del feto, prevenendo le complicazioni materne e neonatali con l'aderenza alla cura prenatale (ANC).
Pazienti e metodi. Nella comunità iraniana è stato condotto uno studio longitudinale retrospettivo/prospettivo integrato con 604 donne incinta partecipanti. Per implementare in tre fasi questo approccio di ricerca è stato utilizzato un valido strumento per ricercatori.
I risultati delle caratteristiche demografiche e ostetriche, l'adeguatezza dell'aderenza al PCGS e gli esiti della gravidanza sono stati analizzati utilizzando la regressione logistica multivariata, al fine di valutare la conformità delle donne agli esiti della gravidanza.
Risultati. Il 71,36% della popolazione totale ha avuto una completa aderenza (80%) ai PCG. Le donne con livelli di istruzione superiore hanno mostrato sostanzialmente una maggiore aderenza a questa linea guida del programma sanitario (p - 0,0001). Per quanto riguarda gli esiti della gravidanza, c'è stata una relazione significativa tra l'aderenza delle donne ai PCG e le complicazioni neonatic ($p < 0,05$).
Conclusione. La valutazione dei contenuti dei PCG è risultata efficace per la valutazione della qualità dell'ANC. La completa adesione dell'ANC alle prime linee guida potrebbe promuovere efficientemente i risultati neonatali, mentre non ha mostrato alcun effetto sui risultati materni.

Corresponding Author: Nahid Akbari
Akbari.n@iums.ac.ir

DOI: 10.36129/jog.32.02.03

Key words: *maternal adherence; prenatal care; maternal and neonatal mortality; pregnant women; pregnancy outcome.*

INTRODUCTION

Antenatal care (ANC) is one of the most recommended measures to prevent pregnancy complications and one of the primary interventions in improving care and neonatal and maternal conditions. ANC services establish proper communication between service providers (physicians and obstetrics) and pregnant women through enabling early diagnosis of risks and complications associated with pregnancy and ensuring access to health services such as health education, vaccination, and diagnostic and therapeutic tests (1,2). A leading and long-standing issue in prenatal care is the timing, content, and type of care during ANC visits. Therefore, purposes of ANC are to deliver healthy newborn babies with a minimum level of maternity risks through the determination of gestational age, recognition of maternal risks, persistent assessment of the health status of the mother and fetus, prognoses and essential interventions, establishing the proper doctor-patient communication, and offering the necessary education (3-7).

Despite improvements in prenatal care, about 800 women and 7700 newborns die every day due to complications in pregnancy, childbirth, and postpartum in the world (8,9). Based on the statistics released by Ministry of Health of Iran, the maternal mortality ratio (MMR) in Iran has been reported to be 23 cases per 100,000 live births in 2013. Although the MMR in this country has further reduced to 20.9% in 100,000 live births in 2017, this ratio still seems to be high (10). In any cultural and socio-demographic context, women need to have a positive pregnancy experience with high quality of antenatal and postnatal cares. Utilizing the prenatal care is important to prevent undesirable pregnancy outcomes. Studies have shown that there is an association between later initiation of prenatal care or having less than four prenatal visits and adverse fetal outcomes such as birth weight or preterm birth (6,9).

There are some differences in the national ANC recommendations among different countries concerning the number, timing, and quality of the visits. However, the WHO recommended a minimum of four visits for the pregnant women with uncomplicated pregnancies, so that the first visit should be before the14th week of gestation. Moreover, it was mentioned that four ANC visits on the 4th, 6th or 7th, 8th, and 9th pregnancy months are necessary for women with normal pregnancies in low- and middle-income countries (9-11). Women with high-risk pregnancies experience negative psychiatric feelings like fear, fury, loneliness, disappointment, and hope (16). Accordingly, the ANC guideline of WHO for women with high-risk pregnancies includes three specific policies: (i) routine care (offered to all women and babies), (ii) additional care (for women and babies with moderately-severe diseases and complications), and (iii) specialized obstetrical and neonatal care (for women and babies with intense diseases and complications) (11-14).

One of the major problems in many specialties, particularly obstetrics is low women's adherence to the related health protocols. Lower adherence to prenatal care has been found to cause lower 5-minute Apgar scores, higher rates of perinatal death, intrauterine infection, and placental abruption, and increased admissions of infants in the neonatal intensive care unit (NICU) (15). Although ANC, as the significant healthcare intermediary has widely been accepted, its efficiency and efficacy in improving the maternal and neonatal outcomes have less been remained unproven. This study aimed to evaluate the adequacy of ANC and its association with pregnancy outcomes, using an approach based on the assessment of the content adequacy and Iranian women's adherence to prenatal care guidelines (PCGs).

METHODS

Study design and participants

A retrospective/prospective longitudinal study was conducted in Tehran's 3rd level hospitals between February and July 2018. These hospitals had surgical, internal, gynecological, pediatric, anesthetic, neurological, infectious, radiological, pathological, and laboratory specialties and were equipped with intensive (ICU), coronary (CCU), and medical intensive (MICU) care units, and NICU. All high-risk pregnant women in hospitals were referred to these care units in the private and public sectors. A convenient sampling method was used to recruit 604 pregnant women between 24 to 34 weeks of gestation,

who participated in this research plan. All the pregnant women were categorized into two groups of low-risk and high-risk based on the interview and case history information. The sample size using a 95% confidence interval, and power of 80% was estimated by an Open-Epi calculator based on the prevalence of pregnancy complications (low- and high-risk). The inclusion criteria for pregnant women participated in this study were having an ability in the Persian listening and speaking to answer questions. The exclusion criteria were limited to the unwillingness to cooperate in the plan and the lack of access to patient information and medical adherence.

DATA COLLECTION AND PROCESSING

Some trained health workers and midwives were qualified to interview recruited pregnant women by filling out questionnaires and to obtain their different health-related information from datasets stored in affiliated hospitals and healthcare centers. It was assumed that all the data on history, examinations, laboratory tests, and conducted treatments were recorded in record files of mothers' health. If any medical and health information was not entered in the record book, it would be deemed not to have been delivered.

This study was conducted in three stages through observation and completion of a researcher-made checklist before and after the ANC. This checklist composed of four sections: (i) a checklist for categorizing the pregnancy risk in pregnant women (low and high levels) according to the national PCGs, (ii) a questionnaire for recording the socio-demographic data, (iii) a checklist for women's adherence to PCGs content, and (iv) a checklist for pregnancy (maternal and neonatal) outcomes.

The content validity of the developed checklist was assessed based on the viewpoints of 10 by members of the expert panel who had a specialty in obstetrics and gynecology, and midwifery care. The reliability of this checklist was also evaluated in the presence of 10% of the population. The high checklist's reliability ($\alpha = 0.91$) was also confirmed by calculating the internal consistency reliability coefficient "Cronbach's alpha".

At first, a set of socio-demographic (e.g., age, parity, education level, nationality, and occupational status), and midwifery (e.g., trimester at the first ANC, number of ANC visits, the timing of the first ANC visit, and previous pregnancy history and complications) characteristics were collected. The questions on the checklist were based on the requirements of the national country guide for obstetric services (CGOS) of Iran, which were consistent with the treatment instructions for the first visit of ANC. Accordingly, a series of responses were resulted concerning maternal (e.g., anemia, asymptomatic bacteriuria (ASB), intimate partner violence (IPV), gestational diabetes mellitus (GDM), tobacco and substance abuse, human immunodeficiency virus (HIV), and nutritional interventions) and fetal (e.g., symphysis-fundal height (SFH), antenatal cardiotocography, sonography, and screenings) assessments. The checklist was again completed in the second visit performed in the next 4-6 weeks. Finally, the information about the maternal and neonatal outcomes was collected using an electronic information system and phone calls to the mother after childbirth. Mothers were evaluated based on the first visit before the 14th week of their pregnancy, the number of ANC visits, medical tests, follow-up examinations, sonographies, screenings, and the use of food and drug supplements.

All maternal and neonatal complications during pregnancy, delivery, and postpartum periods were examined. Maternal complications included antepartum vaginal hemorrhage (APH), pregnancy-induced hypertension (PIH) and hypertensive complications (e.g., preeclampsia (PE), eclampsia (E), and hemolysis, elevated liver enzymes, and low platelets (HELLP) syndrome), anemia, infection, near miss, mother's admission in ICU, and delivery mode of cesarean section (CS). The assessed neonatal complications were preterm labor (PTL), low-birthweight (LBW), small gestational age (SGA), intrauterine fetal death (IUFD), intrauterine growth restriction (IUGR), respiratory distress syndrome (RDS), stillbirth, neonatal jaundice, NICU, and neonatal mortality.

The ANC adequacy was evaluated in two ways, including (i) the content adequacy by assessing the compliance to recommended routine care according to the ANC guidelines of Iran, and (ii) the effect of mothers' complete adherence to the

ANC guidelines on the risk of maternal and neonatal complications. The Kotelchuck index was used to determine the adequacy or quality of ANC during pregnancy (16). One score was assigned for each variable adhered to, while non-adherence was scored zero. Non-adherence to each of the mandatory variables was also classified as incomplete or inadequate adherence. Adherence was defined according to the criteria of following the instructions and recommendations at all levels of care, using prevention processes, self-care, and seeking diagnosis and treatment. Based on the prepared checklist, the compliance of 80% or more was considered as "full compliance", and the incomplete compliance was considered under 80% (17).

DATA ANALYSIS

All the data analyses were carried out using IBM SPSS Statistics for Windows version 24.0 (SPSS Inc., Chicago, IL, USA) at a significance level set at $p < 0.05$. Categorical variables of participants' socio-demographic were expressed as frequency and percentage. The Chi-square test was used to analyze the data related to the previous pregnancy histories and the possible relationship between adherence to the PCGs and patient properties. The nonparametric test of Mann-Whitney was applied for other variables that were not distributed normally. The results of the incidences of maternal and neonatal complications were reported in percentages. A multivariate logistic regression analysis was also performed to examine women's compliance with ANC health services, socio-demographic characteristics, and maternal and neonatal outcomes. Factors influencing the maternal and newborn complications as well as the effect of complete adherence on pregnancy outcomes were reported as odds ratio (OR) with their 95% confidence intervals (CI). Variables such as trimester of first ANC visit, maternal age, parity, the previous pregnancy complication, and any antenatal complication where appropriate were also adjusted. The association between the content adequacy and pregnancy outcomes was assessed using a binary logistic regression in terms of a full model multivariate regression. Adjusted risk estimates were then obtained with the regression model that were fit for variables such as maternal age, maternal education, risk status, and content adequacy.

RESULTS

Table I shows some socio-demographic and obstetric information of subjects who participated in this study. Among the total of 604 qualified pregnant women with the mean age of 29.29±5.40 years, 51.3% (n = 310) and 48.7% (n = 294) were categorized into low-risk and high-risk groups, respectively. Most participants had the 18-35-year age range (85%) and the high-school diploma educational level (43.9%). 4.63% of pregnant women were illiterate, whereas 23.84% of individuals had a secondary education level (**table I**). 95.36% (n = 576) and 28 (4.64%) of the participants were ethnic Iranian and Afghan women, respectively. Only 11.1% of the studied women had a history of previous pregnancy complications, while 13.1% of people were diagnosed to have gestational diabetes mellitus (GDM) at their first antenatal visit. Most participants experienced a cesarean delivery mode (41.56%).

***Table I**. Some socio-demographic and obstetric characteristics of the study participants.*

Variable	Sub-variables	Frequency [n (%)]	Incomplete adherence [n (%)][a]	Complete adherence [n (%)][a]
Total sample	-	604	173 (28.6)	431 (71.4)
Mean age (years)	-	29.29±5.6	26.98±4.4	31.71±5.7
Age (years)	< 18	6 (1.0)	0 (0.0)	6 (1.4)
	18-35	514 (85.10)	145 (83.81)	369 (85.6)
	> 35	84 (13.90)	28 (16.19)	56 (13.0)
Parity	0	216 (35.76)	44 (25.43)	172 (39.90)
	1-2	348 (57.62)	107 (61.85)	241 (55.91)
	3-4	36 (5.96)	18 (10.40)	18 (4.17)

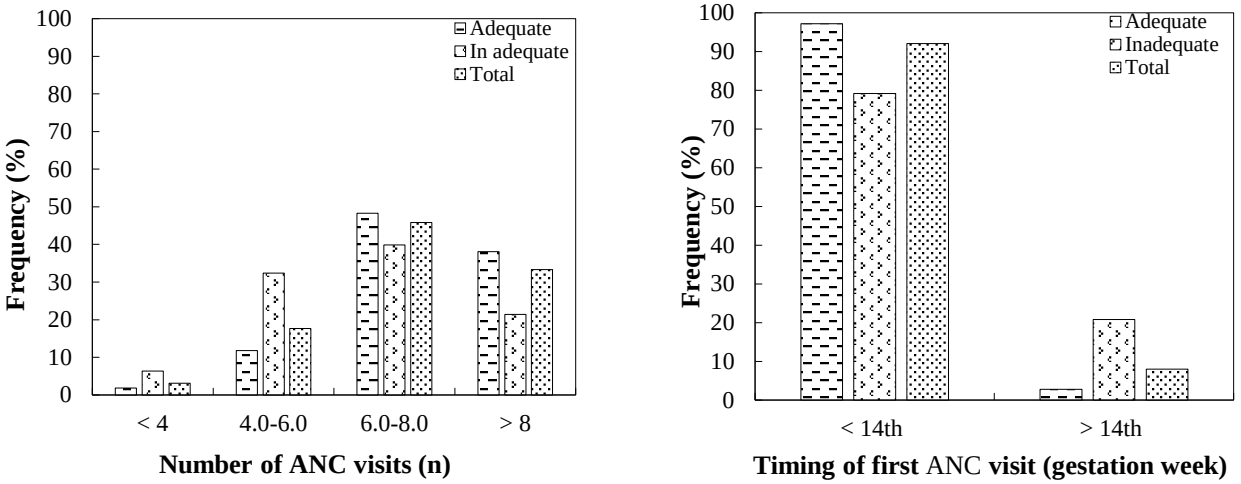
	≥ 5	4 (0.66)	4 (2.31)	0 (0.0)
Education	No education	28 (4.63)	21 (12.14)	7 (1.62)
	Primary school	81 (13.41)	42 (24.28)	39 (9.48)
	Secondary school	144 (23.84)	42 (24.28)	102 (23.66)
	Diploma	265 (43.87)	56 (32.37)	209 (48.49)
	University	86 (14.24)	12 (6.93)	74 (17.17)
Nationality	Iranian	576 (95.36)	151 (87.28)	425 (98.60)
	Afghan	28 (4.64)	22 (12.72)	6 (1.40)
Occupational status	Employed	584 (96.69)	167 (96.53)	417 (96.75)
	Unemployed	20 (3.31)	6 (3.47)	14 (3.25)
Trimester at the first ANC	First	556 (92.05)	137 (79.20)	419 (97.22)
	Second	48 (7.95)	36 (20.80)	12 (2.78)
Previous delivery [b]	Yes-CS	251 (41.56)	69 (39.88)	182 (42.23)
	Yes-NVD	120 (19.87)	51 (29.48)	69 (16.01)
	Yes-CS/NVD	172 (28.47)	9 (5.20)	8 (1.85)
	No	61 (10.1)	44 (25.43)	172 (39.91)
Previous pregnancy complication	Yes	67 (11.1)	26 (15.03)	41 (9.51)
	No	537 (88.9)	147 (84.97)	390 (90.49)

[a] Incomplete and complete adherence were equal to < 80% and ≥80%, respectively.

[b] CS and NVD are cesarean section and natural vaginal delivery, respectively.

According to the results of the Kotelchuck adequacy of prenatal care index (figure 1), 92.05% (n = 556) of women generally had their first antenatal visit during the first trimester (< 14 weeks). Besides, 96.85% of them attended at ANC clinic over four times visit during their pregnancy. Also, 71.36% (n = 431) and 28.64% (n = 173) of women had complete (≥ 80%) and incomplete (< 80%) adherence to the PCGs, respectively (**figure 1**).

Figure 1. *Percent distribution of the number of ANC visits (a), and of the timing of first ANC visit (b) in the population groups with inadequate (n = 173, 28.6%) and adequate (n = 431, 71.4%) adher-ence to PCGs.*



The risk incidence rate of maternal and neonatal complications is given in **table II**. Although no maternal mortality was found amongst the study participants, the risk of maternal near miss was assessed to be 10.43%. The risk rate for any pregnancy, delivery, or post-partum

complication type was 32.8%. The incidence of PIH and hypertensive complications (e.g., PE, E, and HELLP syndrome) and antepartum vaginal bleeding were 4.63 and 1.32%, respectively. The incidence rate of mother's admission in ICU, pregnancy anemia, infection after delivery, and cesarean section delivery were 9.93, 2.65, 3.80, and 70.53%, respectively (**table II**).

The incidence rate of PTLs, LBW babies, stillbirths, and neonatal mortalities were 15.56, 9.60, 0.66, and 1.32%, respectively. Moreover, the risk incidence of SGA, and neonatal RDS or asphyxia/difficulty in breathing, and admissions of infants in NICU were 1.49, 9.43, and 21.02%, respectively. The risk of other neonatal complications such as IUFD and IUGR were 0.66 and 1.65%, respectively (**table II**).

Table II. *The incidence risk rate of maternal and neonatal complications and their percent distribution in the population groups with inadequate and adequate adherence to PCGs.*

Sub-group	Complication [a]	Incidence [n (%)]	Incomplete adherence [n (%)][b]	Complete adherence [n (%)][b]	p-value
Maternal	APH	8 (1.32)	4 (2.31)	4 (0.93)	> 0.05
	PIH (e.g., PE, E, HELLP)	28 (4.63)	8 (4.62)	20 (4.64)	0.427
	Anemia in pregnancy	16 (2.65)	5 (2.89)	11 (2.55)	> 0.05
	Infection	23 (3.80)	4 (2.31)	19 (4.41)	0.373
	Delivery by CS	426 (70.53)	112 (64.74)	314 (72.85)	0.008
	Near miss	63 (10.43)	17 (9.82)	46 (10.67)	0.424
	ICU	60 (9.93)	15 (8.67)	45 (10.44)	0.127
Neonatal	PTL	94 (15.56)	30 (17.34)	63 (14.61)	0.402
	LBW	58 (9.60)	15 (8.67)	43 (9.97)	0.213
	SGA	9 (1.49)	3 (1.73)	6 (1.39)	0.476
	IUFD	4 (0.66)	1 (0.57)	3 (0.69)	0.556
	RDS	57 (9.43)	30 (17.34)	27 (6.26)	0.012
	Stillbirth	4 (0.66)	3 (1.73)	1 (0.23)	> 0.05
	IUGR	10 (1.65)	5 (2.89)	5 (1.16)	0.158
	NICU	127 (21.02)	47 (27.16)	80 (18.56)	0.01
	Mortality	8 (1.32)	4 (2.31)	4 (0.93)	> 0.05

[a] APH: antepartum hemorrhage, PIH: pregnancy-induced hypertension, PE: preeclampsia, e: eclampsia, PIH: HELLP: hemolysis, elevated liver enzymes, and low platelets (syndrome), CS: cesarean section, ICU: intensive care unit, NICU: neonatal intensive care unit, PTL: preterm labor, LBW: low-birth-weight, SGA: small gestational age, IUFD: intrauterine fetal death, IUGR: intrauterine growth restriction, and RDS: respiratory distress syndrome.

[b] Incomplete (n = 173) and complete (n = 431) adherence were equal to < 80% and ≥80%, respectively.

The logistic regression results showed that there was a significant association between women's adherence to the PCGs and their education level (**table III**). Women with higher education were more adherent (OR = 10.718, 95% CI (3.086-37.223), p = 0.0001) and the employed women compared to housewives had lower prenatal care compliance (OR = 0.273, 95% CI (0.083-0.910), p = 0.03). Also, Afghan women compared to Iranian women exhibited lower prenatal care adherence (PCA) (OR= 0.129, 95% CI (0.042-0.397), p = 0.0001). Women with GDM also had lower PCA (OR = 0.323, 95% CI (0.196-0.534), p = 0.0001). There was a significant negative association between PCA with parity so that women's PCA decreased with an increase in parity (OR = 0.011, 95% CI (0.001-0.221), p = 0.003) (**table III**). However, no significant differences were found for the maternal outcomes related to PCA (**table III**).

A significant correlation was detected between women's PCA and a number of neonatal outcomes, including: women with lower PCA were more at risk of RDS (OR = 0.273, 95% CI (0.121-0.617), p = 0.012), as well as babies admitted to NICU (OR = 0.593, 95% CI (0.298-1.180), p = 0.01).

In the multivariable analysis, no significant difference was obtained for PCA related to LBW, SGA, and IUGR (p > 0.05) (**table IV**).

However, there was a significant association between women's PCA, the pregnancy outcomes and the beginning of the visit in the first trimester (OR = 0.178, 95% CI (0.084-0.376), p = 0.0001).

Table III. *The logistic regression analysis of complete adherence to PCGS and socio-demographic/obstetric data before and after adjusting the confounding factors.*

Variable	Sub-variables	Unadjusted			Adjusted	
		OR(%95 CI)	p-value		OR(%95 CI)	p-value
Age (year)	< 18	1			1	
	18-35	1.436(0.710-2.904)	0.314		1.374 (0.676-2.793)	0.380
	> 35	1.103(0.489-2.485)	0.814		1.036 (0.456-2.353)	0.933
Education	No education	1			1	
	Primary school	2.786 (1.067-7.276)	0.036		1.715 (0.558-5.271)	0.234
	Secondary school	7.286 (2.881-18.425)	0.0001		4.183 (1.402-12.482)	0.003
	Diploma	11.196 (4.530-27.672)	0.0001		5.948 (2.033-17.398)	0.0001
	University	18.500 (6.470-52.898)	0.0001		10.718 (3.086-37.223)	0.0001
Occupational status	Housewife	1			1	
	Employed	0.934 (0.353-2.473)			0.273(0.083-0.910)	0.033
Nationality	Iranian	1			1	
	Afghan	0.097(0.039-0.244)	0.0001		0.129(0.042-0.397)	0.0001
Abortion	No	1			1	
	Yes	0.769(0.525-1.129			1.156(0.637-2.097)	0.633
Gestation diabetes	No	1			1	
	Yes	0.351(0.217-0.570)	0.0001		0.323(0.196-0.534)	0.0001
Gravid history	1	1			1	
	2-4	0.448(0.284-0.707)	0.001		0.351(0.133-0.978	0.035
	≥ 5	0.021(0.003-0.167)	0.0001		0.011(0.001-0.221)	0.003
Healthcare center type for the first ANC visit	Private clinic	1			1	
	Public hospital	0.386(0.208-0.715)			0.394(0.209-0.743)	0.004

Table IV*. The effect of complete adherence to PCGs on pregnancy outcomes using the logistic regression analysis before and after adjusting the confounding factors.*

Variable [a]	Sub-variables	Unadjusted			Adjusted	
		OR(%95 CI)	p-value		OR(%95 CI)	p-value
Trimester at the first ANC	First	1			1	
	Second	0.109(0.055-0.215)	0.0001		0.178(0.084-0.376)	0.0001
Delivery age	> 37 weeks	1			1	
	< 37 weeks	1.225(0.762-1.972)	0.402		1.334(0.752-2.368)	0.325
Birth weight (g)	< 2500	1			1	
	2500-4000	0.849(0.458-1.574)	0.604		0.621(0.294-1.313)	0.213
	>4000	1.134(0.320-4.019)	0.846		0.796(0.206-3.066)	0.740
ICU	No	1			1	
	Yes	1.228(0.665-2.267)	0.511		2.126(0.807-5.604)	0.127
NICU	No	1			1	
	Yes	0.611(0.404-0.924	0.020		0.593(0.298-1.180)	0.010
Near miss	No	1			1	

	Yes	1.098 (0.610-1.971)	0.758		1.295(0.687-2.440)	0.424
Infection	No	1			1	
	Yes	1.750(0.542-5.649)	0.232		1.657(0.545-5.037)	0.373
IUGR	No	1			1	
	Yes	0.394(0.113-1.380)	0.145		0.339(0.083-1.380)	0.158
IUFD	No	1			1	
	Yes	1.252(0.129-12.124)	0.672		0.469(0.038-5.819)	0.556
RDS	No	1			1	
	Yes	0.319(0.183-0.554)	0.0001		0.273(0.121-0.617)	0.012
SGA	No	1			1	
	Yes	0.800(0.198-3.235)	0.754		0.562(0.115-2.744)	0.476
Jaundice	No	1			1	
	Yes	1.826(0.829-4.020)	0.110		2.664(1.063-6.681)	0.030
PE	No	1			1	
	Yes	1.004(0.433-2.324)	0.993		0.616(0.187-2.034)	0.427
Previous delivery	CS [b]	1			1	
	NVD [b]	0.555(0.355-0.869)	0.010		0.539(0.342-0.848)	0.008

[a] ICU: intensive care unit, NICU: neonatal intensive care unit, IUFD: intrauterine fetal death, IUGR: intrauterine growth restriction, RDS: respiratory distress syndrome, SGA: small gestational age, and PE: preeclampsia.

[b] CS: cesarean section, and NVD: natural vaginal delivery.

DISCUSSION

This study aimed to evaluate the relationship between the compliance of pregnant women with the content of the standard guidelines for prenatal care and the improvement of maternal and neonatal outcomes. 51.3% of pregnant women in this study were classified into the low-risk group, while 71.4% of the total population had complete adherence to the first ANC guidelines. This fact shows a better assessment than the one found in Yeoh et al. (11) who reported 49.8% of the full adherence level. Moreover, they found Malaysian pregnant women at lower risk (77%) showed higher adherence to ANC guidelines (11). Results showed that there was no significant correlation between the participants' age and adherence degree. No meaningful relationship between these two variables in our study was because of the similarity of risk level in the different age groups. However, Amoakoh-Coleman et al. (18) reported a significant relationship between Ghanaian pregnant women and the adherence level to PCGs so that the adherence level of pregnant women to this care program was increased as their age increased. It seems that older women had higher adherence to the ANC guideline due to their awareness of the important role in improving maternal and neonatal outcomes. In contrast, Yaya et al. (6) realized that older women had less care and less compliance with the ANC guideline. This fact may be ascribed to the high number of study participants in the age group above 35 years, so that this relationship was significant, and women in this group were less adherent. However, better mothers' education is required to complete adherence to the guidelines for providing more exact information to the stakeholders about the content of the instructions and how they might be helpful to improve the delivery of their services. Thus, women with lower education levels significantly had lower adherence to prenatal care during their pregnancy. Similar results have already been reported from other related studies (2,11,19). Agha and Tappis (20) also showed that the lowest compliance level was related to illiterate women owing to their lower awareness of receiving ANC guidelines. The current study also showed that women with higher parity had lower adherence to PCGs than other women, which was in line with the findings reported from other studies (6,11,18). Our study showed that employed women were less adherent to PCGs. This finding could be due to the lack of time for working women to go to public health

clinics or their referral to private settings. We found that the pregnancy number had a significant effect on the mother's adherence to ANC guidelines so that the compliance rate was reduced with an increase in childbirth numbers. It seems that caring for smaller children is a major problem for most pregnant women, requiring a child nurse to care for them, while nulliparous women do not have such worry and possess enough time to refer to healthcare centers. A similar result was obtained by Yaya et al. (6) who reported that nulliparous women compared to multiparous ones were more adherent to PCGs. Conversely, Amoakoh-Coleman et al. (18) mentioned higher compliance with PCGs by multiparous women. They explained that these women were more aware of the importance of these maternal and neonatal care and outcomes. The results showed that pregnant women with history of CS delivery were more adherent than women with natural vaginal delivery (NVD). Lower safety of CS delivery for pregnant women compared to NVD along with the requirement to receive more care and follow-up due to pre-operative hospitalization might result in the more need for health cares and compliance with PCGs. A similar result was reported by Milcent and Zbiri (21) who French pregnant women with a history of CS delivery received more care with more clinical tests and sonography scans.

Also, there was no significant relationship between women's adherence to the antenatal guideline and PTL, ICU, near miss, infection in postpartum, preeclampsia, postpartum and hemorrhage complications. Although some studies have demonstrated that complete adherence to the first antenatal guideline resulted in reduced risk of delivery and neonatal complications (7,11,18). This fact may be due to receiving adequate prenatal care in these groups. Moreover, pregnant women (mainly, with a history of GDM and PE) in most Iranian medical centers will be stayed in the ICU for up to 24 hours postpartum to prevent any maternal complication and then admitted to the ward after being assured of a stable physical condition. Amoakoh-Coleman et al. [18] also reported the same finding and attributed it to the therapeutic methods used in healthcare centers. However, Yeoh et al. (7) pointed out that there was a significant association between adherence of women to the content of PCGs and pregnancy outcomes so that women with higher adherence had a reduced rate of PTL and maternal and neonatal complications. In the present study, the results showed that women who had their first ANC visit before the 14th week of pregnancy exhibited a better maternal outcome and a significant relationship with women who initially visited for ANC after the 14th week of pregnancy.
Pregnant women with the first ANC visit after the 14th week have lost most of the care they need, such as targeted tests, screening, and sonography during pregnancy. Therefore, there was not enough time for health care providers to prevent or treat these complications. Similar findings were obtained by other researchers (7,18,20).
Our results revealed that the risk of RDS and NICU could be increased when there was a low adherence to the prenatal guideline. Other similar studies have also reported an increase in RDS and babies admitted to NICU under lower adherence to PCGs (7).

We found that there was no significant between women's adherence to the ANC guideline with LBW, stillbirth, and preterm birth.
However, some studies demonstrated the significant complete adherence to the first antenatal guideline resulted in reduced risk of LBW, stillbirth, and preterm birth (11, 21-25). The current study indicated the significant role of the quality of prenatal care in evaluating the desired outcomes. The complete adherence to ANC guidelines resulted in a reduced risk of maternal and neonatal complications, as earlier evidenced by other researchers (4).

STUDY LIMITATIONS

In this study, the 3rd level hospitals in Tehran were chosen as research sites, because more than 92% of the pregnant women were referred to these hospitals, and only 8% of them visited private hospitals, where prenatal care was performed differently. Furthermore, pregnant women referred to these hospitals were not available to the researchers. We also used researcher-made instruments to achieve our study objectives, which required validity and reliability analyses.

CONCLUSION

Results of the present study revealed the significant effect of adherence to ANC guidelines on neonatal conditions, while no substantial impact was obtained on maternal outcomes. Therefore, implementing the programs promoting complete adherence to the ANC guideline will be necessary to improve the outcomes of neonatal service deliveries.

However, the early ANC should be encouraged amongst the population. Further investigations on the quantity and quality of prenatal care are suggested to enhance the effectiveness of prenatal care for high-risk pregnancies. There is also a need to explore and understand the possibility of expository mechanisms for these observations. On the other hand, the assessment of ANC content in this survey was based on the current national ANC guidelines. As the Iranian guidelines compared to the evidence-based ones from other countries (especially, in Australia and the UK) resulted in better maternal and neonatal health outcomes, this program might be used as an appropriate practical pattern in the maternity healthcare setting in other countries.

REFERENCES

(1) Lima HM, Carvalho FH, Feitosa FE, Nunes GC. Factors associated with maternal mortality among patients meeting criteria of severe maternal morbidity and near miss. Int J Gynaecol Obstet 2017;136(3), 337-343. doi: 10.1002/ijgo.12077.
(2) Muchie KF. Quality of antenatal care services and completion of four or more antenatal care visits in Ethiopia: a finding based on a demographic and health survey. BMC Pregnancy Childbirth 2017; 17(1):300-307. doi: 10.1186/s12884-017-1488-0.
(3) Abalos E, Chamillard M, Diaz V, Tuncalp Ö, Gülmezoglu AM. Antenatal care for healthy pregnant women: a mapping of interventions from existing guidelines to inform the development of new WHO guidance on antenatal care. BJOG 2016;123(4):519-528. doi: 10.1111/1471-0528.13820.
(4)Amoakoh-Coleman M, Agyepong IA, Zuithoff NP, Kayode GA, Grobbee DE, Klipstein-Grobusch K, Ansah EK. Client factors affect provider adherence to clinical guidelines during first antenatal care. PLoS One 2016;11(6), e01575420157555.doi:10.1371/jounal.pone.0157542.
(5) Dyer J, Latendresse G, Cole E, Coleman J, Rothwell E. Content of first prenatal visits. Matern Child Health J 2018; 22(5):679-684. doi: 10.1007/s10995-018-2436-y.
(6) Yaya S, Bishwajit G, Ekholuenetale M, Shah V, Kadio B, Udenigwe O. Timing and adequate attendance of antenatal care visits among women in Ethiopia. PLoS One 2017;12(9): e0184934. doi: 10.1371/journal.pone.0184934.
(7) Yeoh PL, Hornetz K, Shauki NI, Dahlui M. Evaluating the quality of antenatal care and pregnancy outcomes using content and utilization assessment. Int J Qual Health Care 2018; 30(6):466-471. doi: 10.1093/intqhc/mzy041.
(8) Carvajal–Aguirre L, Amouzou A, Mehra V, Ziqi M, Zaka N, Newby H. Gap between contact and content in maternal and newborn care: An analysis of data from 20 countries in sub-Saharan Africa. J Glob Health 2017;7(2), 020501. doi: 10.7189/jogh.07.020501.
(9) Beeckman K, Louckx F, Masuy-Stroobant G, Downe S, Putman K. The development and application of a new tool to assess the adequacy of the content and timing of antenatal care. BMC Health Serv Res 2011; 11:213. doi: 10.1186/1472-6963-11-213.
(10) World Health Organization. WHO Recommendations on antenatal care for a positive pregnancy experience (pp. 1-172). Geneva: World Health Organization; 2016.
(11) Yeoh PL, Hornetz K, Dahlui M. Antenatal care utilisation and content between low-risk and high-risk pregnant women. PLoS One 2016;11(3): e0152-0167. doi: 10.1371/journal.pone.0152167.
(12) Carter EB, Temming LA, Akin J, Fowler S, Macones GA, Colditz GA, Tuuli MG. Group prenatal care compared with traditional prenatal care: a systematic review and meta-analysis. Obstet Gynecol 2016;128(3): 551-561. doi: 10.1097/aog.0000000000001560.
(13) Lee S, Ayers S, Holden D. A metasynthesis of risk perception in women with high risk pregnancies. Midwifery 2014; 30(4):403-411. doi: 10.1016/j.midw.2013.04.010.
(14) World Health Organization. WHO recommended interventions for improving maternal and newborn health: management of pregnancy and childbirth (pp. 1-6). Geneva: World Health Organization; 2007.
(15) Sperling JD, Maggio L, Has P, Daley J, Khander A, Coustan DR. Prenatal care adherence and neonatal intensive care unit admission or stillbirth among women with gestational and preexisting diabetes mellitus. Am J Perinatol 2018;35(2):103-109. doi: 10.1055/s-0037-1603343.
(16) Kotelchuck M. An evaluation of the Kessner adequacy of prenatal care index and a proposed adequacy of prenatal care utilization index. Am J Public Health 1994;84(9):1414-1420.
(17) Brizot ML, Hernandez W, Liao AW, Bittar RE, Francisco RP, Krebs VL, Zugaib M. Vaginal progesterone for the prevention of preterm birth in twin gestations: a randomized placebo-controlled double-blind study. Am J Obstet Gynecol 2015;213(1):82-e1.
(18) Amoakoh-Coleman M, Klipstein-Grobusch K, Agyepong IA, Kayode GA, Grobbee DE, Ansah EK. Provider adherence to first antenatal care guidelines and risk of pregnancy complications in public sector facilities: a Ghanaian cohort study. BMC Pregnancy Childbirth 2016; 16(1):369-379. doi: 10.1186/s12884-016-1167-6.
(19) Lindquist A, Kurinczuk JJ, Redshaw M, Knight M. Experiences, utilisation and outcomes of maternity care in England among women from different socio-economic groups: findings

from the 2010 National Maternity Survey. BJOG 2015; 122(12):1610-1617. doi: 10.1111/1471-0528.13059.
(20) Agha S, Tappis H. The timing of antenatal care initiation and the content of care in Sindh, Pakistan. BMC Pregnancy Childbirth 2016;16(1):190-199.doi:10.1186/s12884-016-0979-8.
(21) Milcent C, Zbiri S. Prenatal care and socio-economic status: effect on cesarean delivery. Health Econ Rev 2018; 8(1):7-28. doi: 10.1186 /s13561-018-0190-x.
(22) Yeoh PL, Hornetz K, Shauki NI, Dahlui M. Assessing the extent of adherence to the recommended antenatal care content in Malaysia: Room for improvement. PLoS One 2015;10(8): e0135301. doi: 10.1371/journal.pone.0135301.
(23) Alibekova R, Huang JP, Chen YH. Adequate prenatal care reduces the risk of adverse pregnancy outcomes in women with history of infertility: a nationwide population-based study. PLoS One 2013;8(12): e84237. doi: 10.1371/journal.pone.0084237.
(24) da Fonseca CR, Strufaldi MW, de Carvalho LR, Puccini RF. Adequacy of antenatal care and its relationship with low birth weight in Botucatu, Sao Paulo, Brazil: a case-control study. BMC Pregnancy Childbirth 2014; 14:255. doi: 10.1186/1471-2393-14-255.
(25)Dowswell T, Carroli G, Duley L, Gates S, Gülmezoglu AM, Khan-Neelofur D, Piaggio G. Alternative versus standard packages of antenatal care for low-risk pregnancy. Cochrane Database Syst Rev 2015; 7: Cd000934-001017. doi: 10.1 002/14651858.CD000934.pub3.