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Original Research Article

Timing, frequency and the contents of antenatal care visits among mothers in Oman: An assessment of the level of alignment with the WHO recommended guidelines

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Although Oman has a very good maternal health care system, little is known about the pattern of utilization of antenatal care (ANC) services in the country in accordance with the WHO guidelines for early initiation of an ANC visit, the optimum frequency of visits by the ANC and the core content of ANC services. This study looked at the timing of the first ANC visit, the frequency and the content of ANC visits to Oman and assessed the level of alignment with the recommended WHO guidelines for ANC services. Data were obtained from the 2008 Oman National Reproductive Health Survey (ONRHS), which included a nationally representative sample of ever-married women of reproductive age. Information from 2,220 married women aged 15-49 years who had a live birth within five years of the date of the survey was used for analysis. Descriptive, inferential and multiple logistic regression techniques have been used for data analysis using SPSS. The analysis revealed universal (98%) use of at least one ANC visit to Oman. Approximately 75% of mothers initiated ANC in the first trimester and 73% of mothers received the recommended 8 or more ANC visits. On average, the mothers received nine visits to the ANC. Approximately 71% of mothers received all prescribed core components of ANC services. Counseling about danger sign was the least received item (72%). Early initiation appeared as significant predictor for receiving more ANC visit and more components of ANC services. Visiting physicians rather than nurses promote higher frequency of visits to the ANC. Age of mothers, parity, level of education, area of residence, status of contraceptive use appeared to be important predictors of initiation and frequent ANC visits. While Oman has achieved a strong level of compliance with the guidelines recommended by the WHO on the early initiation of ANC visits, the optimal frequency (i.e. at least eight) of ANC visits, and all the components prescribed for ANC services, the country is still lagging behind in achieving universal coverage of all of these services. Efficient policies and services need to be properly prepared to resolve the predictors of early initiation and frequency of ANC visits, such as the age of mothers, parity, level of education, area of residence, contraceptive usage status and timing of initiation of ANC visits, in order to ensure full compliance with the prescribed guidelines in Oman.

Keywords: Antenatal care visit, timing, frequency, components, WHO recommendation, Oman

INTRODUCTION

Pregnancy and child birth are the most important events in the life of a woman and her family. While these are not in themselves diseases, but physiological processes, yet they are the major contributors to death, disability and

morbidity among women, particularly in developing countries. Globally more than three million women die every year due to complications during pregnancy or childbirth and nearly another three million pregnancies are terminated as stillbirth annually, and approximately 99% of these deaths and still births are taking place in developing countries (Alkema et al., 2016; Blencowe et al., 2016; WHO, 2018). However, most of these pregnancy related complications and deaths are preventable with simple and cost-effective antenatal care (ANC) services (Abou-Zahr and Wardlaw, 2003; Lawn et al., 2016). ANC is the routine care of pregnant women starting from the date of conception to onset of delivery.

Within the continuum of maternity care, ANC provides a platform in preventing health problems of mothers and the fetus (WHO, 2002). ANC is the key maternal service that aids in improving a wide range of health outcomes for women and children (Villar et al., 2001; Chen et al., 2007). ANC provides opportunities for reaching pregnant women with a number of interventions, including health promotion, nutrition, screening and diagnosis, and disease prevention (WHO, 2016). Timely regular ANC visits help detect early the signs of risk factors for disease, pregnancy induced complications, followed by timely intervention, and thus reduce maternal and perinatal mortality and maternal morbidity (Carroli et al., 2000; Das, 2017). Studies have shown that ANC alone can reduce maternal mortality by 20%, given the early and regular attendance of ANC visits (Prual et al., 2000; Testa et al., 2002). Coverage of ANC and skilled birth attendance are among the key indicators to track progress of the United Nations' Sustainable Development Goals (SDGs) (United Nations, 2016; Raynes-Greenow, 2017; Benova et al., 2018).

In 2016, the WHO released the new ANC guidelines for routine ANC visits to supplement the existing guidelines on the management of pregnancy-related complications. The new guidelines of the WHO recommend to increase the number of ANC contacts from previously suggested only four focus ANC visits to eight visits in order to improve quality of antenatal care, reduce the risk of stillbirths and pregnancy complications, and provide women a positive pregnancy experience (WHO, 2016). It also emphasizes that all pregnant mothers should start ANC visit within the first trimester of pregnancy (i.e., gestational age of <12 weeks), two contacts in the second trimester, and five contacts in the third trimester and so on (WHO, 2016). The new guidelines also highlighted on the quality and contents of care that a pregnant woman should receive at each of the contacts with the health provider. According to WHO, the standard quality of ANC should comprised of three components: (i) assessment, that is history taking, physical examination and laboratory tests, (ii) health promotion, that includes advice on nutrition, planning the birth, information regarding pregnancy, subsequent contraception and breastfeeding, and (iii) care provision that is comprised of tetanus toxoid immunization, psychosocial support and recordkeeping (WHO, 2009).

Although at least eight ANC visits are necessary during pregnancy, the timing of the first ANC visit is equally important for safe motherhood. Timely initiation of ANC is crucial for early detection of pregnancy related problems and adverse pregnancy outcomes like low birth weight, still birth, newborn death, intra uterine fetal death and other complications (Abou-Zahr and Wardlaw, 2003; WHO, 2016). Timing of first ANC visit has been observed to predict the compliance of full coverage of WHO recommended contents of care (Lawn et al., 2016). A recent study in Pakistan reported that the timing of first ANC visit is a significant predictor of receiving full range of WHO recommended contents of care (Agah et al., 2016). The study observed that women whose first ANC visit occurred within the first trimester of pregnancy received the full range of WHO-recommended components of ANC services, while the women whose first ANC visits occurred late during pregnancy were less likely to receive the full range of services.

Though, the estimated global coverage of early ANC visits increased from 41% in 1990 to 57% in 2013, the coverage is still far from universal (Moller et al., 2017). There are high variations in the coverage of early initiation of ANC visits across the world. The overall coverage was found to be 48% in developing countries in 2013 compared with 85% in developed countries (Moller et al., 2017). Various factors have been attributed to late or no initiation of ANC visits, including age of the mother, parity, planned pregnancy, media access, knowledge about the time of ANC visit and so on (WHO, 2003; Pell et al., 2013; Kondale et al., 2015; Paudel et al., 2017 and Ebonwu et al., 2018).

To make the ANC visits an effective preventive measure, the contents and the quality of ANC also need to be monitored. Although there may be variations in the national strategies about the contents of ANC, WHO recommends a core set of services which include blood pressure measurement, blood test, tetanus toxoid vaccination, urine testing, fetal measurements including use of ultrasound, iron tablet supplementation, body weight measurement and counseling about danger signs and healthy diet. Yet, in most of the developing countries, a large proportion of women do not receive the minimum recommended number of visits (WHO, 2015), and the compliance to minimum level of recommended contents for ANC appeared to be unmet due to various factors (Chowdhury et al., 2003; Mathole et al., 2004).

The Sultanate of Oman has developed a well-organized health care system assuring universal free access to health care services. The country has made impressive gains in the achievement of key millennium development goals (MDGs) (Al-Lamki, 2010), and almost all health indicators show tremendous improvement which has been recognized and acclaimed by various international organizations, including the World Health Organization (WHO, 2000). For example, the infant mortality rate, which was around 211 deaths per 1,000 live births in 1950, declined to about 8 deaths per 1,000 live births in 2019 (Islam, 2020). Maternal mortality rate is also very low in Oman, which has decline from 22 deaths per 100, 000 live births in 1995 to 10.3 deaths per

100,000 live births in 2018 (Ministry of Health [MoH], 2019). However, there is dearth of information about prevalence and factors associated with the timely initiation of ANC, overall coverage of ANC visits and the contents of ANC visits in Oman. Since a woman's overall reproductive health is determined collectively by the complete compliance with the WHO recommendations about ANC, it is important to analyze the levels and determinants of early initiation of ANC Visit, overall ANC coverage and its contents with a view to assess the quality of ANC services, so that the government and other stakeholders can take proper action to improve the maternal health and pregnancy outcomes. Thus, the objective of this study is to investigate the timing, frequency and contents of ANC visits in Oman and assess the extent of compliance with WHO recommendations. Attempt has also been made to determine the factors influencing the utilization of ANC visits and the contents of ANC visits in Oman.

METHODS AND MATERIALS

The study design and the participants

The data for this study was obtained from the 2008 Oman National Reproductive Health Survey (ONRHS), which was a cross-sectional community based national household survey. The survey was tagged on to the 2008 Oman World Health Survey (OWHS) designed by the World Health Organization (WHO) as part of comprehensive standardized data collection on population health in different countries. Both the ONRHS and OWHS were implemented by the Ministry of Health of Oman. The total population of Oman was estimated to be about 4.5 million in 2018 of which about 60% are native Omani and the rest 40% are expatriate non-Omani nationals (National Center for Statistics and Information [NCSI], 2019). This study considered only the Omani nationals.

A multistage stratified cluster sampling design was followed to select the sample respondents. Stratification was made based on two factors: level of urbanization (urban/rural) and geographical distribution. Administratively, Oman was divided into 10 regions at the time of survey. The survey covered all the 10 regions of Oman, dividing into 10 urban and 10 rural strata. The sample was calculated to provide national estimates including estimates for both rural and urban areas and the 10 administrative regions, ensuring adequate precision of the estimates and power of testing hypothesis. Based on the above consideration, a nationally representative sample of 5,464 households were targeted in the survey of which 3,703 were for Omani Nationals. The details of ONRHS may be seen in Al-Riyami et al. (2012). Ultimately 4,560 women of reproductive age of 15-49 years were successfully interviewed of which 3,944 were Omani nationals.

In this study, we have considered the information from 2,220 ever-married women of age 15-49 who had a live birth that occurred in the five years period prior to the survey date. The inclusions of most recent birth help reduce the recall bias. The information was collected about the person and institution providing ANC (if any), the number of ANC visits, the timing of initiation of first ANC visit and the components of ANC services they have received along with the socio-economic and demographic characteristics of mothers. It is worth mentioning here that the 2008 ONRHS is the latest publicly available and accessible national level survey in Oman.

Study variables

This study considered three outcome variables, namely, 1) the timing of first ANC visit, 2) the total number of ANC visit, and 3) the number of component of care received during ANC visit. In ONRHS, the information on timing of first ANC visit was collected according to the month of gestation, which we categorized as: early initiation (i.e., within 3 months or first trimester of gestation) and delayed initiation (i.e., beyond 3 months of gestation). The total number of ANC visits was categorized as <8 visits and 8 or more visits. Our third outcome variable relates to receiving the recommended essential components of ANC services during their visits to health personnel. In the 2008 ONRHS, data were available for five recommended components or items of ANC services. These included measurement of blood pressure, testing of urine sample, testing of blood samples, having ultrasound, and counseling about danger sign of pregnancy complications. Information on these five items was collected by asking mothers whether they received them or not. The number of components received by the mothers was categorized as <5 and exactly 5 components. The study considered those socio-economic and demographic characteristics of mothers that have relevance with uptake of ANC services as explanatory variables.

Statistical analysis

Data was analyzed using both descriptive and inferential statistical techniques. Frequency distribution was used to describe the characteristics of the sample respondents (mothers) across the selected explanatory variables. To examine the association between response variables and the selected explanatory variables, simple summary statistic of the outcome variables, such as percentage, for each category of the selected explanatory variables were obtained. The statistical significance of the association was tested by a χ^2 (chi-square) test, because all of our outcome and explanatory variables are categorical variables. A p-value <0.05 was considered statistically significant. Further, multivariate statistical analyses using generalized linear model (GLM) approach were carried out to ascertain the determinants of early initiation of ANC visit, more than 8 ANC visits and all the 5 components of ANC visits. Since all the response variables are binary variables, we have used multiple logistic regression analysis. The statistical software SPSS 25 was used for all statistical analysis.

RESULTS

Characteristics of mothers

Table 1 presents the distribution of mothers according to their background characteristics. As can be seen from the Table 1, more than sixty percent (67%) of the mothers were in their prime reproductive age between 17 to 34 years. The age of our sample respondents ranged between 17 years and 49 years with the median age of 31.0 years. Majority (72%) of mothers were living in the urban area while the remaining 28% were living in the rural area. Among the regions of residence, the selected sample of mothers varies from 6.1% in Dhahira region to 20.2% from North Al-Batinah. About 40% of the mothers occurred from two regions, viz Muscat (19.5%) and North Al-Batinah (20.2%). About 15% of the mothers had no formal education, 26.1% had primary education and the rest 58.6% had secondary and higher level of education. Most of the mothers (85%) were multiparous. More than half (53%) of the mothers were member of joint family and nearly 70% of the mothers were non-users of family planning methods. Most of the women (71%) belong to household with middle to rich economic status. Most of the mothers (71%) visited doctors for ANC visits and 73% received 8 or more ANC visits.

Level of Utilization of ANC Services

Figure 1 shows the distribution of mothers according to the pattern of utilization of ANC services in Oman. The analysis shows that 98% of the mothers who had a birth within five years of survey date received at least one ANC visits, while 96% received at least four ANC visits and 73% of the mothers had WHO recommended at least eight ANC visits. On average mothers received more than nine visits (9.38 visits) (95% confidence interval: 9.25 – 9.52). Most of the mothers (71%) received ANC from qualified doctor and 29% from nurses or other medically trained providers. Three-fourths of the mothers (74.5%) initiated the first ANC visit within the first trimester. Among the five components of ANC services considered in the survey, about 71% of the mothers received all the selected five components and 28% received four components during ANC visits.

Figure 2 presents the percentage of mothers receiving recommended components or items of ANC services in Oman. As mentioned earlier, the 2008 ONRHS collected data on the following five essential components of ANC services: measurement of blood pressure, testing of urine sample, testing of blood samples, and counseling about danger sign of pregnancy complications. Our analysis revealed that, 71% of mothers received all the five selected components of ANC services. Considering the individual components, except counseling about danger sign of pregnancy complications, all other components of ANC services almost universally (99%) received by the mothers. Thus counseling about danger sign of pregnancy complications was the least received component of ANC services, which was reported to be received by 71% mothers.

Differentials of Frequency of ANC visits: Bivariate Analysis

Table 1 presents the results of the bivariate analysis of the initiation of ANC visit, frequency of ANC visits, and the number of ANC components received, across a set of selected socio-economic and demographic characteristics. The results revealed that maternal age at birth of child, parity of mothers, administrative region, education of mothers, economic status, contraceptive use status, and frequency of ANC visits have significant differential effects on initiation of ANC visits. On the other hands frequency of ANC visits showed significant association with maternal age at birth of child, parity of mothers, education of mothers, administrative region, economic status, ANC provider and initiation of ANC visits, while number of selected ANC components received by mothers showed significant association with parity of mothers, education of mother, administrative region, contraceptive use, economic status, type of family and initiation status of ANC visits.

It was found that older women of age 40 and above were worse in early initiation of ANC as well as receiving recommended 8 or more ANC visit. For example, 71% of mothers of aged 45 – 49 initiated ANC early, compared with 82% of mother aged less than 25 years. Similarly, multi-parity mothers were observed to be less likely to initiate ANC early, receiving 8 or more ANC visits, and receiving all the selected five ANC components than mothers with primi-gravida. Mothers' educational levels showed significant positive association with all three outcome variables. While mothers' economic status showed positive association with early initiation of ANC and receiving 8 or more ANC visits, it showed negative association with receiving all the selected five ANC components. Contraceptive users were found to be more likely to initiate ANC visit early but less likely to receive all the ANC components. Mothers from joint family were more likely to receive all the five ANC components than that of mothers from nuclear family. Early initiation of ANC visits showed significant positive association with receiving 8 or more ANC visits and receiving all the components of ANC services. However, all these above mentioned significant association, obtained through bivariate analysis, are unadjusted, as the effect of a factor on outcome variable was measured without controlling the effects of other factors. Thus to identify the adjusted effect of a factor on the outcome variables, we employed multiple regression analysis in the subsequent sections.

Determinants of timing, frequency and components of ANC visits: Logistic regression analysis

Table 2 shows the results of logistic regression analysis of initiation of ANC visits (model I I), frequency of ANC visit (model II) and number of ANC components received (model

Table 1. Percentage distribution of mothers according to background characteristics, and percentage of mothers with early or delayed initiation of first ANC visit, with at least eight ANC visits or less than 8 visits, and having exactly five or less than five ANC components, according to their background characteristics.

Characteristics	Numbers (%)	Initiation of ANC visit			Frequency of ANC visits			No. of ANC components		
		Early	Delayed	*p*-value‡	<8	≥8	*p*-value‡	<5	5	*p*-value‡
Age										
<25	275 (12.4)	82.2	17.8	<0.001	25.8	74.2	0.005	24.0	76.0	0.267
25-29	636 (28.7)	80.2	19.8		22.3	77.7		28.3	71.7	
30-34	576 (26.0)	69.6	30.4		31.6	68.4		30.3	69.7	
35-39	432 (19.5)	69.7	30.3		28.7	71.3		29.9	70.1	
40-44	214 (9.7)	72.0	28.0		27.6	72.4		29.4	70.6	
45-49	86 (3.9)	71.3	28.7		34.9	65.1		29.3	70.7	
Mean (SD)	31.69(6.39)									
Parity										
Primi	340 (15.3)	85.3	14.7	<0.001	22.9	77.1	0.043	23.2	76.8	0.015
Multi	1880 (84.7)	72.6	27.4		28.2	71.8		29.7	70.3	
Women education										
No education	340 (15.3)	68.2	31.8	<0.001	30.0	70.0	0.038	34.6	65.4	0.008
Primary	580 (26.1)	70.3	29.7		29.8	70.2		31.0	69.0	
Secondary	976 (44.0)	78.1	21.9		26.1	73.9		29.8	70.2	
Higher	324 (14.6)	78.0	22.0		24.1	75.9		25.4	74.6	
Region										
Muscat	432 (19.5)	78.7	21.3	<0.001	24.1	75.9	<0.001	34.7	65.3	<0.001
Dofar	229 (10.3)	60.7	39.3		36.0	64.0		23.2	76.8	
Dhakliya	335 (15.1)	79.8	20.2		15.2	84.8		23.9	76.1	
North Sharkiya	166 (7.5)	86.1	13.9		6.6	93.4		37.6	62.4	
South Sharkiya	196 (8.8)	73.0	27.0		29.1	70.9		19.9	80.1	
North Al-Batinah	448 (20.2)	75.3	24.7		33.5	66.5		21.4	78.6	
South Al-Batinah	279 (12.6)	66.3	33.7		33.0	67.0		39.8	60.2	
Dhahira	134 (6.1)	74.1	25.9		44.8	55.2		34.1	65.9	
Residence										
Urban	1595 (71.9)	75.3	24.7	<0.189	26.9	73.1	0.452	28.3	71.7	0.428
Rural	625 (28.1)	72.6	27.4		28.5	71.5		30.0	70.0	
Contraceptive use										
Yes	673 (30.3)	77.6	22.4	0.032	26.4	73.6	0.513	32.0	68.0	0.024
No	1547(69.7)	73.2	26.8		27.8	72.2		27.3	72.7	
Economic Status										
Poor	636 (28.6)	68.8	31.2	<0.001	30.1	69.9	0.019	23.9	76.1	<0.001
Middle	991 (44.7)	76.6	23.4		28.2	71.8		28.0	72.0	
Rich	593 (26.7)	77.2	22.8		23.1	76.9		35.1	64.9	
Type of family										
Nuclear	1043 (47.0)	73.8	26.2	0.453	26.8	73.2	0.513	33.8	66.2	<0.001
Joint	1177 (53.0)	75.2	24.8		27.9	72.1		24.3	75.7	
Marital Status										
Married	2183 (98.3)	74.6	25.4	0.547	27.3	72.7	0.744	28.8	71.2	0.817
Divorced/Widowed	37 (1.7)	70.3	29.7		29.7	70.3		27.0	73.0	
ANC service provider										
Doctor	1579 (71.1)	75.4	24.6	0.16	26.2	73.8	0.046	28.5	71.5	0.757
Nurse/others	641 (28.9)	72.5	27.5		30.3	69.7		29.2	70.8	
No. of ANC visit										
<8	608 (27.4)	55.9	44.1	<0.001	-	-		28.3	71.7	0.435
≥8	1612 (72.6)	81.6	18.4		-	-		29.9	70.1	
Initiation of ANC										
Early	1655 (75.4)	-	-	<0.001	20.5	79.5	<0.001	26.0	74.0	0.007
Late	565 (25.5)	-	-		47.4	52.6		32.4	67.6	
Total	2220 (100.0)	74.5	25.5		27.4	72.6		28.7	71.3	

‡ *p*-values are based on chi-square test.

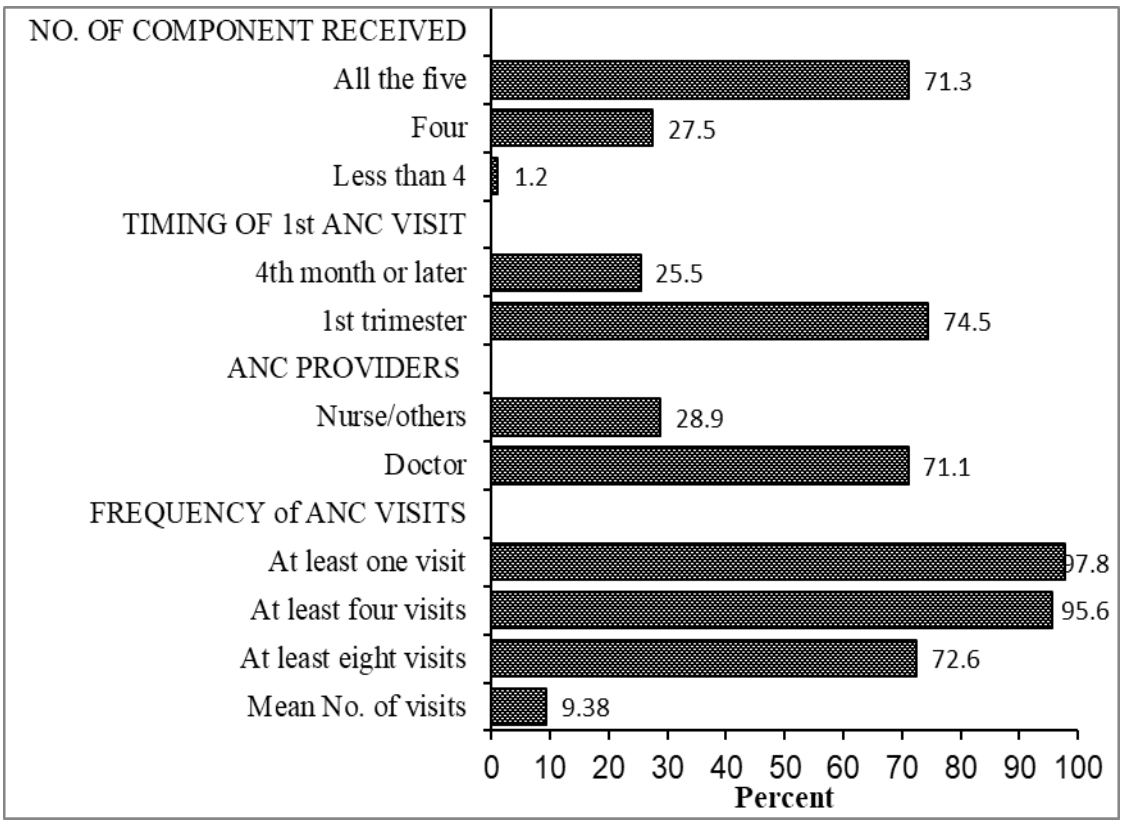

Figure 1: Percentage of mothers according to the timing of initiation of ANC visit, frequency of ANC) visits, ANC providers and the number of components of ANC services received, Oman 2008.

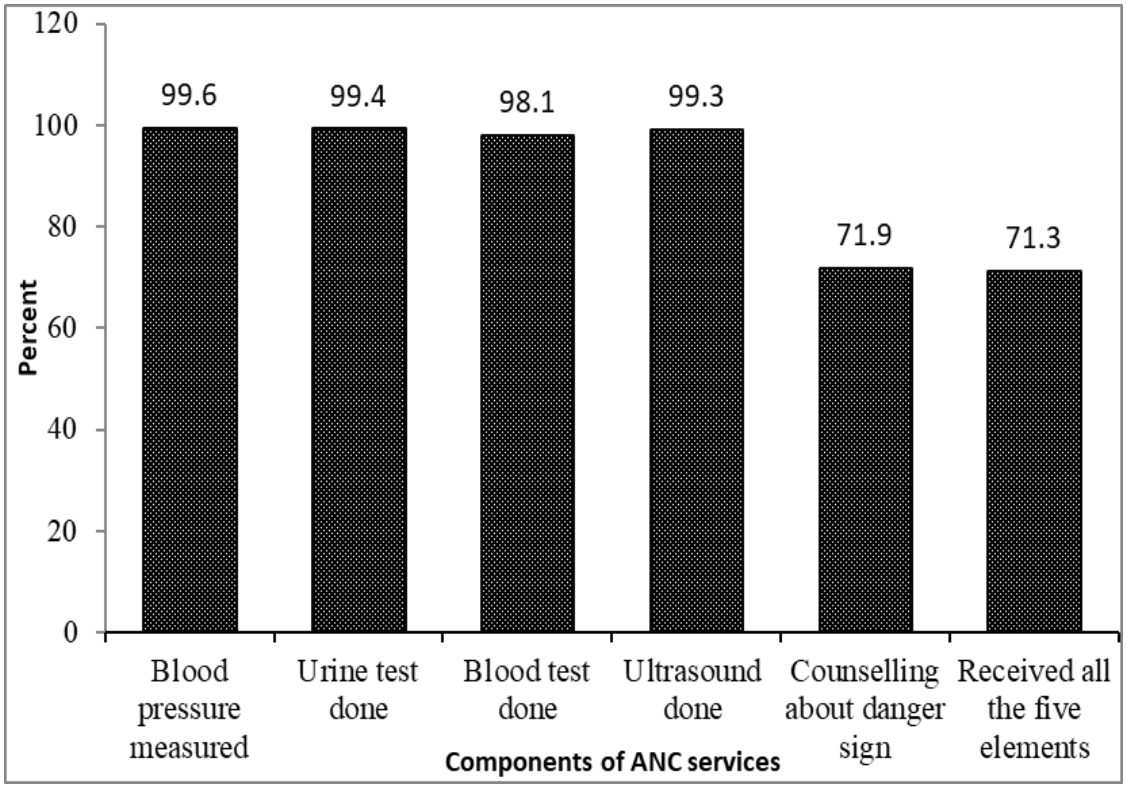

Figure 2: Percentage of mothers who received selected components of ANC services during the last pregnancy, Oman 2008.

Table 2. Logistic regression analysis of delayed initiation of first ANC visit, less than eight ANC visits and having all the five ANC components

Characteristics	Delayed initiation of ANC visit (Model I)			ANC visit <8 (Model II)			Having all the five ANC components (Model III)		
	OR	**95% CI**	***p*-Value**	**OR**	**95% CI**	***p*-value**	**OR**	**95% CI**	***p*-value**
Age									
<25	1.16	0.598 - 2.250	0.661	1.48	1.028 - 1.941	0.046			
25-29	1.13	0.633 - 2.015	0.680	1.00	-	-			
30-34	1.81	1.087 - 3.003	0.046	1.55	1.179 - 2.046	0.002			
35-39	1.74	1.008 - 2.814	0.041	1.29	0.941 - 1.772	0.113			
40-44	1.29	0.714 - 2.326	0.401	1.14	0.759 - 1.710	0.530			
45-49	1.00	-	-	1.33	0.771 - 2.284	0.307			
Parity									
Primi	1.00	-	-	1.00	-	-			
Multi	1.72	1.137 – 2.465	0.009	1.39	1.089 - 1.666	0.038			
Women education									
No education	1.53	1.012 - 2.294	0.041	1.32	1.034 - 2.817	0.039	0.79	0.432 - 0.916	0.037
Primary	1.21	0.827 - 1.765	0.328	1.11	0.774 - 1.602	0.563	0.93	0.660 - 1.306	0.670
Secondary	1.02	0.756 - 1.305	0.658	0.96	0.695 - 1.328	0.807	0.98	0.885 - 1.616	0.244
Higher	1.00	-	-	1.00	-	-	1.00	-	-
Region									
Muscat	1.87	1.030 - 3.389	0.040	6.99	3.434 - 14.230	<0.001	1.36	0.848 - 2.171	0.203
Dofar	4.04	2.194 - 7.443	<0.001	11.05	5.363 - 22.751	<0.001	1.88	1.113 - 3.179	0.018
Dhakliya	1.72	1.009 - 3.145	0.046	3.32	1.599 - 6.906	0.001	1.98	1.225 - 3.221	0.005
North Sharkiya	1.00	-	-	1.00	-	-	1.00	-	-
South Sharkiya	2.18	1.160 - 4.103	0.016	7.56	3.624 - 15.799	<0.001	2.46	1.425 - 4.241	0.001
North Al-Batinah	1.54	0.917 - 2.607	0.102	7.44	3.882 - 14.261	<0.001	2.24	1.477 - 3.393	<0.001
South Al-Batinah	2.54	1.489 - 4.359	0.001	7.54	3.876 - 14.698	<0.001	0.88	0.578 - 1.343	0.556
Dhahira	1.87	0.962 - 3.648	0.065	16.09	7.671 - 33.770	<0.001	1.27	0.742 - 2.195	0.379
Contraceptive use									
Yes	1.00	-	-	-	-	-	1.23	0.998 - 1.516	0.043
No	1.29	1.020 - 1.623	0.032	1.18	0.951 - 1.467	0.132	1.00		
Economic Status									
Poor	1.13	0.826 - 1.537	0.453	1.27	0.938 - 1.719	0.123	1.47	1.096- 2.018	0.010
Middle	0.86	0.645 - 1.133	0.277	1.20	0.918 - 1.576	0.180	1.27	0.990 - 1.634	0.060
Rich	1.00	-	-	1.00	-	-	1.00	-	-
ANC service provider									
Doctor	1.00	-	-	1.00	-	-			
Nurse/Others	1.48	1.015 - 1.916	0.036	1.43	1.051 - 1.940	0.023			
Number of ANC visit									
<8	3.13	2.528 - 3.882	<0.001	-	-	-			
≥8	1.00								
Initiation of ANC									
Early	-	-	-	1.00	-	-	1.34	1.006 - 2.102	0.038
Late	-	-	-	3.13	2.528 – 3.881	<0.001	1.00	-	-

Note: OR= Odds ratio, CI= Confidence interval, Odds ratio of reference category is 1.00

III). Model I represents the predictors of late initiation of ANC, model II presents the predictors of less than 8 ANC visits and model III provides predictors of all the five selected ANC components. According to the results of model I, mothers' age, parity, education region of residence, contraceptive use status, ANC provider and frequency of ANC visits appeared as significant predictors of delayed initiation of ANC visit. All these factors, except contraceptive use status appeared as significant predictors of receiving less than 8 ANC visits. In addition, the timing of ANC also identified as a significant predictor of frequency of ANC visits. The results of model III indicates mothers' education, region residence, economic status, contraceptive use and initiation of ANC visits as the significant predictors of receiving all the five selected ANC components (Table 2).

It was found that mothers of age range between 30 to 34 and 35 to 39 had 1.8 (OR=1.81; 95%CI:1.087 - 3.003) and 1.7 (OR=1.74; 95%CI:1.008 - 2.814) times, respectively, higher odds of late initiation of ANC visit compared to the older mothers of age 40-45 years. On the other hands, young mothers of age less than 25 years and age 30 - 34 years had about 1.5 times higher odds of receiving lesser

number of ANC visits. Multi-parity mothers had significantly higher odds of both delayed initiation of ANC visits and less than 8 ANC visits. Mothers with no education had 1.5 times higher odds of delayed initiation of ANC visit (OR=1.53; 95%CI: 1.012 – 2.294), 1.3 times higher odds of less than 8 ANC visits (OR=1.32; 95% CI: 1.034 – 2.817) and 20% less likely to receive all the selected five ANC components (OR=0.797; 95%CI:0.432 – 0.916) when compared to the mothers with higher education. Region of residence appeared as the most influential predictor of initiation, frequency of ANC visits and receiving all the five ANC components. Mothers from Dofar region were found to have 4 times higher odds of delayed initiation of ANC visits (OR=4.04; 95%CI:2.194 – 7.443), 11 times higher risk of less ANC visits (OR=11.05; 95% CI:5.363 – 22.751), but 1.9 times higher odds of receiving all the five ANC components (OR=1.88; 95% CI:1.113 – 3.179), when compared to mothers from North Sharkiya region. On the other hands, mothers from Dhahira region had as high as 16 times higher odds of receiving less than 8 ANC visits (OR=16.09; 95%CI:7.671 – 33.770). Mothers with no contraceptive use were found to be 1.3 times more likely to have delayed intuition of ANC visits (OR=1.29; 95%CI:1.020 – 1.623). Mothers who received ANC services other than doctor were found to have higher odds of both delayed ANC and less than 8 ANC visits. Late initiation of ANC visit also appeared as a significant predictor of less than 8 ANC visits. For example, mothers with late initiation of ANC visits had 3 times higher odds of receiving less than 8 ANC visits (OR=3.13; 95% CI:2.528 – 3.881). Mothers with poor economic status were found to be 1.5 times more likely to receive all the five ANC components when compared to mothers with rich economic status (OR=1.47; 95% CI:1.097 – 2.018). Early initiation of ANC visits also appeared as a significant predictor of receiving all the five ANC components (OR=1.34, 95%CI: 1.006 – 2.102).

DISCUSSION

The findings of this study demonstrate that Oman has almost universal coverage of at least one ANC visits. Receiving the most of the prescribed components of ANC services are also almost universal in Oman, except the counseling about danger sign or pregnancy complications. Regarding early initiation of ANC visit, about three-fourth of the mothers initiated ANC within first-trimester as. The estimated coverage of early ANC visits in Oman is higher than the contemporary global coverage, but lower than developed regions or high income countries (Moller et al., 2017). Early initiation of ANC appeared as a significant predictor of frequency of ANC visits and receiving all the components of ANC visits. This study identified some socio-economic, demographic and program factors that were related to utilization of ANC services in Oman. Mothers age, parity, education, region of residence, economic status, provider of ANC, contraceptive use status, and timing of initiation of ANC visits were the significant predictors of optimal use of ANC services.

Our findings highlight that Oman has made substantial progress with regards to the prescribed ANC model considering that the data used in this study pertain to time before the release of the new WHO recommended module. Based on data from health centers and hospitals, the recent annual health report of the Ministry of Health (MoH) demonstrated increasing rate of initiation of ANC within first trimester, but declining trends of mean number of ANC visit as well as at least four ANC visits in Oman (MoH, 2019). According to the 2019 annual health report of MoH, the coverage of initiation of ANC visit within 1st trimester has increased from 65% in 2005 to 77% in 2018. On the other hands, during the same time period, the mean number of ANC visits declined from 8.6 visits in 2005 to 6.0 visits in 2018. The proportion of at least four ANC visits also declined from 86% in 2005 to 76% in 2018. Reasons for declining trends of frequency of ANC visits in Oman still unknown and it need further investigation.

The analysis indicate good compliance of the WHO recommended at least eight ANC in Oman, as 73% of the mothers in Oman met the new recommended at least eight ANC visits. Oman could achieve universal coverage of ANC components if every woman receives counseling about danger sign during their ANC visits. In Oman, the lower coverage of receiving counseling about danger sign might have some relation with the utilization of ANC providers, such as those who visited nurse or auxiliary nurse for ANC services might be less likely to receive counseling about danger sign. Our analysis indicates that about 29% mothers visited nurse or auxiliary nurse for ANC services. However, our both bivariate and multivariate analyses do not support the above contention, because ANC provider appears as an insignificant predictor of utilization of ANC components. It then might be the fact that the health professionals in Oman may be less serious about counseling of danger sign during pregnancy. The matter needs further investigation to find out the reasons for lower coverage of counseling about danger sign in Oman.

There remains inequality in ANC utilization across socio-economic and demographic characteristics of mothers. Our analysis revealed that mother's levels of educational attainment have significant positive association with the early initiation of ANC visits, adequate number of ANC visits and the receipt of all the components of ANC services in Oman. The strong association between maternal education and optimal use of ANC services found in this study is consistent with the findings from other countries (Islam and Masud, 2018; Victora et al., 2010; Tran et al., 2012; Agha and Tappis, 2016; Houweling et al., 2007). Mothers' education foster new values and attitudes, greater knowledge about health and health care needs which favor them in optimal utilization of maternal health care (Sharma et al. 2007; Furuta and Salway, 2006; Nwaru et al., 2012; Amin et al., 2010).

We found significant variations in utilization of ANC services across the administrative region of Oman. Mothers from Dofar region were found to be more likely to have

delayed initiation of ANC visits, while mothers from Dhahira region were more likely to receive less than adequate number of ANC visits when compared with the mothers from North Sharkiya region. In the case of receiving all the components of ANC services, South Sharkiya region showed the better performance when compared to North Sharkiya region. It is worth mentioning here that although the Muscat region being the capital of Oman and might have better facility of good quality ANC services, still it was found lagging behind of many other regions of Oman. The observed regional variations in utilization of ANC services may be due to variations in health seeking behavior, availability, accessibility and quality of services. Further study is needed to identify the factors responsible for belter performance in Sharkiya region and relatively lower performance in Muscat region.

Mothers who initiated ANC early (i.e. within 1st trimester) were found to be more likely to receive the recommended adequate number of eight ANC contacts and all the components of ANC services. Early initiation of ANC provides sufficient time to get access to the sufficient number of ANC contacts and more opportunities for early intervention, and this has been previously observed in many studies (Agah et al., 2016; Saad-Haddad et al., 2016; Lawn et al., 2016; Moller et al., 2017; Benova et al., 2018).

This study also documents ANC service providers as significant predictors of both initiation and frequency of ANC visits. Mothers who visited doctors for their ANC services were found to be more likely to initiate ANC early and receive adequate number of ANC visits when compared with mothers who visited nurse or auxiliary nurse. Our findings of the positive impact of the program factors (type of provider) on initiation or frequency of ANC visits are consistent with the finding of many recent studies (Rani et al., 2008; Kyei et al., 2012; Joshi et al., 2014; Islam and Masud, 2018).

Age of mothers at the time of births of their child also found as a significant predictor of initiation of ANC visits and frequency of ANC visits. Mothers aged within thirties (30-39 years) were found to be more likely to initiate ANC late than the mothers of extreme age categories. On the other hands, young mothers of age less than 35 years were observed to be more likely to receive less than eight ANC visits. Previous studies documented mixed results about the association of age of the mother with timing and frequency of ANC visits. A previous study in South Ethiopia indicated that late attendance at ANC visits and utilization of less than 4 ANC visits were associated with younger age group of mothers (Gebremeskel et al., 2015). Our finding is similar to the finding of Yaya et al. (2017) in Ethiopia.

Mothers' parity was found to be a significant predictor of utilization of ANC services. Multi-parity mothers were found to be more likely to initiate ANC late and receive less than eight ANC visit than the mothers with primi-gravida. Our finding is in agreement with the findings of many other studies (Joshi et al., 2014; Agha and Tappis, 2016; Islam and Masud, 2018). Early initiation and more ANC visits for the first pregnancy (primi-gravida) might be related to factors such as unknown fear, complications or excitement over a first baby (Bloom et al., 1999). Unlike other study findings, mother's economic status showed no significant association with initiation of ANC visit and frequency of ANC visits, but mothers with poor economic status were found to be more likely to have all ANC components during ANC visits.

This study has many strengths and limitations. One of the strengths of the study is that it is based on a nationally representative sample, and thus the findings are generalizable to the national as well as subnational levels. Besides, the study is the first of its kind in Oman to evaluate the level of utilization of ANC services in compliance with the WHO recommended ANC guidelines. The study findings may have important policy implications for further improvement of ANC services in Oman, particularly in designing maternal health care program and policies to ensure universal coverage of early initiation (within first trimester) of ANC visits, at least eight ANC visits during pregnancy and achieving full coverage of ANC components. The study has potential to contribute in the literature. Nonetheless, the study is not free from limitations. The data used in the study is cross sectional in nature which was obtained through retrospective interview of a selected group of women who had a live birth within five years of the survey. The retrospective nature of the data may have introduced recall biases and restricts the interpretation of causality. Further, due to data limitation, this study could not address the confounding effects of other potential factors that may act as a barrier for achieving recommended level of ANC services. Some of these potential factors include knowledge and attitudes towards modern health care services, availability and accessibility of health facilities, equity in health service delivery, gestational age or maturity of births.

Conclusions

This study documents substantial progress in utilization of ANC services in Oman in terms of at least one ANC visit, early (within 1st trimester) initiation of ANC visit and receiving the core components of ANC services. Despite the progress made, this study findings highlight that Oman is still lagging behind achieving universal coverage of recommended ANC guidelines. Since early initiation of ANC visit is a strong predictor of recommended at least eight ANC visits and getting all the core components of ANC services, maternal health care program should give more attention to achieve universal coverage of early initiation of ANC visit. More attention should be given to ensure that every pregnant woman receive counseling about danger sign or pregnancy complications during the ANC visit in order to improve the pregnancy outcomes. Visiting skilled providers such as doctor for ANC services need to be emphasized. The findings of low performance in terms of early initiation, frequency and the receipt of all the core components of ANC services among mothers living in Dofar, Al-Batinah, Dhahirah and Sharkiya regions underscore the

requirement to develop policies specific to these regions. It is important to find out why these regions have lower prevalence of adequate care and develop specific solutions for these regions. Having adequate level of ANC visits and ANC contents may contribute to early detection and timely management of risk for adverse pregnancy outcome. For achieving complete compliance of WHO recommended guidelines for positive pregnancy outcomes in Oman, effective policies and programs need to be planned duly addressing the predictors of early initiation and frequency of ANC visits that have been identified in this study.

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Conflict of interest

The authors declare no conflict of interest.

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