Country compliance with WHO-recommended antenatal care guidelines: equity analysis of the 2015–2016 Demography and Health Survey in Myanmar

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ABSTRACT

Introduction Early access to adequate antenatal care (ANC) from skilled providers is crucial for detecting and preventing obstetric complications of pregnancy. We aimed to assess factors associated with the utilisation of the new WHO ANC guidelines including the recommended number, on time initiation and adequate components of ANC contacts in Myanmar.
Methods We examined data from 2943 mothers aged 15–49 years whose most recent birth occurred in the last 5 years prior to the 2015–2016 Myanmar Demographic and Health Survey. Factors associated with utilisation of the new WHO recommended ANC were explored using multinomial logistic regression and multivariate models. We used marginal standardisation methods to estimate the predicted probabilities of the factors significantly associated with the three measures of ANC.
Results Approximately 18% of mothers met the new WHO recommended number of eight ANC contacts. About 58% of the mothers received adequate ANC components, and 47% initiated ANC within the first trimester of pregnancy. The predicted model shows that Myanmar could achieve 70% coverage of adequate components of ANC if all women were living in urban areas. Similarly, if ANC was through private health facilities, 63% would achieve adequate components of ANC. Pregnant women from urban areas (adjusted risk ratio (aRR): 4.86, 95% CI 2.44 to 9.68) were more than four times more likely to have adequate ANC components compared with women from rural areas. Pregnant women in the highest wealth quintile were three times more likely to receive eight or more ANC contacts (aRR: 3.20, 95% CI 1.61 to 6.36) relative to mothers from the lowest wealth quintile. On time initiation of the first ANC contact was fourfold for mothers aged 30–39 years relative to adolescent mothers (aRR: 4.07, 95% CI 1.53 to 10.84).
Conclusion The 2016 WHO ANC target is not yet being met by the majority of women in Myanmar. Our results highlight the need to address health access inequity for women who are from lower socioeconomic groups, or are younger, and those living in rural areas.

Key questions

What is already known?
► Pregnant women in the lower socioeconomic strata are known to be at higher risk for not initiating adequate ANC early and not receiving at least four ANC visits.

What are the new findings?
► We demonstrate that Myanmar could achieve 63% coverage of adequate ANC components if the minimum ANC standards were available from the public health facilities at the same rate as those of private health facilities.
► Also, if women in rural areas had the same access to ANC as women in urban areas, the country would achieve 70% coverage for adequate components of ANC.

What do the new findings imply?
► Efforts to prioritise capacity, including infrastructure and resourcing in rural public health facilities, will improve ANC quality and equity for pregnant women from lower socioeconomic groups and those living in rural areas.

INTRODUCTION

Despite global efforts to expand the coverage of maternal and child healthcare services, most women in low-income and middle-income countries (LMICs) still experience a high-risk of death related to pregnancy and childbirth.[1] [2] Coverage of essential healthcare services such as adequate ANC and skilled birth attendance are among the key indicators to track progress of the Sustainable Development Goals (SDG).[3] [4] SDG-3 aims to reduce maternal mortality to less than 70 per 100 000 live births and neonatal mortality to less than 12 per 1000 live births by 2030.[5] Early access to adequate ANC services from skilled providers is crucial to

ensure the best care for women, including promoting awareness, detection and prevention of complications during pregnancy, labour and the postnatal period and to avoid stillbirths and newborn deaths.[6–8] Although in 2017 an estimated 62% of women globally received four ANC contacts with skilled health providers,[9] the quality of care provided, the skill level of the healthcare provider and early initiation of the first contact remains low and hinders improving health outcomes for women and her offspring.[10 11]

In 2010, a Cochrane systematic review of randomised trials in Thailand, Cuba, Saudi Arabia and Argentina found a borderline significant increase in perinatal mortality for women randomised to four ANC visits compared with eight model of care.[12 13] Based on the recommendation, in 2016, the WHO released the new ANC guidelines for routine ANC to complement the existing WHO guidelines released since 2000 on the management of pregnancy-related complications. The new WHO guidelines recommend eight standard ANC contacts, which previously was only four focus ANC visits.[14] As well as increasing the number of contacts, the new guideline aims to provide pregnant women with respectful, individualised, person-centred care at every ANC contact.[15] This is a major shift in focus that puts pregnant women at the centre of care. It also emphasises that the first ANC contact should be initiated during the first trimester at <12 weeks gestational age.[15] Furthermore, the guideline highlighted the importance of quality of care provided to pregnant women at each ANC contact.[16]

In 2015, Myanmar was among the Southeast Asian countries with the highest maternal mortality, estimated at 178 per 100 000 live births.[2] Postpartum haemorrhage (31%), eclampsia (11%) and abortion-related complications (10%) were the leading cause of maternal mortality in the country.[17] Improving the quality and accessibility of maternal and child healthcare services is a priority of the government of Myanmar, as outlined in the Myanmar National Health Plan 2017–2021.[18] Previous research investigating ANC in Myanmar has identified factors associated with utilisation and access to care during pregnancy,[19–21] birth and postbirth[22 23] and highlighted the need to improve the quality of maternal and newborn care services.[24] However, these studies did not investigate the new WHO recommended ANC guidelines. In 2018, the Myanmar Ministry of Health and Sports issued a national guideline for ANC based on the 2016 WHO guideline for delivery of ANC services.[25] The goal of the national guideline for ANC was to enable service providers at all levels of the health system to use evidence-based knowledge and skills to deliver quality ANC services. In line with the new WHO standard guidelines, this study aims to assess the factors associated with the recommended initiation, number of contacts and adequate components of ANC in order to inform policy and health services of their capacity and compliance with the WHO recommended standard ANC.

METHODS

We examined data from the 2015–2016 Myanmar Demographic and Health Survey (MDHS), which is a stratified national-level household survey conducted in seven states and eight regions of Myanmar.[26] The 2015–2016 MDHS is the first ever Demographic and Health Survey conducted by the Myanmar Ministry of Health and Sports and funded by the US Agency for International Development. A two-stage stratified sampling design was conducted for the selection of the sample in urban and rural areas and for each of the seven states and eight regions of Myanmar. The first stage involved selecting sample points (clusters) consisting of enumeration areas or ward/village tracts with a total of 442 clusters (123 urban and 319 rural). At the second stage, equal probability systematic sampling was used for selection of a fixed number of 30 households from each of the selected clusters. Detailed information of the 2015–2016 MDHS sampling design have been reported elsewhere.[26] The survey collected information on access and utilisation of ANC services based on the focused ANC model, which recommended four ANC contacts. During the survey, women were asked about their access to ANC during pregnancy, such as a number of contacts, initiation and the components of ANC they received. The relevant information on ANC services were obtained from 3176 (2943 weighted) women aged 15–49 years who had ANC contacts from skilled providers during pregnancy for their most recent birth in the 5 years prior to the survey. We included only the most recent birth because these births had the most detailed information on maternal and child healthcare services and are less subject to recall bias. We also excluded 460 (13%) of mothers who did not receive any ANC and 180 (5%) of those mothers who had ANC from unskilled providers.

Study variables

There are three study outcomes for this analysis that assess the new WHO standard ANC guidelines using the 2015–2016 MDHS dataset. The first study outcome was the recommended initiation of the first ANC contact expressed as the number of women with a live birth in the last 5 years prior to the survey who initiated their first ANC contact during the first trimester of pregnancy from skilled providers. We categorised ANC initiation as: (1) on-time initiation (defined as the number of pregnant women who initiated the first ANC contact during the first trimester ≤3 months); (2) late initiation (defined as those pregnant women who initiated their first ANC contact during the second trimester 4–6 months); and (3) very late initiation (defined as the number of pregnant women who initiated their first ANC contact during the third trimester 7–9 months); month is the unit of measurement in the Demographic and Health Survey. The second outcome was the new recommended number of ANC contacts defined as the number of women with a live birth in the 5 years prior to the survey who have had at least eight or more ANC contacts from skilled providers during pregnancy. We defined the number of ANC contacts as: (1) number of pregnant women who had 1–3 ANC contacts, (2) number of pregnant women with 4–7 ANC contacts and

(3) number of pregnant women with eight or more ANC contacts. The third outcome was adequacy of ANC. It is expressed as the number of women with a live birth in the last 5 years prior to the survey who received adequate components of ANC from skilled providers during pregnancy. In this analysis, we included only seven components of ANC. These components were available from the list of the indicators collected during 2015–2016 MDHS such as blood pressure measurement, urine analysis, blood analysis, tetanus vaccination, iron supplementation, intestinal parasite medication and counselling on potential complications of pregnancy. Women receiving ANC components were categorised into: (1) adequate ANC (classified as the number of women who received between six and seven ANC components); (2) inadequate ANC (classified as the number of women who received between four and five ANC components); and (3) severely inadequate ANC (classified as the number of women who received less than four ANC components).

Explanatory variables for this analysis were selected based on the literature[27–29] and included household characteristics; cluster type and location (representing the characteristics of a cluster); and the household wealth quintile (representing the economic status of the household). The maternal and partner factors (describing individual-level circumstances of a pregnant woman and of her partner) included maternal characteristics such as mother's current age, mother's education, mother's working status, and partner characteristics such as husband's working status, and education.[30 31] We also, included exposure to mass media, including radio, television, newspapers or magazines,[32] and birth rank, birth interval, place of ANC services, place of birth, mode of birth, type of birth assistance and postnatal care services.[33 34]

Statistical analysis

All analyses were carried out using STATA/MP V.12.[35] The 'Svy' survey commands were used to allow for adjustments for the cluster sampling design and sampling weights. The frequency tabulations were generated to describe the characteristics of study variables.[35] Since each of the outcome variables had more than two categories, we conducted univariable multinomial logistic regressions to determine the unadjusted risk ratios (aRRs) for the outcome variables. This was followed by conducting multivariable multinomial logistic regression analysis to examine risk ratios for factors associated with each of the outcomes. At the initial stage, we included all the predictor variables, with (p<0.2). This was followed by a manual backward procedure to eliminate non-significant variables but retaining those significant (p<0.05) factors. The final model included all the variables with p<0.05.

To estimate the predicted probabilities of the factors significantly associated with the outcomes, we used marginal standardisation methods describe by Muller and MacLehose.[36] According to this method, the estimated odds of outcome is proportionally adjusted according to a weight for each level of the covariates following confounder-adjusted logistic regression. The following formula was used to examine the marginal standardisation:

$$Pr(y = 1|Set[E = e]) = \sum_z \hat{p}_{ez} Pr(Z = z)$$

Whereas ($p^{\Lambda}ez$) is the predicted probabilities of the study outcome for any (E=e and Z=z) assuming that all respondents (target population) in the dataset had the single set values of the exposure level donated to Set[E=e] and with the same distribution of a given set of observed values for the covariate vector donated to (Z=z). Thus, the logistic regression coefficients were used to calculate predicted probabilities for every respondent at their observed covariate pattern and newly exposure value. The marginal probabilities obtained from this method indicate a weighted average over the distribution of the covariates, which are equivalent to estimates obtained by standardising to the total population. In this analysis, we used the STATA margins command to compute the predicted probability of the factors associated with on time initiation of first ANC contact, receiving the recommended number of eight or more ANC contacts and receiving adequate ANC components after performing a logistic regression model.

Ethical approval consent

Verbal informed consent was taken from each respondent before the interview. The Demographic Health Survey programme gave permission to access and use the data for this research.

Patient and public involvement statement

This study is based on the analysis of secondary data of the 2015–2016 MDHS, which is available in the public domain. The participants were not involved in the design or implementation of this analysis, and there are no plans to disseminate the results of the analysis to study participants due to the deidentified data.

RESULTS

We found 59% (95% CI 56.0% to 62.5%) of mothers met the previous WHO guidelines for the minimum recommended number of 4 or more ANC contacts, of those mothers 42% (95% CI 39.0% to 44.1%) had a minimum number of 4–7 ANC contacts and 18% (95% CI 15.6% to 20.2%) had received the new recommended number of eight or more ANC contacts. About 58% (95% CI 55.1% to 61.2%) of mothers had an adequate number of ANC components. ANC contact was initiated within the first trimester of pregnancy by 47% of women (95% CI 41.1% to 49.5%) (figure 1).

Almost three quarters (73%) of the study population lived in a rural area and 23% of the study population were in the lowest wealth quintiles. Three per cent of mothers were adolescents (<20 years). Public health facilities were the main ANC service providers, accounting for 71% of ANC. About half (53%) of all live births were in non-health facilities, and almost a quarter of all births (23%) were attended by unskilled providers (table 1).

Mothers aged 20–29 years (aRR: 2.85, 95% CI 1.07% to 7.58%), 30–39 years (aRR: 4.07, 95% CI 1.53% to 10.84%) and 40–49 years (aRR: 3.79, 95% CI 1.29% to 11.11%) were at least twofold more likely to initiate ANC during the first
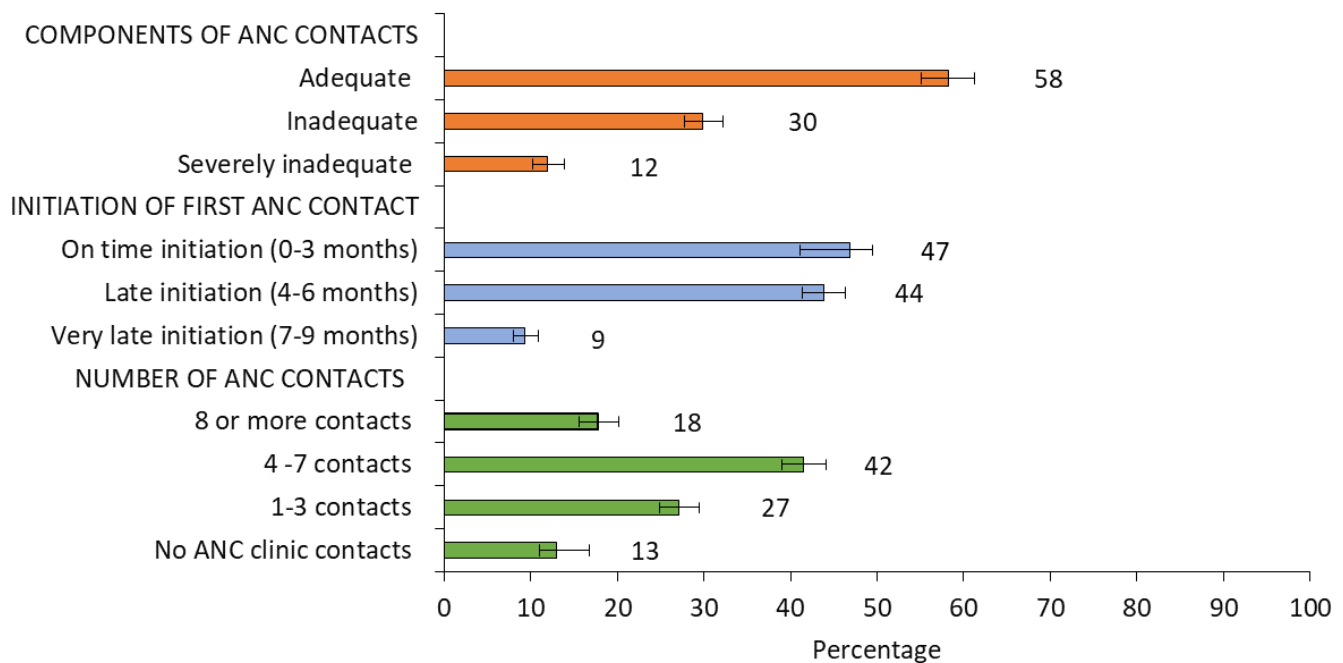
Figure 1 The recommended number, initiation and adequacy of ANC components and contacts (percentage and 95%CI), Myanmar Demographic and Health Survey, 2015–2016. ANC, adequate antenatal care.

trimester of pregnancy relative to adolescent mothers. Mothers assisted by skilled healthcare providers at birth were twofold more likely to have initiated ANC in the first trimester than mothers unassisted at birth or assisted by unskilled healthcare providers (aRR: 2.34, 95%CI 1.45% to 3.77%, table 2).

Urban women were more than fourfold more likely to receive an adequate number of ANC components compared with rural women (aRR: 4.86, 95%CI 2.44 to 9.68). Pregnant women attending private facilities for ANC (aRR: 2.24, 95%CI 1.24 to 4.42) and those attending public facilities for ANC (aRR: 2.37, 95%CI 1.54 to 3.65) were twice more likely to have adequate components of ANC compared with their counterparts who received ANC from home/other informal source (table 3).

Pregnant women in the highest wealth quintile were threefold more likely of having eight and more ANC contacts (aRR: 3.20, 95%CI 1.61 to 6.36) relative to mothers from the lowest wealth quintile. Mothers who gave birth in a health facility were twofold more likely to have received eight or more ANC contacts (aRR: 2.35, 95%CI 1.54 to 3.28) compared with those mothers who gave birth in non-health facility. Receiving eight or more ANC contacts was threefold more likely for women attending a private facility for ANC (aRR: 3.62, 95%CI 1.86 to 6.97), compared with home/other informal sources of ANC (table 4).

In the predictive model keeping the distribution of all covariates the same, except making urban residence universal, we would expect 70% of women to receive an adequate number of components of ANC during their pregnancy (online supplementary file 1). Alternatively, if all women received ANC from private healthcare facilities

keeping all other covariates unchanged, 63% would receive the adequate number of ANC components (online supplementary file 1). Similarly applying the same methods but all women were aged between 15 years and 19 years, we would expect that 30% of women would initiate the first ANC contact during the first trimester of pregnancy. Whereas if all women were 20–29 years, this would be increased to 46% of women initiating the first ANC contact during the first trimester of pregnancy (online supplementary file 2). The best model for the predictive margins for the recommended number of eight ANC contacts were as high as 27% for pregnant women receiving ANC from a private health facility (online supplementary file 3).

DISCUSSION

Our results demonstrate that Myanmar is similar to many other LMICs, with 59% of the pregnant women meeting the previous WHO minimum number of four or more ANC contacts, compared with the global LMIC proportion of 55%.[1 37] We found that about 18% of pregnant women in Myanmar met the new recommended number of eight or more ANC contacts. Less than half of women initiated ANC by 12 weeks gestational age as recommended by WHO.[14] Our estimate of the likelihood of pregnant women receiving the recommended number, adequacy and on time initiation of ANC contacts was significantly higher for urban residents, women aged between 20 years and 49 years and women from the wealthiest households. Our findings highlight that Myanmar has made slow progress over the period of the Millennium Development Goals era with regards to coverage of the new focus ANC model. This needs to be considered in the context of the civil unrest, internal conflicts and of course

Table 1 Baseline characteristics of the study participants analysis of Myanmar Demographic and Health Survey, 2015–2016 (n=2943)

	N	Weighted N (%)
Household factors		
Location of household		
Rural	2347	2158 (73.3)
Urban	829	784 (26.7)
Geographical zone		
Hilly zone	1099	553 (19.4)
Coastal zone	563	344 (12.0)
Delta zone	609	1002 (35.1)
Central plain zone	815	959 (33.5)
Household wealth status		
Lowest quintile	742	680 (23.1)
Second lowest quintile	680	613 (20.8)
Middle quintile	602	528 (18.0)
Fourth quintile	635	584 (19.8)
Highest quintile	517	539 (18.3)
Maternal/partner factors		
Mother's current age (years)		
Under 20	78	74 (2.5)
20–29	1339	1228 (41.7)
30–39	1385	1325 (45.0)
40 and over	374	315 (10.7)
Mother's education		
No education/primary	1747	1676 (56.9)
Secondary or higher	1429	1267 (43.1)
Mother's working status		
Not working	1136	1032 (35.2)
Agriculture-related work	444	369 (12.6)
Non-agriculture related work	1588	1533 (52.3)
Husband's working status		
Agriculture-related work	2491	1758 (60.3)
Non-agriculture related work	1340	1157 (39.7)
Husband's education		
No education/primary	1560	1485 (51.3)
Secondary or higher	1551	1409 (48.7)
Exposure to mass media		
Reading newspaper or magazine		
No	1955	1792 (60.9)
Yes	1221	1150 (39.1)
Listening to radio		
No	1910	1740 (59.1)
Yes	1266	1202 (40.9)
Watching television		
No	1132	762 (25.9)

Continued

Table 1 Continued

	N	Weighted N (%)
Yes	2735	2181 (74.1)
Birth history		
Birth rank		
4th birth rank and over	1043	566 (19.2)
2nd–3rd birth rank	1599	1277 (43.4)
1st birth rank	1225	1099 (37.4)
Preceding birth interval		
Birth interval >3 years	864	453 (15.4)
Birth interval <3 years	1766	1379 (47.0)
First child	1225	1099 (37.5)
Pregnancy, birth and postbirth care		
Place of antenatal care		
Home/other	1136	485 (16.5)
Public health facility	2335	2100 (71.4)
Private health facility	396	358 (12.2)
Birth assistant		
None/traditional birth attendants/other untrained	1363	686 (23.3)
Health professional	2504	2257 (76.7)
Place of birth		
Non-health facility	2403	1552 (52.7)
Health facility	1464	1391 (47.3)
Mode of birth		
Non-caesarean section	3183	2272 (77.2)
Caesarean section	684	671 (22.8)
Postnatal care		
No	2024	1467 (49.8)
Yes	1842	1476 (50.2)

that the ANC model in place was based on the previous WHO ANC module.[38] We also found that there remains inequity in ANC utilisation.

Socioeconomic inequality in ANC contacts exists in Myanmar, as it does in almost all countries around the world.[24 28 39 40] In this study, pregnant women in the lower socioeconomic strata were at a higher risk for not initiating ANC early, not receiving the recommended number of ANC contacts or receiving adequate ANC components. We demonstrated that Myanmar could achieve ~51% coverage of up to seven ANC contacts, if all women were in the highest wealth quintile households. Evidence of improving access to ANC has included cash transfer schemes, housing finance schemes and community mortgage programmes for low-income women.[41] Such initiatives benefit poorer women by improving their living conditions and status within the household through providing them with access to capital, resources, credit, land, technology and information.[42 43] Thus, intervening with similar programmes are

Table 2 Adjusted and unadjusted risk ratios for initiation of first antenatal care contact, analysis of Myanmar Demographic and Health Survey, 2015–2016 (n=2943)

	Initiation of first antenatal care contact											
	Late initiation within second trimester (4–6 months)						On time initiation within first trimester (0–3 months)					
Study variables	RR*	95% CI‡	P value	aRR‡	95% CI‡	P value	RR*	95% CI‡	P value	aRR‡	95% CI‡	P value
Household factors												
Location of household												
Rural	1.00						1.00					
Urban	1.79	(1.22 to 2.64)	0.003				1.32	(0.87 to 1.99)	0.191			
Geographical zone												
Hilly zone	1.00						1.00					
Coastal zone	1.03	(0.62 to 1.72)	0.905				1.12	(0.65 to 1.94)	0.68			
Delta zone	1.09	(0.69 to 1.72)	0.704				1.00	(0.60 to 1.65)	0.996			
Central plain zone	1.10	(0.67 to 1.81)	0.709				1.49	(0.84 to 2.64)	0.168			
Household wealth status												
Lowest quintile	1.00						1.00					
Second lowest quintile	1.13	(0.75 to 1.71)	0.563				1.21	(0.80 to 1.82)	0.367			
Middle quintile	1.10	(0.70 to 1.73)	0.682				1.06	(0.68 to 1.65)	0.802			
Fourth quintile	1.95	(1.21 to 3.16)	0.006				1.74	(1.05 to 2.87)	0.030			
Highest quintile	2.45	(1.43 to 4.17)	0.001				2.88	(1.68 to 4.17)	<0.001			
Maternal/partner factors												
Mother's current age (years)												
Under 20	1.00			1.00			1.00			1.00		
20–29	1.39	(0.68 to 2.83)	0.361	1.28	(0.60 to 2.72)	0.527	3.00	(1.20 to 7.51)	0.019	2.85	(1.07 to 7.58)	0.00
30–39	1.99	(0.99 to 3.99)	0.053	1.66	(0.77 to 3.58)	0.192	4.26	(1.77 to 10.25)	0.001	4.07	(1.53 to 10.84)	0.00
40 and over	1.44	(0.65 to 3.18)	0.364	1.34	(0.56 to 3.22)	0.506	3.31	(1.27 to 8.59)	0.014	3.79	(1.29 to 11.11)	0.00
Mother's education												
No education/primary	1.00			1.00			1.00			1.00		
Secondary or higher	1.79	(1.29 to 2.48)	0.001	1.64	(1.12 to 2.40)		2.02	(1.45 to 2.83)	<0.001	1.73	(1.16 to 2.56)	
Mother's working status												
Not working	1.00						1.00					
Agriculture-related work	0.80	(0.49 to 1.33)	0.392				1.02	(0.64 to 1.63)	0.933			
Non-agriculture related work	1.10	(0.78 to 1.55)	0.601				1.12	(0.79 to 1.61)	0.520			
Husband's working status												
Agriculture-related work	1.00						1.00					
Non-agriculture related work	1.41	(0.99 to 1.99)	0.054				1.22	(0.84 to 1.76)	0.282			
Husband's education												
No education/primary	1.00						1.00					
Secondary or higher	1.41	(1.05 to 1.90)	0.023				1.52	(1.13 to 2.04)	0.005			
Exposure to mass media												
Reading newspaper or magazine												

Continued

Table 2 Continued

| | Initiation of first antenatal care contact | | | | | | | | | | | |
| | Late initiation within second trimester (4–6 months) | | | | | | On time initiation within first trimester (0–3 months) | | | | | |
Study variables	RR*	95% CI‡	P value	aRR‡	95% CI‡	P value	RR*	95% CI‡	P value	aRR‡	95% CI‡	P value
No	1.00			1.00			1.00			1.00		
Yes	1.57	(1.14 to 2.17)	0.006	1.20	(0.84 to 1.70)	0.309	2.06	(1.48 to 2.86)	<0.001	1.51	(1.06 to 2.14)	0.022
Listening to radio												
No	1.00						1.00					
Yes	0.98	(0.69 to 1.40)	0.913				1.31	(0.93 to 1.85)	0.119			
Watching television												
No	1.00			1.00			1.00			1.00		
Yes	1.68	(1.21 to 2.33)	0.002	1.47	(1.04 to 2.09)	0.028	1.49	(1.06 to 2.10)	0.023	1.22	(0.85 to 1.76)	0.283
Birth history												
Birth rank												
4th birth rank and over	1.00						1.00					
2nd–3rd birth rank	1.30	(0.88 to 1.92)	0.19				1.42	(0.91 to 1.99)	0.082			
1st birth rank	1.09	(0.72 to 1.65)	0.689				1.58	(0.87 to 2.05)	0.045			
Preceding birth interval												
Birth interval >3 years	1.00			1.00			1.00			1.00		
Birth interval <3 years	1.97	(1.33 to 2.90)	0.001	1.71	(1.15 to 2.54)	0.008	1.81	(1.21 to 2.71)	0.004	1.47	(0.97 to 2.22)	0.070
First child	1.49	(0.99 to 2.23)	0.056	1.26	(0.80 to 2.00)	0.320	1.67	(1.06 to 2.58)	0.020	1.47	(0.90 to 2.40)	0.121
Pregnancy, birth and postbirth care												
Place of antenatal care												
Home/other	1.00						1.00					
Public health facility	1.01	(0.56 to 1.89)	0.961				1.10	(0.70 to 2.74)	0.673			
Private health facility	0.81	(0.44 to 1.48)	0.491				1.11	(0.60 to 2.07)	0.731			
Birth assistant												
None/traditional birth attendants/other untrained	1.00			1.00			1.00			1.00		
Health professional	1.84	(1.29 to 2.62)	0.001	1.84	(1.19 to 2.83)	0.006	2.27	(1.57 to 3.28)	<0.001	2.34	(1.45 to 3.77)	0.001
Place of birth												
Non-health facility	1.00			1.00			1.00			1.00		
Health facility	1.15	(0.82 to 1.61)	0.414	0.65	(0.42 to 1.03)	0.064	1.13	(0.80 to 1.60)	0.482	0.55	(0.34 to 0.88)	0.013
Mode of birth												
Non-caesarean section	1.00						1.00					
Caesarean section	0.92	(0.62 to 1.36)	0.684				1.24	(0.85 to 1.79)	0.263			
Postnatal care												
No	1.00			1.00			1.00			1.00		
Yes	1.25	(0.91 to 1.72)	0.171	1.22	(0.88 to 1.68)	0.235	1.71	(1.24 to 2.37)	0.001	1.60	(1.16 to 2.23)	0.005

*Unadjusted risk ratio (RR).
†Adjusted risk ratio (aRR) and the risk ratio adjusted for all other variables in the table.
‡Confidence interval (CI).

Table 3 Adjusted and unadjusted risk ratio for adequacy of antenatal care component, analysis of Myanmar Demographic and Health Survey, 2015–2016 (n=2943)

| | Components of antenatal care | | | | | | | | | | | |
| | Inadequate | | | | | | Adequate | | | | | |
Study variables	RR*	95% CI‡	P value	aRR‡	95% CI‡	P value	RR*	95% CI‡	P value	aRR‡	95% CI‡	P value
Household factors												
Location of household												
Rural	1.00			1.00			1.00			1.00		
Urban	2.31	(1.30 to 4.08)	0.004	1.80	(0.90 to 3.61)	0.099	7.31	(4.06 to 13.17)	<0.001	4.86	(2.44 to 9.68)	<0.001
Geographical zone												
Hilly zone	1.00			1.00			1.00			1.00		
Coastal zone	0.64	(0.38 to 1.08)	0.097	0.59	(0.34 to 1.04)	0.069	0.48	(0.26 to 0.89)	0.02	0.43	(0.22 to 0.84)	0.014
Delta zone	0.87	(0.52 to 1.47)	0.612	0.68	(0.39 to 1.21)	0.193	1.23	(0.66 to 2.28)	0.519	0.79	(0.40 to 1.56)	0.490
Central plain zone	0.70	(0.44 to 1.10)	0.121	0.57	(0.34 to 0.95)	0.032	0.71	(0.40 to 1.25)	0.236	0.53	(0.28 to 1.02)	0.058
Household wealth status												
Lowest quintile	1.00						1.00					
Second lowest quintile	0.99	(0.66 to 1.50)	0.962				1.30	(0.88 to 1.93)	0.184			
Middle quintile	1.26	(0.80 to 2.97)	0.323				1.76	(1.12 to 2.75)	0.014			
Fourth quintile	1.66	(0.95 to 2.89)	0.077				3.53	(2.12 to 5.88)	<0.001			
Highest quintile	2.17	(1.17 to 4.02)	0.014				6.44	(3.33 to 12.45)	<0.001			
Maternal/partner factors												
Mother's current age (years)												
Under 20	1.00						1.00					
20–29	0.91	(0.41 to 1.98)	0.805				1.86	(0.84 to 4.99)	0.124			
30–39	0.84	(0.37 to 1.91)	0.678				1.96	(0.88 to 4.91)	0.098			
40 and over	0.72	(0.30 to 1.69)	0.443				1.34	(0.59 to 3.40)	0.483			
Mother's education												
No education/primary	1.00						1.00					
Secondary or higher	1.55	(1.10 to 2.17)	0.018				2.75	(2.02 to 3.73)	<0.001			
Mother's working status												
Not working	1.00			1.00			1.00			1.00		
Agriculture-related work	0.74	(0.48 to 1.14)	0.17	0.79	(0.49 to 1.26)	0.319	0.44	(0.28 to 0.68)	<0.001	0.64	(0.40 to 1.04)	0.070
Non-agriculture related work	0.78	(0.57 to 1.08)	0.131	0.73	(0.52 to 1.03)	0.072	0.67	(0.48 to 0.93)	0.017	0.62	(0.43 to 0.90)	0.011
Husband's working status												
Agriculture-related work	1.00						1.00					
Non-agriculture related work	1.68	(1.22 to 2.31)	0.002				3.01	(2.18 to 4.16)	<0.001			
Husband's education												
No education/primary	1.00						1.00					
Secondary or higher	1.21	(0.87 to 1.68)	0.264				2.12	(1.56 to 2.90)	0.074			

Continued

Table 3 Continued

Study variables	Components of antenatal care											
	Inadequate						Adequate					
	RR*	95% CI‡	P value	aRR‡	95% CI‡	P value	RR*	95% CI‡	P value	aRR‡	95% CI‡	P value
Exposure to mass media												
Reading newspaper or magazine												
No	1.00			1.00			1.00			1.00		
Yes	1.91	(1.36 to 2.70)	<0.001	1.77	(1.24 to 2.51)	0.002	3.71	(2.18 to 4.15)	<0.001	2.12	(1.50 to 2.99)	<0.001
Listening to radio												
No	1.00						1.00					
Yes	1.24	(0.91 to 1.68)	0.174				1.41	(1.06 to 1.88)	0.018			
Watching television												
No	1.00						1.00					
Yes	1.69	(1.28 to 2.24)	<0.001				2.37	(1.77 to 3.17)	<0.001			
Birth history												
Birth rank												
Fourth birth rank and over	1.00						1.00					
2nd–3rd birth rank	1.32	(0.93 to 1.86)	0.122				1.91	(1.37 to 2.66)	<0.001			
First birth rank	1.30	(0.88 to 1.91)	0.186				2.03	(1.43 to 2.88)	<0.001			
Preceding birth interval												
Birth interval >3years	1.00						1.00					
Birth interval <3years	0.82	(0.53 to 1.26)	0.368				0.97	(0.63 to 1.50)	0.905			
First child	0.95	(0.63 to 1.42)	0.807				1.30	(0.85 to 1.97)	0.223			
Pregnancy, birth and postbirth care												
Place of antenatal care												
Home/other	1.00			1.00			1.00			1.00		
Public health facility	1.92	(1.37 to 2.69)	<0.001	1.61	(1.11 to 2.34)	0.012	3.77	(2.55 to 5.57)	<0.001	2.37	(1.54 to 3.65)	<0.001
Private health facility	2.80	(1.53 to 5.14)	<0.001	1.65	(0.87 to 3.13)	0.125	7.88	(4.22 to 14.74)	<0.001	2.24	(1.24 to 4.42)	<0.020
Birth assistant												
None/traditional birth attendants/ other untrained	1.00			1.00			1.00			1.00		
Health professional	1.91	(1.43 to 2.57)	<0.001	1.65	(1.19 to 2.30)	0.003	5.42	(3.93 to 7.48)	<0.001	3.38	(2.38 to 4.81)	<0.001
Place of birth												
Non-health facility	1.00						1.00					
Health facility	1.98	(1.39 to 2.82)	<0.001				4.39	(3.07 to 6.28)	<0.001			
Mode of birth												
Non-caesarean section	1.00						1.00					
Caesarean section	2.11	(1.32 to 3.39)	0.002				3.66	(2.34 to 5.71)	<0.001			

Continued

Table 3 Continued

Study variables	Components of antenatal care											
	Inadequate						Adequate					
	RR*	95% CI‡	P value	aRR‡	95% CI‡	P value	RR*	95% CI‡	P value	aRR‡	95% CI‡	P value
Postnatal care												
No	1.00			1.00			1.00			1.00		
Yes	1.26	(0.91 to 1.73)	0.158	1.36	(0.98 to 1.90)	0.066	1.72	(1.23 to 2.39)	0.001	2.22	(1.57 to 3.14)	<0.001

*Unadjusted risk ratio (RR).
†Adjusted risk ratio (aRR) and the risk ratio adjusted for all other variables in the table.
‡Confidence interval (CI).

likely to benefit women to access ANC, and these interventions may be worth considering for Myanmar.

Pregnant women who received the adequate number of components and recommended number of eight ANC contacts were more likely to use skilled healthcare providers at birth and postbirth care services than women who did not. Late initiation of ANC precludes sufficient time to access the sufficient number of ANC contacts thus missing opportunities for early intervention, and this has been previously identified.[44–46] In other settings such as South-eastern Tanzania and Afghanistan, a counselling intervention of early ANC initiation that involved training community health volunteers to provide ANC information to women within their own communities has been shown to improve on-time initiation of ANC.[47 48]

Urban residence was predictive of women receiving adequate ANC components, consistent with a previous study in 91 LMICs.[49] In Myanmar, inadequate ANC components could be explained by poor healthcare infrastructure particularly in rural areas. Our findings demonstrate that, if the minimum standards of ANC components such as diagnostic tests were available from the public health facilities at the same rate as those of private health facilities, the country would achieve 63% coverage of adequate components of ANC. In addition to our findings, a lack of availability and distribution of health resources such as a sufficient supply chain, financial resources and infrastructure particularly in rural and hard-to-reach conflict and postconflict areas are among the challenges facing the health system as indicated in the Myanmar National Health Plan 2017–2021.[50] Thus, building capacity, infrastructure and resourcing public health facilities in rural areas needs to be prioritised.[50–52]

In Myanmar, the risk of late initiation of ANC was higher among adolescent mothers. These adolescent mothers were generally primiparous, living in poorer and rural households. As in many LMICs, late initiation of ANC could be explained by the inability of pregnant adolescents to recognise the signs and symptoms of pregnancy, or trying to conceal their pregnancies, leading to delays in initiating antenatal care.[21 53 54] Adolescent pregnancy has poorer outcomes thus, an intervention that promotes delayed childbirth for married adolescents and more broadly promotes the use of contraception for adolescents could effectively reduce the risk of adolescent pregnancy and improve maternal and child health outcomes.

The study strengths include a representative national sample with a high response for women (96%). Data on birth history were restricted to the most recent birth in order to minimise recall bias. The study was however a cross-sectional survey that restricts the interpretation of causality. The reliance on maternal recall for the data is also a weakness; however, any bias is likely to be non-differential. Not all ANC service indicators, measurement and information on pregnancy, birth and postbirth complications or measurement of knowledge and attitude were collected during the 2015–16 MDHS, and this

Table 4 Adjusted and unadjusted risk ratios for recommended number of antenatal care contacts, analysis of Myanmar Demographic and Health Survey, 2015–2016 (n=2943)

Study variables	Number of antenatal care contacts											
	4–7 ANC contacts						8 or more ANC contacts					
	RR*	95% CI‡	P value	aRR‡	95% CI‡	P value	RR*	95% CI‡	P value	aRR‡	95% CI‡	P value
Household factors												
Location of household												
Rural	1.00			1.00			1.00			1.00		
Urban	3.42	(2.44 to 4.79)	<0.001	1.84	(1.29 to 2.62)	0.001	9.62	(6.30 to 14.68)	<0.001	2.56	(1.64 to 4.00)	<0.001
Geographical zone												
Hilly zone	1.00						1.00					
Coastal zone	0.88	(0.61 to 1.28)	0.501				1.10	(0.64 to 1.88)	0.739			
Delta zone	1.43	(1.02 to 2.01)	0.039				1.32	(0.78 to 2.23)	0.296			
Central plain zone	1.15	(0.83 to 1.57)	0.389				1.24	(0.74 to 2.07)	0.421			
Household wealth status												
Lowest quintile	1.00			1.00			1.00			1.00		
Second lowest quintile	1.30	(0.99 to 1.72)	0.058	1.09	(0.82 to 1.46)	0.551	1.93	(1.26 to 2.93)	0.002	1.41	(0.90 to 2.21)	0.137
Middle quintile	1.77	(1.30 to 2.40)	<0.001	1.19	(0.87 to 1.64)	0.278	3.59	(2.30 to 5.61)	<0.001	1.85	(1.14 to 3.00)	0.013
Fourth quintile	2.34	(1.77 to 3.29)	<0.001	1.21	(0.83 to 1.78)	0.306	6.56	(4.23 to 10.18)	<0.001	2.04	(1.25 to 3.33)	0.005
Highest quintile	5.52	(3.13 to 9.73)	<0.001	1.70	(0.92 to 3.13)	0.087	27.65	(14.58 to 52.44)	<0.001	3.20	(1.61 to 6.36)	0.001
Maternal/partner factors												
Mother's current age (years)												
Under 20	1.00						1.00					
20–29	1.62	(0.86 to 3.06)	0.134				1.94	(0.84 to 4.50)	0.120			
30–39	1.97	(1.06 to 3.64)	0.032				2.37	(1.04 to 5.38)	0.039			
40 and over	1.40	(0.72 to 2.73)	0.322				1.08	(0.45 to 2.61)	0.864			
Mother's education												
No education/primary	1.00			1.00			1.00			1.00		
Secondary or higher	2.51	(2.00 to 3.15)	<0.001	1.33	(1.03 to 1.73)	0.032	4.92	(3.72 to 6.51)	<0.001	1.19	(0.84 to 1.68)	0.322
Mother's working status												
Not working	1.00						1.00					
Agriculture-related work	0.62	(0.45 to 0.85)	0.003				0.38	(0.24 to 0.60)	<0.001			
Non-agriculture related work	0.95	(0.74 to 1.21)	0.671				1.13	(0.84 to 1.54)	0.418			
Husband's working status												
Agriculture-related work	1.00			1.00			1.00			1.00		
Non-agriculture related work	1.98	(1.55 to 2.53)	<0.001	1.09	(0.83 to 1.41)	0.542	5.26	(3.91 to 7.09)	<0.001	1.63	(1.18 to 2.25)	0.003
Husband's education												
No education/primary	1.00			1.00			1.00			1.00		
Secondary or higher	2.04	(1.64 to 2.53)	<0.001	1.20	(0.94 to 1.55)	0.145	4.98	(3.72 to 6.67)	<0.001	1.76	(1.27 to 2.43)	0.001
Exposure to mass media												
Reading newspaper or magazine												

Continued

Table 4 Continued

| Study variables | Number of antenatal care contacts | | | | | | | | | | | |
| | 4–7 ANC contacts | | | | | | 8 or more ANC contacts | | | | | |
	RR*	95% CI‡	P value	aRR‡	95% CI‡	P value	RR*	95% CI‡	P value	aRR‡	95% CI‡	P value
No	1.00			1.00			1.00			1.00		
Yes	1.95	(1.56 to 2.43)	<0.001	1.29	(1.01 to 1.66)	0.042	2.80	(2.15 to 3.64)	<0.001	1.21	(0.91 to 1.60)	0.197
Listening to radio												
No	1.00						1.00					
Yes	1.32	(1.05 to 1.65)	0.016				1.19	(0.91 to 1.56)	0.193			
Watching television												
No	1.00						1.00					
Yes	1.87	(1.47 to 2.39)	<0.001				2.61	(1.97 to 3.47)	<0.001			
Birth history												
Birth rank												
4th birth rank and over	1.00						1.00					
2nd–3rd birth rank	1.31	(1.03 to 1.68)	0.029				2.96	(1.92 to 4.24)	<0.001			
1st birth rank	1.73	(1.34 to 2.24)	<0.001				5.16	(3.14 to 6.96)	<0.001			
Preceding birth interval												
Birth interval >3 years	1.00						1.00					
Birth interval <3 years	1.43	(1.10 to 1.86)	0.008				1.85	(1.27 to 2.71)	0.002			
First child	1.90	(1.41 to 2.55)	<0.001				3.48	(2.29 to 5.29)	<0.001			
Pregnancy, birth and postbirth care												
Place of antenatal care												
Home/other	1.00			1.00			1.00			1.00		
Public health facility	2.16	(1.63 to 2.88)	<0.001	1.62	(1.19 to 2.20)	0.002	4.41	(2.78 to 6.99)	<0.001	2.08	(1.24 to 3.50)	0.006
Private health facility	4.03	(2.42 to 6.71)	<0.001	1.88	(1.10 to 3.23)	0.022	20.40	(11.20 to 37.12)	<0.001	3.62	(1.86 to 6.97)	<0.001
Birth assistant												
None/traditional birth attendants /other untrained	1.00			1.00			1.00			1.00		
Health professional	2.78	(2.17 to 3.55)	<0.001	1.59	(1.21 to 2.09)	0.001	8.76	(5.66 to 13.56)	<0.001	2.20	(1.32 to 368)	0.003
Place of birth												
Non-health facility	1.00			1.00			1.00			1.00		
Health facility	2.40	(1.88 to 3.06)	<0.001	1.26	(0.93 to 1.71)	0.140	7.34	(5.38 to 10.01)	<0.001	2.35	(1.54 to 3.28)	<0.001
Mode of birth												
Non-caesarean section	1.00						1.00					
Caesarean section	1.97	(1.47 to 2.60)	<0.001				4.97	(3.65 to 6.76)	<0.001			
Postnatal care												
No	1.00			1.00			1.00			1.00		
Yes	1.30	(1.06 to 1.60)	0.011	1.45	(1.17 to 1.80)	0.001	1.33	(1.00 to 1.76)	0.044	1.83	(1.35 to 2.47)	<0.001

*Unadjusted risk ratio (RR).
†Adjusted risk ratio (aRR) and the risk ratio adjusted for all other variables in the table.
‡Confidence interval (CI).

could have affected the result. However, these data are the best nationally representative data available from Myanmar.

CONCLUSION

Myanmar has made slow progress towards the previous WHO guidelines of four or more ANC contacts. The overall findings from this analysis show that the county is still far from attaining the new recommended number of eight and more ANC contacts. The main factors associated with on-time initiation, adequacy and recommended eight or more ANC contacts were urban residence, women aged between 20 years and 49 years and women from the wealthiest households. Interventions that address the persistent health access inequity for younger, poorer and rural women need to be prioritised in order for the country to improve access to recommended care throughout pregnancy and for a positive pregnancy experience thus improving maternal health and birth outcomes.

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