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Socio-demographic factors associated with early antenatal care visits among pregnant women in Malawi: 2004–2016

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Abstract

Introduction

In 2016, the WHO published recommendations increasing the number of recommended antenatal care (ANC) visits per pregnancy from four to eight. Prior to the implementation of this policy, coverage of four ANC visits has been suboptimal in many low-income settings. In this study we explore socio-demographic factors associated with early initiation of first ANC contact and attending at least four ANC visits ("ANC4+") in Malawi using the Malawi Demographic and Health Survey (MDHS) data collected between 2004 and 2016, prior to the implementation of new recommendations.

Methods

We combined data from the 2004–5, 2010 and 2015–16 MDHS using Stata version 16. Participants included all women surveyed between the ages of 15–49 who had given birth in the five years preceding the survey. We conducted weighted univariate, bivariate and multivariable logistic regression analysis of the effects of each of the predictor variables on the binary endpoint of the woman attending at least four ANC visits and having the first ANC attendance within or before the four months of pregnancy (ANC4+). To determine whether a factor was included in the model, the likelihood ratio test was used with a statistical significance of $P< 0.05$ as the threshold.

Results

We evaluated data collected in surveys in 2004/5, 2010 and 2015/6 from 26386 women who had given birth in the five years before being surveyed. The median gestational age, in months, at the time of presenting for the first ANC visit was 5 (inter quartile range: 4–6). The proportion of women initiating ANC4+ increased from 21.3% in 2004–5 to 38.8% in 2015–

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Abbreviations: ANC, Antenatal care; ANC4+, At least four ANC visits prior to six months of first ANC visit; CHAM, Christian Health Association of Malawi; FANC, Focused Antenatal Care; HIC, High Income Countries; LIC, Low Income Countries; MMR, Maternal Mortality Ratio; MDHS, Malawi Demographic and Health Survey; MPHC, Malawi Population and Housing Census; NSO, National Statistical Office; WHO, World Health Organization; SSA, Sub-Saharan Africa.

16. From multivariate analysis, there was increasing trend in ANC4+ from women aged 20–24 years (adjusted odds ratio (aOR) = 1.27, 95%CI:1.05–1.53, P = 0.01) to women aged 45–49 years (aOR = 1.91, 95%CI:1.18–3.09, P = 0.008) compared to those aged 15–19 years. Women from richest socio-economic position ((aOR = 1.32, 95%CI:1.12–1.58, P<0.001) were more likely to demonstrate ANC4+ than those from low socio-economic position. Additionally, women who had completed secondary (aOR = 1.24, 95%CI:1.02–1.51, P = 0.03) and tertiary (aOR = 2.64, 95%CI:1.65–4.22, P<0.001) education were more likely to report having ANC4+ than those with no formal education. Conversely increasing parity was associated with a reduction in likelihood of ANC4+ with women who had previously delivered 2–3 (aOR = 0.74, 95%CI:0.63–0.86, P<0.001), 4–5 (aOR = 0.65, 95%CI:0.53–0.80, P<0.001) or greater than 6 (aOR = 0.61, 95%CI: 0.47–0.79, <0.001) children being less likely to demonstrate ANC4+.

Conclusion

The proportion of women reporting ANC4+ and of key ANC interventions in Malawi have increased significantly since 2004. However, we found that most women did not access the recommended number of ANC visits in Malawi, prior to the 2016 WHO policy change which may mean that women are less likely to undertake the 2016 WHO recommendation of 8 contacts per pregnancy. Additionally, our results highlighted significant variation in coverage according to key socio-demographic variables which should be considered when devising national strategies to ensure that all women access the appropriate frequency of ANC visits during their pregnancy.

Introduction

Following the ratification of the Millennium Development Goals in 2000, significant progress has been made in improving maternal and perinatal health internationally, demonstrated through a global 29% reduction in maternal deaths between 2000 and 2015 [1] and a 19% reduction in stillbirths in the same time period [2]. However, low-income countries (LIC) continue to experience disproportionately greater rates of maternal and perinatal mortality when compared to high income-countries (HIC) [1–4]. An estimated two-thirds of all maternal deaths in 2015 occurred in Sub-Saharan Africa, with the region experiencing a maternal mortality ratio (MMR) twice that of HIC and with latest data suggesting that geographic inequalities in maternal health continue to widen [1]. International and intraregional disparities in maternal health outcomes are, in part, attributable to the substantial variation in both coverage and uptake of key maternity services [5]. Antenatal care (ANC), the care of a woman and her foetus from conception until the onset of labour, is one such service in which coverage, especially within the first trimester of pregnancy, is particularly variable. Many LICs reporting higher MMR than the global average have low ANC coverage [6].

Since its inception in 2002, many LICs have adopted the World Health Organization's (WHO) Focused Antenatal Care (FANC) model in which women are recommended to undertake at least four ANC visits during their pregnancy, at around weeks 12, 26, 32 gestation and between 36 and 38 weeks of gestation [7]. Whilst this model involves fewer visits per-pregnancy than models of care employed across HICs, both women's attendance of their initial ANC visit within the first trimester and attending at least four visits (ANC4+) remains very

low across the region of SSA [8]. Despite low uptake of ANC services under the FANC model, the WHO published recommendations in 2016, doubling the previous number of recommended ANC visits, now renamed as 'contacts', to eight within the duration of a woman's pregnancy at 12, 20, 26, 30, 34, 36, 38 and 40 weeks of gestation [9]. These guidelines are supported by evidence from a number of trials which demonstrates that this model of care, more closely resembling contact-schedules employed across HICs, may lead to a reduction in perinatal death and improvements in women's perception of care-quality when compared to the FANC model [10,11].

Malawi is one such country which, despite demonstrating progress in improving maternal outcomes since 2000 [12], continues to report women attend ANC both later and at a lesser frequency than recommended by the FANC model [13]. Pooled data from the Malawi Demographic and Health Surveys (MDHS) collected between 2000 and 2010 showed that only 10% of women accessed ANC within the first trimester and 49% of women achieved ANC4+ under the FANC model [13]. Ensuring both early access to ANC and ANC4+ for women in Malawi is important, as not only does ANC lead to improved maternal [10], newborn [14] and early childhood outcomes [15] but early initiation of ANC is positively associated with women attending both ANC4+ and attending at eight or more ANC visits in other settings [8]. Additionally, access to ANC is associated with improved probability that women will undergo facility-based delivery with the assistance of a skilled birth attendant, a vital service in improving maternal and perinatal health [16].

In this study we explore the social and demographic factors which are associated with women attending fourth contacts with her first visit occurring during or prior to 4 months gestation in Malawi between 2004 and 2016; we define this 'ANC4+'. We have undertaken an analysis of MDHS data which was collected prior to publication of the WHO's 2016 guidelines and adoption of these guidelines by the Malawian government. Whilst ours is not the first study to explore determinants or timeliness of ANC attendance in Malawi [13,17–20], our study is the first to include data collected as part of the 2015–2016 MDHS, the year prior to the implementation of the most recent WHO ANC guidelines. Our study is also the first to explore what factors are associated with both early initiation of ANC and attendance of four or more ANC visits through the use of a combined outcome variable. Therefore, this study is less likely to over-estimate the true proportion of women with ANC4+ visits since mostly the women with at least 4 ANC visits. Most women with at least four ANC visits but with first ANC visit was after five months tended to have pregnancy complications. In additional to socio-demographic factors we also explored the services that were accessed by the women during their ANC visits. Finally, we believe that the results of this study will provide vital insight into potential barriers for early initiation of ANC4+ visits in Malawi and other similar settings, providing key information to guide policy makers, clinicians or programme managers working in maternal and reproductive health.

Methods

Study design

We conducted a secondary analysis of the women's questionnaire data collected from three Malawi Demographic and Health Surveys (MDHS) administered between 2004 and 2016 [21–23]. The Women's Questionnaire is one of the four primary DHS survey questionnaires, accompanying the Household, Men's and Biomarker Questionnaires, employed within the data collection process for the MDHS. This questionnaire is used to collect data from female participants on topics such as maternal and child health and healthcare use, contraception and women's socio-economic status in the country of study. All women aged between 15–49 years

are eligible for inclusion and any relevant participants are identified for recruitment via administration of the national Household Questionnaire. Within this study only those respondents who had given birth during in the preceding five years were included in the analysis.

Sampling procedure

The sampling frame used for the 2010 and 2015–16 MDHS is the frame of the Malawi Population and Housing Census (MPHC) conducted in Malawi in 2008 while the sampling frame for the 2004–5 MDHS was the 1998 MPHC provided by the Malawi National Statistical Office (NSO) [21–23] The sampling frame is a complete list of all census standard enumeration areas (SEAs) created for the 1998 or 2008 MPHC depending on the wave of the MDHS. A SEA is a geographic area that covers an average of 235 households. The sampling frame contains information about the SEA location, type of residence (urban or rural), and the estimated number of residential households.

The MDHS samples were stratified and selected in two stages. Each district was stratified into urban and rural areas; this yielded 56 sampling strata [21–23]. Sample of SEAs were selected independently in each stratum in two stages. Implicit stratification and proportional allocation were achieved at each of the lower administrative levels by sorting the sampling frame within each sampling stratum before sample selection, according to administrative units in different levels, and by using a probability proportional to size selection at the first stage point sampling [21–23].

Data management

We extracted and combined data from the 2004–5, 2010 and 2015–16 MDHS. We classified the variables as relating to external environment (rural/urban location, survey year, and region of residence), socio-demographics (age of the woman, household wealth index, education, marital status and number of children ever born), knowledge (frequency of listening to radio or watching television)) and enablers (permission to visit health services, money to pay for health services, distance to health facilities, presence of companion, and desire for pregnancy). We also extracted the tests performed during ANC visits (blood, urine and blood pressure) as well as the services that were received (Iron tablets for 90+ days, HIV testing and counselling, sulfadoxine-pyrimethamine (SP)/Fansidar for malaria prophylaxis) amongst the women that had ANC.

The primary outcome was whether or not women had four or more antenatal care visits with a skilled service provider, namely a doctor/medical officer, clinical officer, assistant clinical officer, or nurse/midwife, with the first visit occurring in or prior to the four months of pregnancy. This was the recommended ANC schedule at the time for all the observations in the dataset (i.e., 2004–2016). This analysis included women with their most recent birth within two years preceding each MDHS.

Statistical analysis

We calculated counts, weighted percentages, weighted odds ratios (OR) and their associated 95% confidence intervals (95%CI). We performed data management and analysis using Stata version 16 (Stata Corp., Texas, USA). The weighting variable from each of the MDHS was divided by 1000000 [24]. We further calculated the equal weights for each sample cluster and divided the average weight for each cluster by three (as data from three survey rounds being used together), as illustrated by Friedman and Jang in 2002 [25]. We conducted weighted univariate, bivariate and multivariable logistic regression analysis of the effects of each of the predictor variables on the binary endpoint of early initiation of ANC4+. Multiple weighted

logistic regression models were used with a forward and back-ward step-wise selection method. To determine whether a factor was included in the model, the likelihood ratio test (LRT) was used with a statistical significance of $P < 0.05$ as the threshold.

Ethical considerations

The individual consent was conducted by National Statistical Office (NSO) of Malawi during the DHS 2004/2005, 2010 and 2015/2016. We obtained permission to use this data from the MEASURE DHS. The Malawi DHS datasets were downloaded from https://www.dhsprogram.com/data/available-datasets.cfm. Furthermore, this study was approved by the College of Medicine Research Committee (COMREC) in Blantyre, Malawi (protocol #: P.10/19/2820). As this study used secondary anonymised data, individual informed consent was not required.

Results

Characteristics of women included in this study

The characteristics of the women included in the study are shown in Table 1. A total of 26386 women were evaluated between 2004 and 2016. Of these 6012 (23%) were interviewed in 2004/5 MDHS; 10802 (41%) were interviewed in the 2010 MDHS while 9572 (36%) were interviewed in the 2015/16 MDHS. We observed variation in the proportions of women by age group, with an increasing trend from 15 to 29 years and a decreasing trend from 25 years to 49 years (see Table 1). The median age of the respondents was 26 years (interquartile range (IQR): 22–32). Between 2004 and 2016, the highest proportion of women had between 2 and 3 children previously (37%) while the lowest proportion of the women had six or more children (18%). The median number of previous children was 3 (IQR: 2–5). The majority of women had primary education while the minority had tertiary education (see Table 1). Almost 44% (11702 of 26386) were from households of poor socio-economic level and we observed a higher proportion of the households from poor socio-economic position.

Eighty-seven percent of the women were from rural areas while twelve percent were from the urban areas, and more women were interviewed from rural areas (see Table 1). Although 12815 of 26386 listened to radio between 2004 and 2016, we observed a decreasing trend from 65% in 2004/5 to 30% in 2015/16. Overall, the majority of women (24136 of 26386) did not watch a television (TV) for more than once a week but the numbers watching TV increased from 5% in 2004/5 to 10% in 2015/16. Over the 2004 to 2016 surveys, women cited different barriers for them to access ANC and these barriers had different trends. The major barriers were long distance to health facilities (59% of 26386) and lack of money to use in accessing health services (55% of 26386). Across the survey populations, the majority of the women were married while the lowest proportion were widowed (see Table 1).

Factors associated with early antenatal care of at least four visits

Distribution of women by number of ANC visits. The distribution of women by number of ANC visits is shown in Table 2. Of the 26386, 7449 (28%) of the women had attended early initiation of ANC4+. We observed increasing trends in the proportion of women with early initiation of ANC4+ from 21% in 2004/5 to 37% in 2015/16 ($P<0.001$). The proportion of women with early initiation of ANC4+ decreased with increasing number of children ever born (see Table 2). The women from richest households (35%) had the highest coverage of early initiation of ANC4+ compared to those from the poorest households (25%). The rural women were less likely to demonstrate early initiation of ANC4+ than the urban women (see Table 2).

Table 1. Characteristics of women interviewed during the Malawi Demographic and Health Surveys conducted between 2004 and 2016.

Characteristics	Total		2004–5		2010		2015–16	
	Number	%	Number	%	Number	%	Number	%
Total	26386	100.0	6012	100.0	10802	100.0	9572	100.0
Age group								
15–19	2671	10.0	602	9.7	997	9.0	1072	11.3
20–24	8212	31.4	2081	35.4	3118	29.4	3013	31.3
25–29	6542	24.9	1486	25.0	2903	26.8	2153	22.8
30–34	4507	16.9	894	14.4	1897	17.4	1716	17.9
35–39	2889	10.9	583	9.7	1221	11.2	1085	11.3
40–44	1176	4.4	273	4.4	491	4.6	412	4.3
45–49	389	1.4	93	1.4	175	1.6	121	1.3
Region								
North	4506	15.1	746	12.4	1955	15.1	1805	16.7
Centre	9204	38.3	2247	40.1	3679	38.3	3278	37.3
South	12676	46.6	3019	47.5	5168	46.6	4489	46.0
Number of children ever born								
1	5787	22.2	1284	21.4	2023	19.0	2480	26.2
2–3	9621	36.7	2212	37.3	3859	36.2	3550	37.0
4–5	6274	23.6	1376	22.7	2713	24.8	2185	22.8
6+	4704	17.5	1140	18.5	2207	20.1	1357	14.0
Education level								
None	4274	16.1	1481	24.0	1711	15.9	1082	11.5
Primary	17753	67.1	3859	64.8	7517	69.0	6377	66.5
Secondary	4104	15.7	659	11.0	1507	14.4	1938	20.0
Tertiary	255	1.1	13	0.2	67	0.7	175	1.9
Wealth index quintile								
Poorest	5768	21.9	1160	18.7	2439	22.3	2169	23.2
Poorer	5934	22.4	1392	23.2	2446	22.4	2096	22.0
Middle	5670	21.3	1389	23.4	2428	22.1	1853	19.1
Richer	4968	18.6	1183	19.7	2030	18.6	1755	18.0
Richest	4046	15.8	888	14.9	1459	14.6	1699	17.7
Residence								
Urban	3240	12.9	655	11.2	1037	11.1	1548	16.0
Rural	23146	87.1	5357	88.8	9765	88.9	8024	84.0
Sources of antenatal care knowledge								
Frequency of listening to radio								
Less than once a week	13571	52.0	2146	35.4	4767	44.7	6658	70.3
At least once a week	12815	48.0	3866	64.6	6035	55.3	2914	29.7
Frequency of watching television								
Less than once a week	24136	91.4	5732	95.5	9762	90.0	8642	90.6
At least once a week	2250	8.6	280	4.5	1040	10.0	930	9.4
Barriers to access antenatal care								
Permission to visit health services								
No problem	23076	87.2	5490	91.5	9524	87.9	8062	83.8
Big problem	3310	12.8	522	8.5	1278	12.1	1510	16.2
Money to pay for health services								
No problem	11893	44.6	2157	35.4	4948	46.1	4788	48.6
Big problem	14493	55.4	3855	64.6	5854	53.9	4784	51.4

(*Continued*)

Table 1. (Continued)

Characteristics	Total		2004–5		2010		2015–16	
	Number	%	Number	%	Number	%	Number	%
Distance to health facilities								
No problem	10910	41.4	2224	36.7	4274	40.6	4412	45.2
Big problem	15476	58.6	3788	63.3	6528	59.4	5160	54.8
Presence of companion								
No problem	18762	70.6	4411	73.7	7380	67.8	6971	71.9
Big problem	7624	29.4	1601	26.3	3422	32.2	2601	28.1
No drugs at health facility								
No problem	13473	49.7	6012	100.0	4253	38.5	3208	31.4
Big problem	12913	50.3	0	0.0	6549	61.5	6364	68.6
No female provider								
No problem	20981	79.3	5158	86.1	8419	77.4	7404	77.2
Big problem	5405	20.7	854	13.9	2383	22.6	2168	22.8
Marital status								
Never married	871	3.3	138	2.2	281	2.6	452	4.7
Married	22522	85.4	5257	87.7	9311	86.3	7954	83.1
Widowed	445	1.7	113	2.0	185	1.7	147	1.5
Divorced	2548	9.6	504	8.1	1025	9.5	1019	10.7

% = weighted percentage.

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Crude odds ratios of women having early antenatal care of at least four visits. The crude odds ratios for early initiation of ANC4+ are presented in Table 3. There was increasing trend in the odds of women demonstrating early initiation of ANC4+ from 2004 to 2016 (P<0.001). There was a decreasing trend in the odds in early initiation of ANC4+ with the number of children ever born (Table 3). Watching TV was associated with higher likelihood of ANC4+ (OR = 1.53, 95%CI: 1.31–1.79, P<0.001).

Adjusted odds ratios of women having early antenatal care of at least four visits. The adjusted odds ratios for early initiation of ANC4+ are presented in Table 3. The likelihood of women having early initiation of ANC4+ varied by age, survey year, number of children ever born to the woman, education level and wealth index quintile. After adjusting for age, number of children ever born to the woman, education level and wealth index quintile; there was an increasing trend in the likelihood of having early initiation of ANC4+ by year of survey. Women who were wealthier, and more educated, and married were more likely to have had early initiation of ANC4+ (see Table 3). On the other hand, women with more children were less likely to have reported early initiation of ANC4+ visits.

Services received by antenatal care women. The services accessed by women that attended ANC in Malawi are shown in Fig 1. The proportion of women that had a blood sample taken for full blood count increased from 32% in 2004/5 to 91% in 2015/16 (Chi-Square P <0.001). Similarly, there was increasing trend in the proportion of women with urine test from 18% in 2004/5 to 32% in 2015/16 (P<0.001). We also observed an increasing trend in the proportion of ANC women that were given at least two doses of Fansidar/SP for malaria prophylaxis from 79% in 2004/5 to 91% in 2015/16 (P<0.001). The percentage of women that had HIV testing at ANC increased from 0% in 2004/5 to 92% in 2010 and 88% in 2015/16. There was an increase in the proportion of women with blood pressure measurement from 73% in

Table 2. Distribution of women by number of antenatal care visits in Malawi between 2004 and 2016.

Characteristics	Total				2004–5				2010				2015–16			
	<4 ANC		ANC4+		<4 ANC		ANC4+		<4 ANC		ANC4+		<4 ANC		ANC4+	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Total	18937	71.9	7449	28.1	4755	78.7	1257	21.3	8199	76.0	2603	24.0	5983	63.2	3589	36.8
Age group																
15–19	1931	72.6	740	27.4	467	76.7	135	23.3	735	74.4	262	25.6	729	68.9	343	31.1
20–24	5857	71.4	2355	28.6	1613	77.2	468	22.8	2348	75.3	770	24.7	1896	63.3	1117	36.7
25–29	4678	71.7	1864	28.3	1197	80.4	289	19.6	2182	75.0	721	25.0	1299	61.3	854	38.7
30–34	3244	72.2	1263	27.8	723	80.1	171	19.9	1472	78.0	425	22.0	1049	61.9	667	38.1
35–39	2077	71.8	812	28.2	461	77.8	122	22.2	938	76.3	283	23.7	678	63.6	407	36.4
40–44	877	74.7	299	25.3	222	82.0	51	18.0	384	79.0	107	21.0	271	65.0	141	35.0
45–49	273	71.4	116	28.6	72	78.2	21	21.8	140	82.5	35	17.5	61	50.5	60	49.5
Region																
North	3180	70.7	1326	29.3	588	77.9	158	22.1	1462	75.3	493	24.7	1130	62.8	675	37.2
Centre	6541	71.5	2663	28.5	1804	80.1	443	19.9	2707	74.1	972	25.9	2030	63.0	1248	37.0
South	9216	72.6	3460	27.4	2363	77.7	656	22.3	4030	77.8	1138	22.2	2823	63.5	1666	36.5
Number of children ever born																
1	3905	67.3	1882	32.7	951	73.3	333	26.7	1435	70.8	588	29.2	1519	61.6	961	38.4
2–3	6909	72.1	2712	27.9	1762	79.6	450	20.4	2937	76.2	922	23.8	2210	63.0	1340	37.0
4–5	4586	73.6	1688	26.4	1128	81.3	248	18.7	2091	77.5	622	22.5	1367	64.2	818	35.8
6+	3537	75.0	1167	25.0	914	79.9	226	20.1	1736	78.8	471	21.2	887	65.0	470	35.0
Education level																
None	3267	76.7	1007	23.3	1206	81.4	275	18.6	1337	79.0	374	21.0	724	67.1	358	32.9
Primary	12893	72.7	4860	27.3	3065	79.1	794	20.9	5767	76.7	1750	23.3	4061	64.3	2316	35.7
Secondary	2678	65.6	1426	34.4	478	71.1	181	28.9	1061	70.6	446	29.4	1139	59.8	799	40.2
Tertiary	99	39.9	156	60.1	6	32.7	7	67.3	34	50.5	33	49.5	59	36.0	116	64.0
Wealth index quintile																
Poorest	4323	75.1	1445	24.9	954	82.2	206	17.8	1939	79.8	500	20.2	1430	66.5	739	33.5
Poorer	4309	72.8	1625	27.2	1111	79.1	281	20.9	1873	77.1	573	22.9	1325	63.9	771	36.1
Middle	4110	72.7	1560	27.3	1103	79.1	286	20.9	1820	75.3	608	24.7	1187	64.6	666	35.4
Richer	3563	71.7	1405	28.3	925	77.9	258	22.1	1533	75.0	497	25.0	1105	63.7	650	36.3
Richest	2632	65.4	1414	34.6	662	73.9	226	26.1	1034	70.9	425	29.1	936	55.8	763	44.2
Residence																
Urban	2108	67.3	1132	32.7	491	74.8	164	25.2	751	73.2	286	26.8	866	56.6	682	43.4
Rural	16829	72.8	6317	27.2	4264	79.0	1093	21.0	7448	76.4	2317	23.6	5117	64.4	2907	35.6
Sources of antenatal care knowledge																
Frequency of listening to radio																
Less than once a week	9740	71.9	3831	28.1	1765	81.8	381	18.2	3692	77.8	1075	22.2	4283	64.7	2375	35.3
At least once a week	9197	71.9	3618	28.1	2990	77.0	876	23.0	4507	74.6	1528	25.4	1700	59.7	1214	40.3
Frequency of watching television																
Less than once a week	17503	72.7	6633	27.3	4550	78.9	1182	21.1	7444	76.5	2318	23.5	5509	64.5	3133	35.5
At least once a week	1434	63.5	816	36.5	205	73.0	75	27.0	755	72.0	285	28.0	474	50.6	456	49.4
Barriers to access antenatal care																
Permission to visit health services																
No problem	16620	72.1	6456	27.9	4357	78.9	1133	21.1	7250	76.2	2274	23.8	5013	62.9	3049	37.1
Big problem	2317	70.4	993	29.6	398	76.7	124	23.3	949	74.8	329	25.2	970	64.8	540	35.2
Money to pay for health services																
No problem	8303	70.2	3590	29.8	1668	76.7	489	23.3	3728	75.8	1220	24.2	2907	61.3	1881	38.7

(*Continued*)

Table 2. (Continued)

Characteristics	Total				2004–5				2010				2015–16			
	<4 ANC		ANC4+		<4 ANC		ANC4+		<4 ANC		ANC4+		<4 ANC		ANC4+	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Big problem	10634	73.3	3859	26.7	3087	79.7	768	20.3	4471	76.2	1383	23.8	3076	64.9	1708	35.1
Distance to health facilities																
No problem	7674	70.6	3236	29.4	1720	76.7	504	23.3	3258	76.4	1016	23.6	2696	61.9	1716	38.1
Big problem	11263	72.8	4213	27.2	3035	79.8	753	20.2	4941	75.8	1587	24.2	3287	64.3	1873	35.7
Presence of companion																
No problem	13428	71.8	5334	28.2	3487	78.6	924	21.4	5625	76.3	1755	23.7	4316	62.9	2655	37.1
Big problem	5509	72.1	2115	27.9	1268	78.7	333	21.3	2574	75.4	848	24.6	1667	64.0	934	36.0
No drugs at health facility																
No problem	9991	74.2	3482	25.8	4755	78.7	1257	21.3	3246	76.1	1007	23.9	1990	62.7	1218	37.3
Big problem	8946	69.7	3967	30.3	0	0.0	0	100.0	4953	76.0	1596	24.0	3993	63.4	2371	36.6
No female provider																
No problem	15046	71.8	5935	28.2	4090	78.8	1068	21.2	6391	76.1	2028	23.9	4565	62.2	2839	37.8
Big problem	3891	72.3	1514	27.7	665	77.8	189	22.2	1808	75.8	575	24.2	1418	66.4	750	33.6
Marital status																
Never married	629	73.7	242	26.3	110	80.2	28	19.8	213	74.9	68	25.1	306	71.1	146	28.9
Married	16134	71.7	6388	28.3	4146	78.4	1111	21.6	7057	75.9	2254	24.1	4931	62.4	3023	37.6
Widowed	330	74.1	115	25.9	92	80.2	21	19.8	144	78.2	41	21.8	94	64.1	53	35.9
Divorced	1844	73.1	704	26.9	407	80.6	97	19.4	785	77.4	240	22.6	652	65.4	367	34.6

<4 ANC = Less than four early antenatal care (ANC) visits.

ANC4+ = At least four ANC visits prior to six months of first ANC visit.

% = weighted percentage.

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2004/5 to 82% in 2015/16. We observed increasing trend in the percentage of women that received iron tablets from 80% to 92% (see Fig 1).

Timing of antenatal care visits. The median time of presenting for the first ANC care was 5 months (IQR: 4–6). Over the time period, there is strong evidence of association between timing of first ANC visit by survey year (P<0.001). The proportion of women with less than four ANC visits varied by survey year and month of first ANC visit. In general, the proportion of women with less than four ANC visits was the highest in 2010 while the least was observed in 2004.

The characteristics of women with at least four ANC visits regardless of the timing of the first ANC visit are shown in Table 4. A total of 12738 women had at least 4 ANC visits regardless of timing of their first visit. Of these, 9353 (74%) started ANC after the fourth month of pregnancy. Between 2004 and 2016, we observed a decreasing trend in the proportion of women with who attended their first ANC visit after four months from 88% in 2004/5 to 61% in 2015/16. There was increasing trend in proportion of women with late attendance of ANC by parity (see Table 4). However, increasing level of education was associated with increasing trend in the proportion of women with early attendance of ANC from 21% amongst those with no education to 52% amongst those with tertiary education.

Discussion

The primary aim of this study was to explore the social and demographic factors associated with early initiation of ANC4+ in women in Malawi between 2004 and 2016 using MDHS data

Table 3. Bivariate and multivariate odds ratios for factors associated with attending at least four or more antenatal care visits prior to prior to six months of first antenatal care visit in Malawi, 2004–2016.

Characteristics (n = 26386)	Bivariate analysis		Multivariate analysis	
	OR (95%CI)	P-value	OR (95%CI)	P-value
Age group				
15–19	1.00		1.00	
20–24	1.06 (0.90–1.26)	0.49	1.27 (1.05–1.53)	0.01
25–29	1.05 (0.88–1.25)0.59	0.22	1.44 (1.15–1.81)	0.002
30–34	1.02 (0.85–1.23)	0.82	1.49 (1.15–1.93)	0.003
35–39	1.04 (0.85–1.28)	0.69	1.64 (1.22–2.20)	0.001
40–44	0.90 (0.68–1.18)	0.44	1.51 (1.05–2.16)	0.02
45–49	1.06 (0.70–1.61)	0.77	1.91 (1.18–3.09)	0.008
Year				
2004/5	1.00		1.00	
2010	1.16 (1.02–1.33)	0.025	1.15 (1.01–1.32)	0.04
2015/16	2.15 (1.89–2.45)	<0.001	2.03 (1.78–2.32)	<0.001
Region				
North	1.00			
Centre	0.96 (0.84–1.11)	0.56		
South	0.91 (0.79–1.04)	0.18		
Number of children ever born				
1	1.00		1.00	
2–3	0.80 (0.71–0.90)	<0.001	0.74 (0.63–0.86)	<0.001
4–5	0.74 (0.65–0.85)	<0.001	0.65 (0.53–0.80)	<0.001
6+	0.69 (0.59–0.80)	<0.001	0.61 (0.47–0.79)	<0.001
Education level				
None	1.00		1.00	
Primary	1.23 (1.08–1.41)	0.003	1.10 (0.95–1.28)	0.19
Secondary	1.72 (1.46–2.03)	<0.000	1.24 (1.02–1.51)	0.032
Tertiary	4.95 (3.20–7.66)	<0.001	2.64 (1.65–4.22)	<0.001
Wealth index quintile				
Poorest	1.00		1.00	
Poorer	1.12 (0.97–1.30)	0.11	1.14 (0.98–1.31)	0.09
Middle	1.13 (0.98–1.31)	0.10	1.15 (1.00–1.34)	0.06
Richer	1.19 (1.02–1.38)	0.023	1.16 (0.99–1.35)	0.06
Richest	1.60 (1.37–1.86)	<0.001	1.32 (1.12–1.58)	<0.001
Residence				
Urban	1.00			
Rural	0.72 (0.63–0.83)	<0.001		
Sources of antenatal care knowledge				
Frequency of listening to radio				
Less than once a week	1.00			
At least once a week	1.00 (0.91–1.10)	1.00		
Frequency of watching television				
Less than once a week	1.00			
At least once a week	1.53 (1.31–1.79)	<0.001		
Barriers to access antenatal care				
Permission to visit health services				
No problem	1.00			

(*Continued*)

Table 3. (Continued)

Characteristics (n = 26386)	Bivariate analysis		Multivariate analysis	
	OR (95%CI)	P-value	OR (95%CI)	P-value
Big problem	1.09 (0.95–1.25)	0.23		
Money to pay for health services				
No problem	1.00			
Big problem	0.86 (0.78–0.94)	0.001		
Distance to health facilities				
No problem	1.00			
Big problem	0.90 (0.82–0.99)	0.028		
Presence of companion				
No problem	1.00			
Big problem	0.99 (0.89–1.09)	0.80		
No drugs at health facility				
No problem	1.00			
Big problem	1.25 (1.14–1.37)	<0.001		
No female provider				
No problem	1.00			
Big problem	0.98 (0.87–1.09)	0.67		
Marital status				
Never married	1.00			
Married	1.11 (0.85–1.45)	0.45		
Widowed	0.98 (0.62–1.55)	0.94		
Divorced	1.03 (0.76–1.40)	0.85		

OR = weighted odds ratios of attending at least four antenatal care (ANC) visits prior to six months of first ANC visit.

95%CI = 95% Confidence Interval.

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from three nationally representative surveys. Most studies exploring the factors associated with ANC uptake have not taken into account the month of the first ANC visit in calculating the distributions of women with ANC4+ visits. To our knowledge, this is the first study in Malawi that has analysed the likelihood of a pregnant woman having early initiation of ANC4 + visits. Whilst attendance of ANC4+ has often been a focus of ANC service use research in SSA, both early attendance for the first ANC visit and undertaking the recommended number of visits per-pregnancy are important for pregnancy outcomes. Early initiation of ANC allows healthcare workers to improve both maternal and perinatal outcomes by undertaking screening and tests that are more efficacious in early pregnancy, including accurate gestational dating or screening for maternal anaemia [9]. Identification of these complications early allows for the appropriate management for the length of pregnancy to improve outcomes. It is equally important that women also undertake visits for the length of their pregnancy, not only so indicated screening and treatment can continue, but to prepare women for birth and potential complications of delivery, which can lead to increased likelihood of women seeking facility delivery [26].

The results of this study provide vital insight into how coverage of ANC4+ changed during this time period and may highlight potential barriers that could be faced whilst rolling-out the updated WHO eight 'contact' ANC model, through identification of which women are at risk of attending ANC too late and at an insufficient frequency. However, it should be noted that whilst early initiation of ANC is significantly associated with attendance of ANC4+ and ANC8

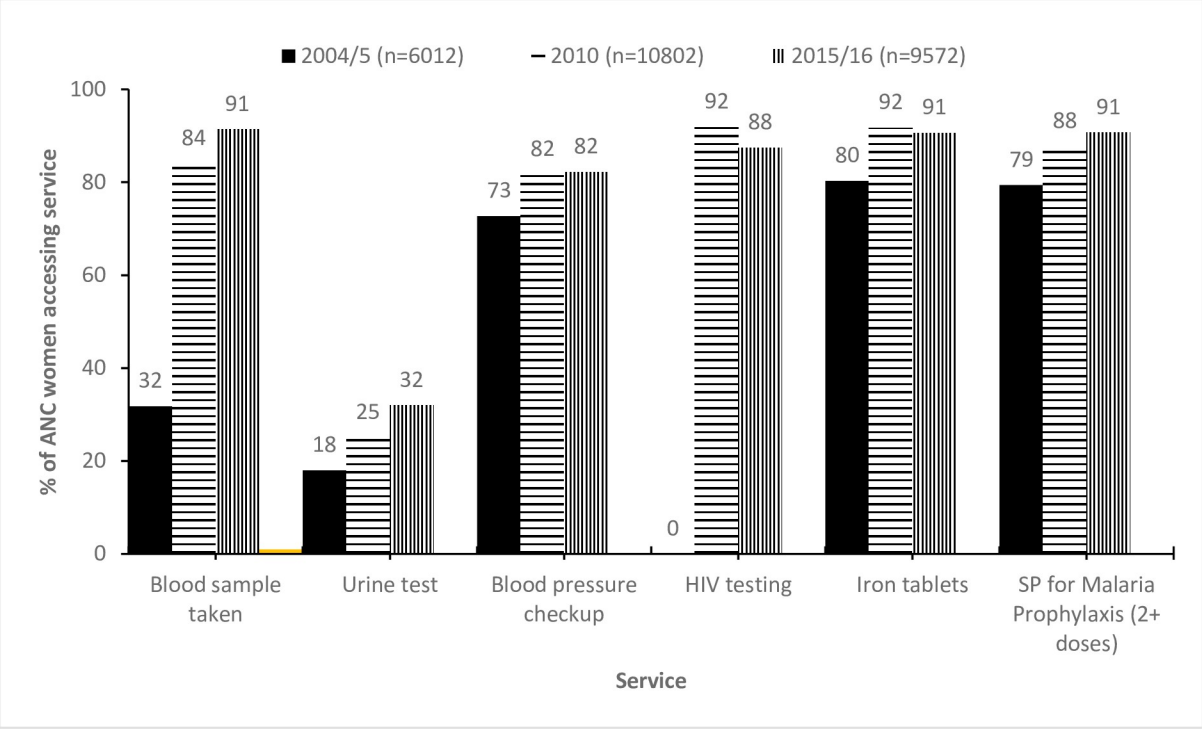

Fig 1. Services received by women that attended antenatal care in Malawi between 2004 and 2016. SP = Sulfadoxine-Pyrimethamine, % = weighted percentage.

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+ in other LMIC settings [8], other socio-demographic determinants of ANC8+ in Malawi may not be consistent with those found in this study due to increased time commitment and possible associated costs of attending an increased number of visits. Additionally, the focus of this study is limited to individual-level socio-demographic factors and their influence on early initiation of ANC4+. As we outline below, we are unable to fully explore the effect of other key determinants of health care seeking such as quality of care on ANC attendance as this is not suitably captured within the datasets we used for our analysis.

Significant predictors of early initiation of ANC4+ attendance, determined through our analysis and discussed below, included maternal factors (number of children ever born, age, marital status) and socio-economic factors (wealth quintile and education status). The positive relationship between higher wealth and education status and increased likelihood of early initiation of ANC4+ highlight considerable inequalities present in ANC attendance in the population. Our results demonstrate that women are significantly more likely to have initiated ANC4 + early in 2015 than in 2004 (21% of women in 2004 vs 37% of women in 2015). Similarly, women who received care were more likely to receive key interventions during their ANC as we found substantial increases in the coverage of essential interventions between 2004 and 2016 including undertaking full blood counts, performing urine dipsticks to detect bacteremia and/or pre-eclampsia, malaria prophylaxis and HIV testing suggesting an overall improvement in quality of ANC services. Whilst this is promising, only 37% of women surveyed in 2015 had initiated ANC4+ early. With the sub-optimal number of women attending the ANC4+, the implementation of the at least eight ANC visits in settings like Malawi may not be feasible as echoed by authors of studies analyzing coverage of ANC in other LIC settings [8].

Table 4. Distribution of women with at least four antenatal care visits by the socio-demographic characteristics of the women in Malawi between 2004 and 2016.

Characteristics	ANC attendance for women with ANC4+			
	Early		Late	
	n	%	n	%
Total	3385	26.0	9353	74.0
Age group				
15–19	327	26.4	888	73.6
20–24	1046	26.5	2867	73.5
25–29	870	25.9	2371	74.1
30–34	581	26.4	1604	73.6
35–39	373	25.5	1035	74.5
40–44	133	22.8	444	77.2
45–49	55	26.2	144	73.8
Year				
2004/5	405	12.1	2957	87.9
2010	1081	22.5	3507	77.5
2015/16	1899	39.1	2889	60.9
Region				
North	674	30.2	1523	69.8
Centre	1158	25.0	3396	75.0
South	1553	25.5	4434	74.5
Number of children ever born				
1	834	27.5	2151	72.5
2–3	1255	26.9	3297	73.1
4–5	771	25.3	2233	74.7
6+	525	23.1	1672	76.9
Education level				
None	417	21.3	1541	78.7
Primary	2224	25.9	6177	74.1
Secondary	645	28.1	1545	71.9
Tertiary	99	52.0	90	48.0
Wealth index quintile				
Poorest	691	27.7	1807	72.3
Poorer	678	23.9	2139	76.1
Middle	708	25.1	1988	74.9
Richer	637	25.8	1803	74.2
Richest	671	28.0	1616	72.0
Residence				
Urban	527	28.0	1268	72.0
Rural	2858	25.7	8085	74.3
Sources of antenatal care knowledge				
Frequency of listening to radio				
Less than once a week	1805	28.1	4486	71.9
At least once a week	1580	24.0	4867	76.0
Frequency of watching television				
Less than once a week	2982	25.5	8515	74.5
At least once a week	403	30.8	838	69.2
Barriers to access antenatal care				

(*Continued*)

Table 4. (Continued)

Characteristics	ANC attendance for women with ANC4+			
	Early		Late	
	n	%	n	%
Permission to visit health services				
No problem	2934	25.6	8247	74.4
Big problem	451	29.0	1106	71.0
Money to pay for health services				
No problem	1716	28.4	4158	71.6
Big problem	1669	24.1	5195	75.9
Distance to health facilities				
No problem	1530	27.1	3914	72.9
Big problem	1855	25.2	5439	74.8
Presence of companion				
No problem	2454	26.0	6720	74.0
Big problem	931	26.0	2633	74.0
No drugs at health facility				
No problem	1532	21.9	5277	78.1
Big problem	1853	30.5	4076	69.5
No female provider				
No problem	2717	25.9	7556	74.1
Big problem	668	26.5	1797	73.5
Marital status				
Never married	102	25.8	274	74.2
Married	2903	25.8	8079	74.2
Widowed	46	22.2	170	77.8
Divorced	334	28.5	830	71.5

% = weighted percentage.

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We have reported a number of key determinants of early initiation of ANC4+ in this study. Increasing number of children ever born was associated with a reduced likelihood of ANC4+, with those women who have delivered more than 5 children being the least likely to undergo early initiation of ANC4+ visits. These findings are largely consistent with literature both in Malawi [13] and across SSA [27] and other LIC with high MMR [13]. It is plausible that women who have given birth and accessed these services before, possibly multiple times, are less likely to seek care as they feel that they are equipped with sufficient knowledge to proceed without formal maternity care. Additionally, the quality of maternity care women receive in Malawi remains variable, with some women reporting extensive stock outs and reception of treatment that lacked dignity or respect [28]. Although we infer quality of ANC service, we did not have data on quality of ANC services as such data were not collected by the MDHS. Women who have experienced poor quality may be less likely to seek care again, something that may happen with increasing frequency as number of children ever born increases. The relationship between increasing number of children ever born and reduced access to services is not unique to ANC but is present across other essential maternal and child health services both in Malawi and a number of countries with higher fertility rates [28]. The link between higher order births and increased risk of maternal and perinatal mortality is well described in the literature and it is possible that the inverse relationship between number of children ever born and service-use may be a contributing factor in this phenomenon [29].

Interestingly, whilst increasing number of children ever born was found to be associated with a reduced likelihood of early initiation of ANC4+, the opposite appears true regarding age, as women aged between 45 and 49 in our study population were nearly twice as likely to attend ANC4+ earlier than the youngest mothers after adjusting for number of children ever born and other factors. Whilst this association has been supported by findings from a number of studies exploring coverage of ANC, it has not been universally reported in the literature [27]. Older age does seem to affect care-seeking for other maternity services with older nulliparous women more likely to access facility delivery than their younger counterparts in a number of SSA regions [30].

Factors pertaining to a woman's socio-economic status, namely wealth quintile and level of education were found to be associated with early initiation of ANC4+ in this study. Women in the highest wealth quintile and those who had undertaken tertiary education were more likely to have initiated ANC early than their counterparts. The associations between both education and wealth level and maternal care seeking are similarly well documented in SSA and is not limited to access to ANC [13,27,31]. Despite women from lower wealth quintiles being least likely demonstrate early initiation of ANC4+ services provided through both public and Christian mission (CHAM) facilities in Malawi have been exempt from user-fees, and therefore free at the point of use, since 2004. This suggests that out-of-pocket payments provided to health-care workers when accessing services is unlikely to explain the relationship between wealth level and the primary outcome. This relationship however could be explained by other costs associated with accessing services such as transportation. Initial exemption of user-fees following the initialization of service-level agreement between the Malawian Ministry of Health and CHAM facilities lead to increased utilization of maternity services in CHAM facilities [32]. However, in Tanzania cost was found to be a barrier for accessing ANC services [33].

Our study does have several limitations. Whilst the combined outcome variable capturing early attendance and complete attendance of the FANC model may be useful in determining who is more likely to engage successfully with ANC services, we were unable to assess the quality of these visits which may have impacted on a woman's propensity to seek further care. Additionally, the results for any variable captured in the MDHS survey at the time of administration may differ from the result at the time of last pregnancy and birth (i.e., changes in wealth or education over time). Similarly, time lag between administration and last birth may make survey responses vulnerable to recall bias and, as with all survey data, data captured in the MDHS is self-reported and subject to reporting bias, such as social desirability bias. We also recognize that the important factors which might influence ANC such as hypertension, diabetes and previous HIV status prior to the current pregnancy were not captured in the MDHS hence these were not included in this analysis. Finally, although HIV status being captured in the MDHS, there is no information on the timing of the HIV status to the pregnancy.

Conclusion

In conclusion, whilst coverage of early initiation of ANC4+ and key ANC interventions in Malawi have increased significantly since 2004, there remains inequality in determinants of access to early initiation of ANC4+. Key socio-economic factors (education and and wealth) continue to impact women's likelihood of accessing these vital services and in 2016, just over a third of women surveyed were undertaking the recommended number of visits under the FANC model with the first ANC visit initiated early. Ensuring that all women are able to engage with ANC services at the appropriate point in their pregnancy and at the correct frequency will require consideration of the impact of inequality on how women engage with ANC services.

Supporting information

S1 File.
(ZIP)

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