Tropical Medicine and International Health doi:10.1111/tmi.12788

VOLUME 21 NO 12 PP 1552–1561 DECEMBER 2016

Effects of planned, mistimed and unwanted pregnancies on the use of prenatal health services in sub-Saharan Africa: a multicountry analysis of Demographic and Health Survey data

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Abstract

OBJECTIVES We analysed the extent of planned, mistimed and unwanted pregnancies and how they predict optimal use of prenatal (timing and number of antenatal) care services in 30 African countries.

METHODS We pooled data from Demographic and Health Surveys conducted in 30 African countries between 2006 and 2015. We described the extent of mistimed and unwanted pregnancies and further used mixed effects logistic and Poisson regression estimation techniques to examine the impacts of planned, mistimed and unwanted pregnancies on the use of prenatal health services.

RESULTS In total, 73.65% of pregnancies in all countries were planned. Mistimed pregnancy ranged from 7.43% in Burkina Faso to 41.33% in Namibia. Unwanted pregnancies were most common in Swaziland (39.54%) and least common in Niger (0.74%). Timely (first trimester) initiation of ANC was 37% overall in all countries; the multicountry average number of ANC visits was optimal [4.1; 95% CI: 4.1–4.2] but with notable disparities between countries. Overall, mistimed and unwanted pregnancies were strongly associated with late ANC attendance and fewer visits women made in the pooled analysis.

CONCLUSIONS Unintended pregnancies are critical risks to achieving improved maternal health in respect of early and optimal ANC coverage for women in Africa. Programmes targeted at advancing coverage of ANC in Africa need to deploy contextually appropriate mechanisms to prevent unintended pregnancies.

keywords planned, mistimed, unwanted, pregnancy, prenatal, Africa

Introduction

Poor maternal and child health indicators remain unacceptably high in the developing world, particularly in sub-Saharan Africa (SSA), despite the steady global progress in reducing pregnancy and childbirth-related deaths by 40% between 1990 and 2015. Still, roughly 830 women die every day of preventable conditions related to pregnancy and childbirth, with an estimated 303 000 deaths in 2015 in SSA [1]. Although the Millennium Development Goals' target of reducing maternal mortality by three quarters was not uniformly achieved globally, the gains made offer hope for achieving more. Consequently, there is renewed commitment by countries to reduce the global maternal mortality ratio to <70 per 100 000 live births by 2030 [2]. Preventive care against causes of maternal deaths, especially the direct ones, can be strengthened during the prenatal period through optimal use of antenatal care (ANC) services [3].

WHO recommends a minimum of at least four ANC visits for pregnant women to be assisted by a skilled attendant, spaced at regular intervals through the pregnancy, with the first visit recommended in the first trimester of pregnancy [4]. Benefits of early ANC visits are iron–folic acid (IFA) supplementation, tetanus toxoid (TT) injections, treatment of maternal and placental malaria, advice and counselling on prevention, detection and treatment of anaemia and other conditions [5–10]. Evidence shows that about 14% of maternal deaths, of which the majority occurs in sub-Saharan Africa (SSA), are associated with hypertensive disorders [11]. Fortunately, the first ANC visit in the first trimester can contribute to averting such deaths since the first ANC is devoted to identifying women who require standard

care (four visits) from those who need specialised and more than four ANC care [12]. Using data from a demographic surveillance site in Kenya, Desai *et al.* [1] found that one-third of maternal deaths were caused by infectious diseases – malaria, HIV and tuberculosis, which could have been averted by early detection during the pregnancy period. Others (e.g. [13, 14]) also attest to the important association between pregnancy intentions and adequate ANC coverage. For example, Muhwava *et al.* [13] revealed that women who wanted a pregnancy were twice more likely to have a first trimester ANC attendance than those who did not. Wado *et al.* [15] also reported similar findings in Ethiopia.

Much progress has been made globally towards increasing access to, and use of, ANC, although the overall proportion of women obtaining the WHO-recommended minimum of four visits is still small [13–15]. Similarly, it has been observed that women who seek antenatal care mostly do so later than within the recommended first 3 months of pregnancy (Central Statistical Authority [16] Ethiopia and International, 2012, [14]. Several factors affect ANC coverage/attendance: age, premarital status, maternal education, husband's education, availability of health service, cost of health services, household income, employment status, media exposure and having a history of obstetric complications. But the direction and magnitude of effect is inconsistent across time and space [17–20].

A woman's attitude and feelings about a particular pregnancy may influence her prenatal behaviours, such as whether she would avail herself of the recommended antenatal visits and their benefits [21–23]. Unintended pregnancy – defined as a pregnancy that is mistimed (i.e. earlier than desired) or unwanted – can lead to negative consequences for women and children. Unintended pregnancy may determine the behaviour of mothers both during and after pregnancy, which may directly impact on the health and well-being of the child [24, 25] with unintended pregnancies linked to elevated morbidity and mortality for both women and children [26, 27]. Yet, rates of unintended pregnancies worldwide are high. For instance, 41% of the 208 million pregnancies estimated worldwide in 2008 were unintended, averaging 86 per 1000 [28] in Africa. These unintended pregnancies largely reflect unavailability, rare or inconsistent use of contraception [29].

Prior research, exploring the relationship between unintended pregnancies and prenatal behaviours, has produced mixed results, with a majority of these studies indicating a positive association between pregnancy intentions and use of prenatal health services (e.g. [30, 31]). In a comprehensive review of evidence on unintended pregnancies and maternal and child health, Gipson *et al.* [21] identified the scarce evidence on the subject from developing countries as a major gap for further research. Pooling large household surveys across Africa, where ANC coverage levels are comparatively low compared to other regions, our current study contributes to understanding the connections between pregnancy intentions and the use of ANC (timing and number) services in 30 African countries where data are available for the last 10 years. We also control for the socio-economic (wealth and education) and demographic (age and parity/number of children) characteristics of women to test the resilience of pregnancy intentions on the use of prenatal health services.

Methods

Data

Data for this study were drawn from Demographic and Health Surveys (DHS) conducted in 30 African countries. Since the late 1980s, DHS have been conducted in several African and Asian countries as a way of generating demographic and health indicators for national planning. The main aim of the DHS programme is to provide data on women of reproductive age (15–49 years) and on the welfare of their children. To allow for cross-country comparison of basic indicators of health and demographic variables, the surveys follow the same data collection techniques – sampling, data collection, and coding and analysis procedures. The survey in each country employs a two-stage stratified sampling procedure for selecting respondents. The first stage involves stratifying regions/provinces into urban and rural areas. A probability-proportional-to-size selection procedure is then used to select enumeration areas (EAs) or clusters in urban and rural areas. At the second stage, a fixed number of households per cluster or EA are selected with equal probability from household lists in each cluster. Interviewers are required to visit and interview only the selected households without any condition of replacement to avoid or minimise biases. In each selected household, all women aged 15–49 years who are usual residents or who slept in the selected households in the previous night (de facto residence) prior to the survey are considered eligible respondents. In each country, the most recent survey, mainly conducted in the last 10 years (2006–2007 and 2014), was used in this study. Each individual respondent gave both written and verbal consent. Ethical clearance was obtained from the respective national bodies responsible for granting such approvals. The data sets are publicly available on request at www.measuredhs.org.

Definition of variables

Outcome variables. The two main outcome variables of interest were as follows: timing of first ANC – whether it occurred in the first trimester or later and the second was number of ANC visits. Regarding first ANC, women were asked to indicate the month during the pregnancy period when they attended the first ANC. This variable was recategorised into first trimester = 1 or otherwise = 0, given that ANC attendance in the first trimester is more beneficial to women and their children than those occurring later in pregnancy (see, [32, 33]). For the second dependent variable, respondents were asked to indicate the number of ANC visits for the reference pregnancy/childbirth. The ANC continuum of care recommends a minimum of four visits for uncomplicated pregnancies and more, depending on health provider's assessment of the pregnant woman. However, because this was captured as a continuous variable, we restricted the analysis to women with the exact count of number of ANC visits.

Key explanatory variable and covariates. In all surveys, respondents answered questions about each child they had had in the preceding five years as well as any current pregnancy. One of these questions was whether the birth or pregnancy was wanted then (planned), wanted later (mistimed) or not wanted at all (unplanned) at the time of conception. Since each of these outcomes measures different aspect of pregnancy planning or decision-making, we maintained the original categorisation. Our analysis was based on ANC records for the most recent birth of interviewed women. The use of the most recent records on ANC was due to the possibility of recall errors associated with reproductive events that had occurred relatively earlier [34]. To help us gauge the magnitude of effect of pregnancy planning on utilisation of prenatal health services, we included maternal education, wealth, measured at the household level (recategorised into terciles – poor, average and wealthiest), residence (urban–rural), age and parity of women, which have been noted as potential confounders to maternal and child health (MCH) services utilisation [35, 36].

Statistical analysis

Descriptive and inferential statistics were performed. The descriptive figures are reported in means (with corresponding confidence intervals) for continuous variables (number of ANC attendance, age and number of children) and proportions for categorical variables (wealth, education and timing of first ANC) by country, an approach commonly used in presenting multicountry analysis of large-scale household surveys (e.g. [37]). We first estimated crude odds ratios (ORs) and incident risk ratios (IRRs) for each country to determine whether the effects of pregnancy intentions were consistent on timing and number of ANC visits and across countries. Logistic regression was used to test for the statistical significance of pregnancy intentions (wanted, mistimed and unwanted) on timing of first ANC attendance at both bivariate and multivariate levels. Poisson regression was used to analyse the effects on the number of ANC visits, given its count nature. To account for randomness at the country level, we applied mixed effect logistic and Poisson regressions in the estimation. We also present only the pooled country-level mixed models, instead of specific countries,[1] showing country-level variance consistent with the extant literature (e.g. [38–40]). The analyses took into account clustering at primary sampling level and weighting factors to generate representative results within and across countries.

Results

Characteristics of respondents across countries

Selected information on the 30 African countries is shown in Table 1. Mistimed pregnancy ranged from 7.43% in Burkina Faso to 41.33% in Namibia. Unwanted pregnancies were most frequent in Swaziland (39.54%) and rarest in Niger (0.74%). Overall, approximately one quarter (26.37%) of the most recent births were unintended (18.52% mistimed; 7.85% unwanted). The average number of ANC attendances ranged from 1.6 (95% CI: 1.5–1.6) in Ethiopia to 8.5 (95% CI: 8.4–8.6) in Egypt with a total average of 4.1 (95% CI: 4.1–4.2) for all countries. In 12 countries, women reported fewer than the optimum (4) number of ANC visits (Table 1, panel 3). Across the 30 countries, 37% of women had their first ANC in the first trimester. This varied across the countries, with 83% of women attending first trimester ANC in Egypt *vs.* 13% in Malawi. Other countries with fewer than 20% reporting first ANC in the first trimester were DR Congo (19%), Mozambique (14.5%) and Tanzania (15.4%). Average parity was lowest in Namibia and Lesotho (1.8, 95% CI: 1.7–1.9) and highest in Niger (4.2, 95% CI: 4.1–4.2). The aggregated mean parity was approximately three

[1]We did analyse multivariable estimates of timing of first ANC and the number of ANC visits that are not reported here for the sake of brevity and economy of space. Nonetheless, some of the findings from the individual country multivariable estimates are mentioned here.

Table 1 Background characteristics of sampled women in 30 African countries

Country	Weighted *N**	Mean ANC visits (95% CI)	% First trimester ANC visit	% of Mistimed pregnancy	% of Unwanted pregnancy	Parity (95% CI)	Mean age	% Urban	% Wealthiest	% No education
Burkina Faso, 2010	10 356	3.0 (3.0–3.1)	43.38	7.43	1.85	3.0 (3.2–3.3)	28.8	27.06	44.7	73.97
Benin, 2011–2012	8723	4.2 (4.2–4.3)	55.35	13.49	6.67	2.7 (2.6–2.8)	28.9	46.46	46.12	59.52
Burundi, 2011	4902	3.2 (3.1–3.2)	20.86	26.65	6.48	2.7 (2.6–2.8)	27.7	10.67	39.70	44.85
DR Congo, 2013–2014	11 214	3.5 (3.4–3.6)	18.93	26.17	6.15	3.0 (3.0–3.1)	28.1	38.38	43.72	15.42
Congo Bra., 2011–2012	6429	4.8 (4.8–4.9)	49.55	26.77	4.32	2.4 (2.4–2.5)	28.6	68.60	43.03	5.77
Cote d'Ivoire, 2011–2012	5392	3.4 (3.3–3.5)	32.54	22.79	4.02	2.6 (2.6–2.7)	28.4	51.39	46.15	53.19
Cameroon, 2011	7566	4.2 (4.1–4.3)	40.30	19.15	7.63	2.7 (2.6–2.8)	27.9	53.86	47.13	20.01
Egypt, 2015	11 224	8.5 (8.4–8.6)	83.28	8.12	10.33	2.7 (2.7–2.8)	33.0	35.03	40.25	24.04
Ethiopia, 2011	7737	1.6 (1.5–1.6)	26.38	21.40	10.85	2.9 (2.8–2.9)	27.7	23.90	45.16	50.83
Gabon, 2012	4093	5.3 (5.2–5.4)	66.89	36.25	6.10	2.4 (2.1–2.3)	28.4	88.64	45.06	4.43
Ghana, 2014	4272	6.5 (6.3–6.5)	65.73	24.90	8.02	2.3 (2.3–2.4)	29.8	53.76	45.88	19.07
Guinea, 2012	4975	4.0 (3.0–4.1)	45.98	16.36	2.72	2.9 (2.9–3.0)	28.4	36.34	44.11	66.98
Kenya, 2014	14 898	4.0 (3.9–4.0)	20.70	27.95	12.13	2.4 (2.4–2.5)	28.9	40.83	47.47	7.00
Liberia, 2013	5127	5.8 (5.7–5.9)	68.59	27.34	5.30	2.8 (2.8–2.9)	28.5	60.97	46.05	33.18
Lesotho, 2009	3080	4.9 (4.8–5.0)	35.53	31.55	24.39	1.8 (1.7–1.9)	28.2	33.74	52.94	1.22
Madagascar, 2008–2009	8483	3.4 (3.4–3.5)	30.50	7.59	5.75	2.9 (2.8–2.9)	28.9	17.35	44.89	18.52
Mali 2012–2013	6652	3.0 (2.9–3.1)	46.50	10.96	3.20	3.3 (3.2–3.5)	28.6	24.78	43.64	75.82
Malawi, 2010	13 663	3.5 (3.5–3.6)	12.66	19.18	28.48	3.1 (3.0–3.1)	29.9	18.69	43.02	15.23
Mozambique, 2011	7516	3.5 (3.4–3.5)	14.52	12.37	4.02	2.9 (2.8–3.0)	28.6	34.72	43.81	31.23
Nigeria, 2013	19 084	4.5 (4.4–4.6)	27.03	7.63	2.18	3.0 (3.0–3.1)	28.7	42.14	43.40	37.82
Niger, 2012	7645	2.7 (2.7–2.8)	25.98	8.07	0.74	4.2 (4.1–4.2)	28.8	18.7	43.35	80.08
Namibia, 2013	3126	6.2 (6.1–6.4)	44.26	41.33	11.65	1.8 (1.8–1.9)	28.8	56.56	47.16	4.56
Rwanda, 2014–2015	5955	3.2 (3.2–3.3)	56.65	26.37	13.07	2.2 (2.2–2.3)	28.7	19.45	42.29	12.33
Sierra Leone, 2013	7270	7.5 (7.4–7.6)	45.92	12.64	2.64	3.0 (2.8–3.0)	28.4	35.62	44.32	55.02
Senegal 2010–2011	4449	3.3 (3.3–3.4)	60.85	17.71	3.35	2.4 (2.3–2.5)	28.1	53.68	46.31	51.02
Swaziland 2006–2007	2072	5.3 (5.2–5.4)	26.59	27.14	39.54	2.2 (2.2–2.4)	27.7	26.67	47.57	8.06
Togo, 2013–2014	5001	3.7 (3.6–3.7)	29.89	22.36	6.94	2.6 (2.5–2.7)	29.3	45.40	48.27	31.77
Tanzania, 2012	5325	3.4 (3.4–3.5)	15.41	23.62	4.90	2.9 (2.8–2.9)	28.6	28.52	44.53	19.13
Zambia, 2013–2014	9257	3.7 (3.7–3.8)	24.89	33.81	6.93	2.9 (2.9–3.0)	28.3	46.22	46.39	8.39
Zimbabwe, 2010–2011	4336	4.3 (4.2–4.4)	21.66	25.38	7.70	2.0 (2.0–2.1)	28.1	38.69	47.43	2.32
Total (N = 424 065)	219 822	4.1 (4.1–4.2)	36.52	18.52	7.83	2.8 (2.7–2.8)	28.6	37.9	44.81	30.93

*Number of women with data on number of ANC visits.

children. Women in urban areas were most common in Egypt (89%) and least common in Burundi (11%). More than half (53%) of women in Lesotho were in the wealthiest tercile; Burundi had the smallest proportion of women in the wealthiest tercile (40%). There were substantial variations in educational attainment across countries. For example, approximately 1% of respondents in Lesotho had no formal education, compared to approximately eight of every 10 women in Niger (Table 1).

Country-level bivariate association between mistimed and unwanted pregnancies on prenatal services utilisation

Table 2 demonstrates that in 27 of the countries, if a pregnancy was mistimed, the woman was less likely to initiate first ANC in the first trimester, with the strongest association observed in Egypt (OR = 0.54, 95% CI: 0.45–0.65) and Swaziland (OR = 0.54, 95% CI: 0.42–0.70). Unwanted pregnancies were found to negatively impact on ANC initiation in 25 countries. Similar to what was observed for mistimed pregnancy, Egyptian women who had unwanted pregnancies reported the least odds of having a first trimester ANC visit *vs*. women from other countries (Table 2). Contrary to expectations, the likelihood of more ANC visits varied substantially across countries. The strongest negative effect of mistimed pregnancy on the number of ANC was evidenced in Swaziland (IRR = 0.85 95% CI: 0.81–0.89), Zimbabwe (IRR = 0.88 95% CI: 0.85–0.91) and Lesotho (IRR = 0.88, 95% CI: 0.84–0. 92). However, mistimed pregnancies were rather positively associated with more ANC visits in Nigeria (IRR = 1.29, 95% CI: 1.21–1.38). The largest detrimental effect of unwanted pregnancy on number of ANC visits was seen in Mali (IRR = 0.78, 95% CI: 0.66–0.92).

In multivariable models for each country on each of the outcome measures, we found almost universal effect of pregnancy intentions on timing of first ANC and the number of visits women made. Regarding the timing, apart from Mozambique and Guinea where women who wanted no more children reported 42% and 34% likelihood of first trimester ANC, in all other countries, wanting no more children or wanting them later was a meaningful predictor of delaying ANC. Of the number of visits, after controlling for the covariates in all the countries, it was only in Nigeria where an unexpected association between wanting pregnancies later and no more positively increased number of ANC visits.

Pooled country results

Table 3 presents pooled results for all countries. The unadjusted negative effects of mistimed and unwanted pregnancies on initiation of early ANC attendance were 15% (OR = 0.85; 95% CI: 0.79–0.91) and 24% (OR = 0.76; 95% CI: 0.67–0.85) lower likelihood, respectively, compared to women who had a wanted pregnancy. Controlling for covariates, the negative effects of mistimed pregnancy on first ANC attendance increased by 20% (OR = 0.79; 95% CI: 0.74, 0.87), while the impacts of unwanted pregnancy attenuate (OR = 0.81, 95% CI: 0.75, 0.86; Model II Table 3) compared to Model I (Table 3).

The unadjusted association between mistimed pregnancies (IRR = 0.98, 95% CI: 0.98, 0.99) and unwanted pregnancies (IRR = 0.94, 95% CI: 0.92, 0.94) and the number of ANC visits women reported was negative. When we controlled for education, wealth, residence, age and number of children, the effects of mistimed and unwanted pregnancy compared to wanted pregnancy on the number of ANC attendance remained statistically significant (Table 3). However, the magnitude of unintended pregnancy (mistimed and unwanted) on the number of ANC visits was minimal compared to the effect on timing of first ANC. On other covariates, women's achievement of higher education had the strongest impact on initiation and frequency of ANC attendances. There were, however, no statistically significant differences between urban and rural women.

Discussion

This study aimed to examine the impacts of pregnancy intentions (wanted, mistimed and unwanted) on utilisation of prenatal care (first and total number of ANC) across Africa. The data returned evidence to show wide discrepancies in the proportion of unwanted (<1% to 40%) and mistimed (7–41%) pregnancies across the selected countries. Although explanations are not explicit from the data, we attempt some plausible explanations. First, the countries show varying fertility regimes and in high fertility countries in particular, the majority of pregnancies may be considered wanted. For example, in the specific case of Burkina Faso and Niger, the analysis shows that even though average parities were high, the prevalence of mistimed and unwanted pregnancies was low.

Also, while the English version of the DHS questionnaire is standardised across countries, there are many local languages into which questions are translated. The possibility of measurement problems becomes real. More importantly, ethnographic evidence shows that pregnancy intentions are embedded in complex social relationships, involving partners, family, peers and health workers. Some surveys have therefore added indicators such as

Table 2 Bivariate logistic and Poisson regression results on the timing of first ANC within the first trimester and the number of ANC visits women reported by country

	First ANC attendance†		Number of ANC attendance†	
Country	Mistimed (OR)	Unwanted	Mistimed	Unwanted
Burkina Faso	0.96 (0.82–1.12)	0.69 (0.49–0.95)*	1.01 (0.98–1.03)	0.99 (0.92–1.06)
Benin	0.94 (0.81–1.07)	0.86 (0.70–1.03)	0.94 (0.90–0.99)*	0.89 (0.82–0.95)**
Burundi	0.71 (0.60–84)***	0.56 (0.41–0.76)***	0.93 (0.86–0.95)***	0.90 (0.91–0.95)***
DR Congo	0.71 (0.62–0.81)***	0.77 (0.60–0.98)*	1.04 (1.00–1.07)*	1.01 (0.96–1.07)
Congo Brazzaville	0.75 (0.66–0.85)***	0.96 (0.75–1.23)	0.94 (0.91–0.97)***	0.95 (0.88–1.02)
Cote d'Ivoire	0.82 (0.70–0.96)*	0.70 (0.49–0.99)*	1.04 (1.00–1.09)*	0.98 (0.90–1.07)
Cameroon	0.95 (0.84–1.1)	0.75 (0.61–0.93)*	0.99 (0.95–1.03)	0.95 (0.90–1.00)
Egypt	0.54 (0.45–0.65)***	0.43 (0.37–0.51)***	0.90 (0.85–0.94)***	0.81 (0.77–0.85)***
Ethiopia	0.96 (0.79–1.2)	0.88 (0.67–1.2)	1.04 (0.95–1.14)	0.95 (0.84–1.08)
Gabon	0.75 (0.64–0.86)***	0.62 (0.49–0.78)***	0.97 (0.93–1.00)	0.86 (0.80–0.92)***
Ghana	0.68 (0.57–0.81)***	0.51 (0.39–0.66)***	0.93 (0.89–0.97)**	0.87 (0.81–0.94)**
Guinea	0.91 (0.77–1.10)	1.02 (0.66–1.55)	1.01 (0.95–1.06)	1.00 (0.85–1.17)
Kenya	0.87 (0.75–1.01)*	0.56 (0.45–0.70)***	0.94 (0.82–0.90)***	0.86 (0.91–0.97)***
Liberia	0.88 (0.77–1.00)	0.86 (0.70–1.10)	1.01 (0.98–1.05)	0.94 (0.88–1.00)
Lesotho	0.62 (0.52–0.75)***	0.61 (0.50–0.76)***	0.88 (0.84–0.92)***	0.82 (0.78–0.87)***
Madagascar	0.79 (0.65–0.96)*	0.55 (0.42–071)***	0.92 (0.88–0.97)**	0.87 (0.82–0.92)***
Mali	1.12 (0.95–1.45)	1.00 (0.68–1.48)	0.99 (0.92–1.07)	0.78 (0.66–0.92)**
Malawi	0.89 (0.78–1.02)	0.89 (0.79–100)	0.96 (0.94–0.97)***	0.96 (0.94–0.97)***
Mozambique	1.06 (0.88–1.28)	1.41 (1.07–1.84)*	1.04 (1.00–1.08)	1.04 (0.98–1.10)
Nigeria	1.02 (0.89–1.18)	0.89 (0.69–1.16)	1.29 ((1.21–1.38)***	1.45 (1.31–1.60)***
Niger	0.96 (0.79–1.72)	1.60 (0.89–2.86)	1.02 (0.97–1.07)	0.94 (0.82–1.08)
Namibia	0.90 (0.78–1.03)	0.76 (0.62–0.93)*	0.98 (0.93–1.02)	0.90 (0.84–0.97)*
Rwanda	0.59 (0.53–0.66)***	0.48 (0.41–0.57)***	0.93 (0.91–0.94)***	0.91 (0.88–0.93)***
Sierra Leone	0.84 (0.72–0.98)*	0.89 (0.67–1.19)	1.07 (1.02–1.13)*	0.97 (0.88–1.07)
Senegal	0.72 (0.60–0.87)**	0.56 (0.40–0.79)**	0.94 (0.91–0.98)*	0.87 (0.81–0.94)**
Swaziland	0.54 (0.42–0.70)***	0.51 (0.41–0.64)***	0.85 (0.81–0.89)	0.86 (0.82–0.90
Togo	0.88 (0.74–1.05)	0.89 (0.68–1.18)	0.95 (091–0.98)*	0.92 (0.86–0.98)*
Tanzania	0.88 (0.73–1.06)	0.74 (0.51–1.08)	0.95 (0.92–0.98)*	0.97 (0.92–1.03)
Zambia	0.83 (0.75–0.92)**	0.85 (0.69–1.10)	0.95 (0.94–0.97)***	0.99 (0.96–1.02)
Zimbabwe	0.88 (0.74–1.06)	1.07 (0.75–1.37)	0.88 (0.85–0.91)	0.89 (0.82–0.95)**

†Reference is pregnancy wanted.
*$P < 0.10$, **$P < 0.05$, ***$P < 0.001$.

happiness about being pregnant, wanting to become pregnant, trying to become pregnant, wanting to become pregnant with a specific partner and the woman's perception of her partner's intention, all aimed at strengthening the measurement of pregnancy intentions [41]. In essence, pregnancy intention is affective, cognitive and cultural [23] and how it is understood can vary across time and space.

That said, our findings show that mistimed and unwanted pregnancies have considerable effects on women initiating ANC within the first trimester of pregnancy as well as the number of visits made, although the negative effects were more pronounced in the former than the latter. However, we found the pooled effect of mistimed and unwanted pregnancies on ANC attendance in the first trimester to be lower than what Eggleston [42] and Cheng *et al.* [43] reported. The important difference, however, is that many of these previous studies were based on single-country or small-scale data. More so is the fact that the effect of mistimed and unplanned pregnancies remained statistically robust even after controlling for key known confounders of ANC services utilisation. Our country-level results show the inverse effect of mistimed and unwanted pregnancies on first ANC attendance and this was either close to or more than 50% in some countries. Nonetheless, our study reveals some inconsistencies – mistimed and unwanted pregnancies were appreciably associated with high frequency of ANC visits although this observation was not on a large scale and only statistically significant in Nigeria.

Although the reasons accounting for the disparate ANC services utilisation between women with unintended (mistimed and unwanted) and intended pregnancies are not very clear, we surmise the following particularly in

Table 3 Mixed effects logistic and Poisson regression models of timing of first and number of ANC visits in 30 African countries, 2006–2014

	Timing of first ANC tested with binary logistic regression				Number of ANC attendances tested with Poisson regression			
	Model I		Model II		Model III		Model IV	
Explanatory factors	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Pregnancy intention								
Wanted then	1	[1, 1]	1	[1, 1]	1	[1, 1]	1	[1, 1]
Mistimed	0.848***	[0.788, 0.911]	0.798***	[0.735, 0.867]	0.988***	[0.982, 0.993]	0.962***	[0.956, 0.968]
Unwanted	0.756***	[0.671, 0.852]	0.805***	[0.751, 0.863]	0.935***	[0.927, 0.943]	0.955***	[0.947, 0.964]
Education								
No education			1	[1, 1]			1	[1, 1]
Primary			1.216***	[1.110, 1.332]			1.238***	[1.231, 1.246]
Secondary			1.565***	[1.342, 1.824]			1.355***	[1.346, 1.364]
Higher			2.679***	[2.058, 3.486]			1.556***	[1.539, 1.573]
Wealth status								
Poor			1	[1, 1]			1	[1, 1]
Average			1.081***	[1.034, 1.131]			1.131***	[1.124, 1.138]
Wealthiest			1.309***	[1.173, 1.462]			1.245***	[1.237, 1.252]
Residence								
Rural			1	[1, 1]			1	[1, 1]
Urban			1.092	[0.971, 1.227]			1.063***	[1.057, 1.069]
Age								
15–19			1	[1, 1]			1	[1, 1]
20–24			1.198***	[1.121, 1.280]			1.078***	[1.068, 1.088]
25–29			1.410***	[1.283, 1.549]			1.151***	[1.140, 1.161]
30–34			1.497***	[1.350, 1.660]			1.216***	[1.203, 1.228]
35–39			1.668***	[1.481, 1.878]			1.277***	[1.263, 1.292]
40–44			1.809***	[1.607, 2.036]			1.312***	[1.294, 1.331]
45–49			1.942***	[1.714, 2.201]			1.337***	[1.312, 1.362]
Number of children		0.918***	[0.904, 0.932]			0.968***	[0.967, 0.970]	
Constant	0.628**	[0.468, 0.842]	0.476***	[0.426, 0.533]	4.073***	[3.649, 4.547]	2.901***	[2.634, 3.196]
Country-level variance	0.819	[0.636–1.055]	0.828	[0.643–1.067]	0.307***	[0.239, 0.396]	0.269***	[0.209, 0.347]
Log likelihood	−111 574.86		−109 515.28		−509 834.2		−488 419.8	
N	191 024		191 001		211 796		211 772	

**$P < 0.01$, ***$P < 0.001$.

the light of our findings suggesting smaller effect on number of visits compared to early initiation: first, the depth of recognition of pregnancy is low in some African countries, leading to late detection [44]. This can be worsened by the absence or unavailability of early pregnancy testing services, which is characteristic of developing countries [45]. Of importance also is the negative perception that health care becomes important only when foetal movement begins, which normally occurs in the second trimester. For women with such misconceptions, first trimester ANC can be deferred till the second semester [45]. Another plausible pathway is that women may have low vulnerability perception, particularly when no pregnancy-related complication is noticed at the early stages of the pregnancy. The reverse has been previously reported – women who have had a negative pregnancy outcome such as miscarriage and stillbirth tended to initiate ANC earlier [44] than women who had no serious complication in a previous/earlier one. Other results from our analysis which partly support this position were the negative association between parity and timing and number of ANC visits – higher-parity women were less likely to comply with recommended ANC services. Given that unintended pregnancy is a major reason accounting for induced abortion [46], it is probable that some women with an unintended pregnancy will delay first ANC due to the period of time where they contemplate whether the pregnancy should be carried to term or terminated.

The fact that the effects of unintended pregnancies on the number of ANC visits were minimal compared to timing of ANC also highlights the possibility of increasing availability of prenatal health services to women across Africa so that regardless of delays in seeking the first ANC, women are able to achieve the optimum number of visits required. Increasingly, policies to promote ANC services utilisation for pregnant women are being implemented in SSA countries including Ethiopia, Kenya and Zambia. Here, maternal health services are provided free of charge in public facilities and at minimal cost in private facilities [20, 47]. In Ghana too, maternal care has been placed under the National Health Insurance Scheme (NHIS) to remove financial barriers to accessing ANC services [48]. These specific interventions which are increasing accessibility [49] to maternal care could explain why more women are able to meet the optimum number of ANC visits despite delaying their first visit. Again, it is likely that women are able to obtain the required number of ANC visits, as health workers are able to successfully explain the benefits of achieving the expected visits once the first attendance is made.

Nonetheless, early initiation of ANC should be encouraged among pregnant women by, first, increasing resources for early pregnancy detection and also educating women on the benefits of early ANC to themselves and children. While women may eventually attain the required number of ANC visits at the term of the pregnancy, the benefits of early attendance remain critical. For instance, early ANC affords opportunities for healthcare providers to detect diseases that can be transferred to the foetus, such as HIV. First trimester ANC attendance can positively affect skilled birth attendance [50].

Our results also highlight the consistent positive returns of female education to improving maternal and child health. Regarding both timing and number, the influence of female education was relatively stronger than wealth. Apart from the established fact that educated women are better informed about the colossal health benefits of first trimester and optimum ANC coverage [15, 51–53] and also inclined to comply with other health recommendations [54], they stand a better chance of being able to detect pregnancy early and subsequently avail themselves of early prenatal health services [55].

This study has some obvious limitations. First, we included surveys that were conducted at different times: the earliest was in Swaziland in 2006/2007, while the latest was 2014 in Egypt. Reproductive behaviours investigated might have changed within the span of time between surveys. However, the prevalence of unintended pregnancies (40%) for Swaziland reported in this paper is much lower than the prevalence (62%) reported in a recent study in the same country [56]. The fact that pregnancy intention information is collected retrospectively raises the possibility of women changing their responses after delivery [41, 57], and this must be factored into the interpretation.

Conclusion

This study underlined the harmful consequences of unintended pregnancies among women on use of an important health service as prenatal care in Africa. The findings underscore the importance of increasing contraceptive prevalence in Africa and other developing contexts. Tackling unintended pregnancies as part of the continuum of services aimed at improving maternal and child health is as important as improving access and availability of pre- and post-natal care, free/subsidised care, delaying childbirth and other socio-economic advancement (e.g. education).

Acknowledgement

We are grateful to the three anonymous reviewers for the insightful comments provided on the initial version of the paper. The comments we received from Prof Kofi Awusabo-Asare, Department of Population and Health,

University of Cape Coast, Ghana, are also acknowledged. We are also thankful to Measure DHS for making all the datasets freely available for our analysis.

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