Journal of Biosocial Science (2023), 55: 1, 131–149
doi:10.1017/S0021932021000729

CAMBRIDGE UNIVERSITY PRESS

RESEARCH ARTICLE

Psychosocial influences on pregnancy and childbirth behaviours in north-western Nigeria: a cross-sectional analysis

Emily White Johansson[1,2]*, Udochisom Anaba[1,2], Dele Abegunde[1,3], Mathew Okoh[4,5], Shittu Abdu-Aguye[4,5], Paul C. Hewett[1,3] and Paul L. Hutchinson[1,2]

[1]Breakthrough RESEARCH/Nigeria, Abuja, Nigeria, [2]Department of Global Community Health and Behavioral Sciences, School of Public Health and Tropical Medicine, Tulane University, New Orleans, LA, USA, [3]Population Council, Washington DC, USA, [4]Breakthrough ACTION/Nigeria, Abuja, Nigeria and [5]Johns Hopkins Center for Communication Programs, Baltimore, MD, USA
*Corresponding author. Email: ejohansson@tulane.edu

(Received 5 February 2021; revised 14 November 2021; accepted 15 November 2021; first published online 07 February 2022)

Abstract

Antenatal care (ANC) and facility delivery are essential maternal health services, but uptake remains low in north-western Nigeria. This study aimed to assess the psychosocial influences on pregnancy and childbirth behaviours in Nigeria. Data were from a cross-sectional population-based survey of randomly sampled women with a child under 2 years conducted in Kebbi, Sokoto and Zamfara states of north-western Nigeria in September 2019. Women were asked about their maternal health behaviours during their last pregnancy. Psychosocial metrics were developed using the Ideation Model of Strategic Communication and Behaviour Change. Predicted probabilities for visiting ANC four or more times (ANC4+) and giving birth in a facility were derived using mixed-effects logistic regression models adjusted for ideational and socio-demographic variables. Among the 3039 sample women, 23.6% (95% CI: 18.0–30.3%) attended ANC4+ times and 15.5% (95% CI: 11.8–20.1%) gave birth in a facility. Among women who did not attend ANC4+ times or have a facility-based delivery during their last pregnancy, the most commonly cited reasons for non-use were lack of perceived need (42% and 67%, respectively) and spousal opposition (25% and 27%, respectively). Women who knew any ANC benefit or the recommended number of ANC visits were 3.2 and 2.1 times more likely to attend ANC4+ times, respectively. Women who held positive views about health facilities for childbirth had 1.2 and 2.6 times higher likelihood of attending ANC4+ times and having a facility delivery, respectively, while women who believed ANC was only for sickness or pregnancy complications had a 17% lower likelihood of attending ANC4+ times. Self-efficacy and supportive spousal influence were also significantly associated with both outcomes. To improve pregnancy and childbirth practices in north-western Nigeria, Social and Behavioural Change programmes could address a range of psychosocial factors across cognitive, emotional and social domains which have been found in this study to be significantly associated with pregnancy and childbirth behaviours: raising knowledge and dispelling myths, building women's confidence to access services, engaging spousal support in decision-making and improving perceived (and actual) maternal health services quality.

Keywords: Nigeria; Pregnancy; Ideation

Introduction

Globally, there are an estimated 300,000 maternal deaths each year, and approximately 20% of these occur in Nigeria (WHO, 2015). In 2015, it was estimated that Nigeria's maternal mortality

ratio (MMR) was 800 deaths per 100,000 live births, which totals approximately 58,000 deaths (WHO, 2015). It is likely that the MMR is much higher in north-western Nigeria where maternal health outcomes are typically worse than national averages (Government of Nigeria and DHS Program, 2019). Given the burden of maternal mortality in Nigeria, improving maternal health in the country is both a national priority and a cornerstone for achieving the United Nations Sustainable Development Goals (United Nations, 2015; Government of Nigeria & DHS Program, 2019; Souza, 2019).

Antenatal care (ANC) visits and facility-based deliveries are critical contact points with the formal health system that present opportunities to reach mothers and newborns with effective interventions to improve their chances of survival and well-being (WHO, 2016). The World Health Organization (WHO) has recommended at least four ANC visits (ANC4+) during pregnancy, and more recently eight routine check-ups, in order to provide a range of interventions for a positive pregnancy experience (WHO, 2016). The WHO also promotes giving birth in a health facility with skilled personnel, since most deaths are due to direct obstetric causes that occur around the time of delivery and are difficult to predict in advance (Sageer *et al.*, 2019). Nigerian national guidelines for pregnancy and childbirth are closely aligned with these global recommendations (Government of Nigeria, 2017a).

Despite the importance of these essential maternal health services, there remains low utilization of ANC and facility-based delivery in north-western Nigeria (Pedersen & Liu, 2012). According to the 2018 Nigeria Demographic and Health Survey (DHS), only half (53%) of women aged 15-49 years in north-western Nigeria attended ANC at least one time with a skilled provider during her last pregnancy, and only 16% gave birth in a facility (DHS, 2019). Previous qualitative and quantitative research conducted in north-western Nigeria suggests that barriers to uptake of these services may include distance to the health facility, health care costs, spousal disapproval, religious beliefs, maternal education, lack of perceived need, as well as broader gender norms and socio-cultural dynamics (Adamu & Salihu, 2002; Fetohy, 2004; Doctor *et al.*, 2012; Fagbamigbe & Idemudia, 2015; Ishola *et al.*, 2017; Meh *et al.*, 2019).

Psychosocial factors are also posited by theories as important intermediate determinants of a person's actions, and are often targeted by Social and Behavioural Change (SBC) programmes to spur action. In the Ideation Model of Strategic Communication and Behaviour Change, psychosocial factors are theorized to consist of three ideational domains – cognitive, emotional and social – and each domain consists of specific behavioural influences, including: knowledge, attitudes, beliefs, perceived risk, subjective norms and self-image (cognitive); emotional response, empathy and self-efficacy (emotional); and social support, social influence, interpersonal communication and personal advocacy (social) (Kincaid *et al.*, 2013).

Despite the theorized importance of psychosocial influences on behavioural outcomes, there there has only been limited quantitative research examining their relationship with pregnancy and childbirth behaviours in low- and middle-income countries (LMICs), including Nigeria. The aim of this paper was to develop a set of pregnancy-related ideational metrics relevant to the north-western Nigerian context, and to subsequently examine their associations with the use of essential maternal health services, including attending ANC4+ times and giving birth in a facility.

Methods

Study setting

Data for this study were from a survey conducted in September 2019 in Kebbi, Sokoto and Zamfara states in north-western Nigeria within wards targeted for a SBC programme to help improve the health and well-being of women and children. The study analysed baseline survey data collected prior to initiation of the SBC programme (Johansson *et al.*, 2020).

https://doi.org/10.1017/S0021932021000729 Published online by Cambridge University Press

The three study states share a border with Niger Republic, while Kebbi also borders Benin Republic to the west. The estimated populations of the states were 4.9 million (Sokoto), 4.3 million (Kebbi) and 4.4 million (Zamfara) in 2015 (Govenrment of Nigeria 2017b). Hausa is the dominant ethnicity and Islam is the main religion in the three states. The study area also has some of the highest poverty rates within Nigeria, and among the worst maternal and child mortality outcomes. According to the 2018 Nigeria Demographic and Health Survey (DHS, 2019) the under-five mortality rate was highest in the north-west region at 187 deaths per 1000 live births. Maternal mortality is relatively high in this region compared with national estimates (800 deaths per 100,000 live births in 2015). The region also has the highest total fertility rate in Nigeria, with 6.6 births per woman, and, on average, 8.3 children were born to a woman aged 40–49 years in 2018. In addition, only half of women attended ANC at least once during her last pregnancy, and only 16% delivered in a health facility according to the 2018 survey (DHS, 2019).

This same survey also showed that women's empowerment measures in the north-western region were among the lowest nationally, including women who completed primary school (9%), were unemployed in the past 12 months (45%) and owned a mobile phone (35%), and married women who participated in their own health care decisions (20%). Early child marriage is common in this area, with mean age of first marriage at 15.4 years for women, and 18 years was the median age of first birth for a woman in 2018 (DHS, 2019). Early child marriage is linked to poverty and lack of educational and economic opportunities for women, reinforces the dominant role of men in the household and societal decision-making more broadly, and places young women at greater risk of pregnancy complications and other adverse health outcomes (Efevbera & Bhabha, 2020; Ntoimo *et al.*, 2020). Qualitative research further highlights the importance of gender and cultural norms in health care utilization and broader social and economic opportunities for women (Adamu & Salihu, 2002; Oguntunde *et al.*, 2019; Yaya *et al.*, 2019).

The health system context itself also shapes women's perceptions and their utilization of maternal health services. Health care provision is the responsibility of federal, state and local governments in Nigeria, and also commonly includes private health care provision (Government of Nigeria 2016). The federal government sets health policies, standards and regulations, and is also responsible for tertiary level care at federal medical centres and teaching hospitals. The State Ministries of Health provide secondary level care at comprehensive medical centres and general hospitals, while Local Government Areas (LGAs) focus on primary health care, which is overseen by the National and State Primary Health Care Development Agencies. In terms of maternal health services, the primary level is responsible for providing antenatal, delivery and postnatal care in addition to basic emergency obstetric care. Each LGA typically consists of 10–15 wards that have their own structures for Primary Health Care (PHC) delivery, including PHC centres, dispensaries, health posts and Community Health Extension Workers (CHEWs), which are also supported by Ward Development Committees (WDCs). Private provision of health care is also common in this area, including Proprietary and Patent Medicine Vendors (PPMVs) (Beyeler *et al.*, 2015).

Nevertheless, the availability and quality of maternal and reproductive health services varies across LGAs and wards in the north-west region (FMOH, 2016). Previous studies have highlighted important health system challenges in this area, including human resource constraints, limited service availability and inadequate equipment and supplies with common medicine stock-outs (Galadanci *et al.*, 2007; Fagbamigbe & Idemudia, 2015, 2017; FMOH, 2016). Such health system constraints influence community perceptions and practices with respect to local health services, as shown in this previous research and further investigated in the current study. Importantly, the SBC programme that will be implemented in the study area will be complemented by health system strengthening work which, taken together, aim to improve both supply- and demand-side problems in health system utilization in these states. The findings reported in this paper were derived from a baseline survey of the SBC programme evaluation to gauge women's perceptions of local maternal health services.

https://doi.org/10.1017/S0021932021000729 Published online by Cambridge University Press

Study design

A two-stage cluster-sample cross-sectional survey was conducted targeting women with a child under 2 years living in Kebbi, Sokoto and Zamfara states within wards targeted for SBC programming. The survey sample size was determined based on the SBC programme evaluation design, with three comparison groups. Sample size estimation allowed for a 10% non-response rate, a power criterion of 0.80, an alpha coefficient of 0.05 and varying intra-cluster correlations and minimal detectable differences for priority outcomes of the evaluation. Based on this estimation, a sample size of approximately 3000 women with a child under 2 years was estimated for survey inclusion. At the first sampling stage, a total of 108 enumeration areas (EAs) was selected from programme wards within the three states (36 EAs per state) using digital maps and a grid sampling methodology. At the second sampling stage, all households within each sampled EA were enumerated to randomly select households with a resident woman aged 15–49 years who had a child under 2 years.

Data collection

Fieldwork was conducted in September–October 2019 over a 4-week period by female interviewers recruited from the local communities. Interviewer training occurred during the 1-week period prior to data collection. This training reviewed the study objectives, protocol and instruments, fieldwork procedures and ethical considerations. All interviewers participated in a pilot exercise that tested skip patterns, checked questionnaire translation (Hausa) and assessed question appropriateness and sequence. There were two questionnaires administered to survey participants. The household questionnaire collected information on household members, characteristics and assets. The female questionnaire collected information on respondent demographics, reproductive history and gender norms. For women with a child under 2 years, respondents were specifically asked about behaviours during their last pregnancy in a standardized format to the Nigeria Demographic and Health Survey (DHS, 2019). These behaviours included ANC attendance, timing, location, provider type, content and number of check-ups during her last pregnancy. Women were also asked where she gave birth to her youngest child and who assisted with the delivery. Women who did not attend ANC or who gave birth outside a facility were asked about reasons for service non-use. In addition, all respondents were asked ideational questions related to various health behaviours, including pregnancy and childbirth.

Explanatory variables

Table 1 presents the definitions of pregnancy-related ideations that were the main explanatory variables in the analysis. Ideational questions were developed using Kincaid's Model of Strategic Communication and Behaviour Change with the aim to measure at least one psychosocial factor within each cognitive, emotional and social domain (Kincaid *et al.*, 2013). Survey questions were also adapted from ideational research in other health areas as appropriate (Kincaid *et al.*, 2013; Babalola *et al.*, 2015; Larson *et al.*, 2015; Storey *et al.*, 2018). Socio-demographic variables were included in the analysis based on empirical evidence of their relationship with use of maternal health services in Nigeria and elsewhere (Amoakoh-Coleman *et al.*, 2015; Fagbamigbe & Idemudia, 2015; Aliyu & Dahiru, 2017; Okedo-Alex *et al.*, 2019; Ntoimo *et al.*, 2020). These variables included maternal age (15–24, 25–34 or 35–49 years), maternal education (any formal education, none or informal education), spousal education (any formal education, none or informal education), maternal employment (works outside home or student, or does not work outside home), spousal employment (works outside home or student, or does not work outside home) and household wealth (lowest, second, third, fourth or highest wealth quintile). Wealth was measured using an asset-based measure constructed from ownership of key consumer durables and

https://doi.org/10.1017/S0021932021000729 Published online by Cambridge University Press

Table 1. Pregnancy-related ideational metrics

Dimension	Domain	Likert-scale statement/question	Response coding for analyses
Cognitive	Knowledge	How many times should a woman receive a check-up during pregnancy?	Spontaneously reports 4 or more times versus other responses
		In your opinion, when should a pregnant woman first go to ANC?	Spontaneously reports 'as soon as she thinks she is pregnant' or 'first trimester' versus other responses
		What are some benefits to the mother of ANC attendance?	Spontaneously reports any benefit versus other responses
	Beliefs about pregnancy	Pregnant women attending 4+ ANC visits have safer pregnancies	Agree (strongly or somewhat) versus disagree (strongly or somewhat) versus don't know
		Pregnant women only need ANC when sick	Agree (strongly or somewhat) versus disagree (strongly or somewhat) versus don't know
		Only first-time pregnant women need ANC	Agree (strongly or somewhat) versus disagree (strongly or somewhat) versus don't know
	Beliefs about health services	The health facility is the best place to deliver a baby	Agree (strongly or somewhat) versus disagree (strongly or somewhat) versus don't know
		It is better to use a traditional provider than a health facility for ANC	Agree (strongly or somewhat) versus disagree (strongly or somewhat) versus don't know
Emotional	Self-efficacy	Confident that you could get to a health facility for ANC Confident that you could get to a health facility for delivery	Confident (strongly or somewhat) versus uncertain (strongly or somewhat) versus don't know
		Confident to start a conversation with husband about ANC	Confident (strongly or somewhat) versus uncertain (strongly or somewhat) versus don't know
		Confident to start a conversation with husband about facility delivery	
Social	Social influence	Who else influences your decision about going to 4+ ANC visits?	Spontaneously reports partner versus other responses; spontaneously reports mother-in-law versus other responses; spontaneously reports health worker versus other responses
		Who else influences your decision about having a facility delivery?	
	Social norms	It's important for a woman to discuss her pregnancy with her husband	Agree (strongly or somewhat) versus disagree (strongly or somewhat) versus don't know

then compiled into an index using principal components analysis (Filmer & Pritchett, 1998). Households were then categorized into quintiles from lowest to highest wealth asset ranking.

Outcome definitions

There were two main outcomes. The first outcome was ANC4+, defined as reported attendance at ANC at least four times by the respondent during her last pregnancy within the past 2 years, and where the first visit was with a skilled provider (doctor, nurse or midwife). Specifically, during the

https://doi.org/10.1017/S0021932021000729 Published online by Cambridge University Press

Table 2. Socio-demographic characteristics of study sample

Characteristics	Kebbi % [*N*=892]	Sokoto % [*N*=1078]	Zamfara % [*N*=1069]	Total % [*N*=3039]
Respondent's characteristics				
Age in years (mean)	26.2	25.7	26.0	26.0
Any formal schooling, primary attendance or higher	25.2	19.3	28.9	26.1
Employment outside home or student	47.9	45.6	52.8	50.3
ANC4+ attendance during last pregnancy	23.6	17.0	26.1	23.6
Facility-based delivery during last pregnancy	14.8	13.8	16.3	15.5
Spouse's characteristics				
Age in years (mean)	37.4	37.4	39.4	38.7
Any formal schooling, primary attendance or higher	27.3	19.4	36.5	31.0
Employment outside home or student	93.7	93.2	90.9	91.9
Number of wives (mean)	2.1	2.0	2.2	2.2

Point estimates were derived using weights to account for unequal probabilities of selection in the survey sample.

survey interview, the woman was asked if she saw anyone for ANC during her last pregnancy, and if so, whom she saw for the first visit. She was then asked how many ANC check-ups she had during this pregnancy. The second outcome was facility-based delivery, defined as giving birth in a health facility during her last pregnancy within the past 2 years. During the survey interview, the woman was asked where she gave birth during this pregnancy; a facility-based delivery included: government hospital, PHC centre, health post, community health outreach post, nursing/maternity home, private hospital or private clinic.

Data analysis

Mixed-effects logistic regression models were used to estimate average marginal effects, or the change in the probability of an outcome when a predictor variable increased by one unit. For binary predictor variables, marginal effects represent the additional likelihood of using ANC or delivering in a facility for a person who possesses that characteristic (e.g. husband influences decisions about delivering in a facility) relative to a person who does not. All ideational and socio-demographic variables were included in the models as categorical fixed effects nested within cluster identifiers. Testing for multicollinearity among variables was conducted using variance inflation factors. The level of statistical significance was set to $p<0.05$. Point estimates were tabulated using weights to account for unequal probabilities of selection. Standard error estimation accounted for data clustering in the complex survey design. All analyses were conducted in Stata version 16.

Results

A total of 3039 women responded to questions about the antenatal and delivery care received during her last completed pregnancy in the past 2 years. Among these respondents, 23.6% (95% CI: 18.0–30.3) attended ANC4+ times during her last pregnancy, and 15.5% (95% CI: 11.8–20.1) gave birth in a health facility (Table 2). The mean age of respondents was 26.0 years,

https://doi.org/10.1017/S0021932021000729 Published online by Cambridge University Press

while the average age of their spouse was 38.7 years. Only 26.1% and 31.0% of respondents and their spouses had any formal schooling, while 50.3% and 91.9% worked outside the home, respectively. There was a mean of 2.2 wives per husband in the study sample.

Bivariate results of ANC4+ and facility-based delivery by ideational variables

Among respondents attending ANC4+ times during her last pregnancy, a greater percentage had positive cognitive, emotional or social ideations than negative or disagreeable ones. For example, 48.1% (95% CI: 39.2%–57.2%) knew that women should receive four or more check-ups during pregnancy and only 4.9% (95% CI: 3.2%–7.5%) were unaware of this (*knowledge*) (Table 3). Similarly, 11.7% (95% CI: 23.3%–40.6%) believed pregnant women only need ANC when sick compared with 34.9% (95% CI: 26.4%–44.4%) who did not hold this belief (*beliefs*). At the same time, 34.0% (95% CI: 26.6%–42.3%) of these respondents were confident they could get to a health facility for ANC compared with 1.3% (95% CI: 0.6%–3.1%) who were uncertain (*self-efficacy*). Among respondents attending ANC4+ times during their last pregnancy, health workers (37.9%, 95% CI: 20.1%–59.6%) and spouses/partners (28.9%, 95% CI: 21.5%–37.5%) were most commonly cited as influencing the woman's decision.

A similar ideational pattern occurred among women who gave birth in a facility during her last pregnancy. Specifically, 29.6% (95% CI: 23.1%–36.9%) of respondents who gave birth in a facility knew that women should receive four or more check-ups during pregnancy compared with 4.8% (95% CI: 3.2%–7.2%) of respondents who did not know (*knowledge*). Similarly, 27.2% (95% CI: 21.3%–33.9%) of these same respondents believed that the health facility was the best place to deliver a baby compared with 1.7% (95% CI: 0.9%–3.1%) who disagreed (*beliefs*), while 29.9% (95% CI: 23.7%–37.0%) of these respondents were confident they could get to a health facility for delivery compared with 1.1% (95% CI: 0.6%–1.9%) who were uncertain (*self-efficacy*). Among respondents who gave birth at a facility during the last pregnancy, spouses/partners (21.8%, 95% CI: 16.3%–28.5%) were most commonly cited as influencing the woman's decision to give birth in a facility.

Among women who did not attend ANC4+ times or give birth in a facility during her last pregnancy (Figure 1), 41.4% and 66.8% did not perceive it as necessary to go to ANC (95% CI: 33.0%–50.3%) or give birth in a facility (95% CI: 58.5%–74.3%), respectively. Spousal opposition was also a commonly cited reason for not attending ANC4+ times (25.2%, 95% CI: 18.3%–33.6%) or for giving birth in a facility (27.3%, 95% CI: 20.8%–34.9%).

Ideational associations with ANC4+ visits

The psychosocial factors significantly associated with attending ANC4+ times in regression analyses included: ANC knowledge, beliefs about ANC efficacy and health services quality, self-efficacy and supportive spousal influence on decision-making (Table 4, Figure 2). In the adjusted analysis, the probability of attending ANC4+ times increased 16 percentage points (95% CI: 0.12–0.19, $p<0.001$) if the respondent knew that women should receive four or more check-ups during pregnancy compared with those who were not aware (*knowledge*); increased 5 percentage points (95% CI: 0.02–0.08, $p=0.002$) if she knew that women should initiate ANC in the first trimester or as soon as she thinks she is pregnant (*knowledge*); increased 16 percentage points (95% CI: 0.10–0.23, $p<0.001$) if she was able to report any ANC benefit for herself (*knowledge*); increased 5 percentage points (95% CI: 0.01–0.10, $p=0.021$) if she believed women who attend ANC4+ have safer pregnancies (*beliefs*); decreased 4 percentage points (95% CI: 0.00–0.08, $p=0.037$) if she believed only sick pregnant women needed ANC (*beliefs*); increased 4 percentage percentage points (95% CI: 0.01–0.08, $p=0.006$) if she believed that the health facility was the best place to deliver a baby (*beliefs*); increased 15 percentage points (95% CI: 0.11–0.20, $p<0.001$) if she felt confident that she could get to a health facility for ANC (self-efficacy); increased 4 percentage

https://doi.org/10.1017/S0021932021000729 Published online by Cambridge University Press

Table 3. Facility-based delivery and ANC4+ attendance reported by women aged 15–49 years with a live birth in the past 2 years by socio-demographic and ideational variables

Variables	Responses	*n*	ANC4+		Facility delivery	
			%	95% CI	%	95% CI
Total sample		**3039**	**23.6**	**18.0–30.3**	**15.5**	**11.8–20.1**
Ideational variables[a]						
How many times should a woman receive a check-up during pregnancy?	4 or more times	1266	48.1	39.2–57.2	29.6	23.1–36.9
	Other response	1773	4.9	3.2–7.5	4.8	3.2–7.2
When should a pregnant woman first go to ANC?	As soon as she thinks she is pregnant or in the first trimester	880	34.9	26.7–44.2	13.0	9.2–18.1
	Other response	2159	19.1	13.2–26.9	21.9	16.0–29.1
What are some benefits to the mother of ANC attendance?	Any benefit	2462	28.8	22.2–36.3	18.4	14.1–23.7
	Other response	577	0.3	0.1–1.5	2.5	0.1–5.4
Pregnant women visiting ANC have safer pregnancies	Agree	1979	35.6	28.4–43.5	23.5	18.5–29.4
	Disagree	744	4.6	2.6–8.2	2.8	1.2–6.3
	Don't know	316	1.2	0.4–3.5	0.9	0.3–3.0
Pregnant women need ANC only when sick	Agree	1268	11.7	23.3–40.6	12.7	8.5–18.6
	Disagree	1569	34.9	26.4–44.4	19.2	13.8–26.1
	Don't know	202	2.2	5.5–8.0	1.7	0.4–7.0
Only first-time pregnant women need ANC	Agree	798	15.8	9.6–24.8	16.9	11.2–24.5
	Disagree	1949	29.8	22.5–38.3	17.0	12.4–22.8
	Don't know	292	2.0	0.7–5.2	3.1	1.2–7.9
The health facility is the best place to deliver a baby	Agree	1688	33.8	26.3–42.2	27.2	21.3–33.9
	Disagree	1254	12.1	7.9–18.1	1.7	0.9–3.1
	Don't know	97	1.0	0.2–4.0	1.1	0.3–4.3
It's better to use a traditional provider than a facility for ANC	Agree	1104	12.0	7.6–18.2	10.2	6.8–14.8
	Disagree	1752	32.1	24.7–40.5	19.9	14.7–26.4
	Don't know	183	5.8	2.1–15.1	2.8	1.3–6.1

(*Continued*)

Table 3. (*Continued*)

Variables	Responses	*n*	ANC4+		Facility delivery	
			%	95% CI	%	95% CI
It's important for a woman to discuss her pregnancy with her husband	Agree	2784	24.8	19.0–31.8	16.5	12.5–21.4
	Disagree	184	8.9	3.5–20.7	3.5	1.4–8.6
	Don't know	71	2.7	0.5–12.4	2.4	0.9–6.2
Feels confident she could get to a health facility for ANC [delivery]	Confident	2084	34.0	26.6–42.3	29.9	23.7–37.0
	Uncertain	876	1.3	0.6–3.1	1.1	0.6–1.9
	Don't know	79	0.9	0.1–7.1	0.3	0.0–2.9
Besides yourself, who else influences your decision to attend ANC [give birth] at a facility?	Partner	2045	28.9	21.5–37.5	21.8	16.3–28.5
	Other response	994	12.9	8.3–19.4	6.8	4.5–10.2
	Mother-in-law	66	20.6	9.3–39.5	13.5	6.5–26.1
	Other response	2973	23.6	18.0–30.4	15.6	11.8–20.2
	Health worker	66	37.9	20.1–59.6	15.1	11.4–19.6
	Other response	2973	23.2	17.6–30.0	29.6	15.3–49.4
Intends to make at least four ANC visits [give birth in a facility] during next pregnancy	Likely	2034	33.8	26.5–42.1	29.0	22.9–36.0
	Unlikely	865	3.2	1.5–6.8	1.3	0.7–2.4
	Don't know	140	2.7	0.8–8.7	0.9	0.2–4.0
Socio-demographic variables						
Household wealth quintile	Lowest	716	7.7	4.4–13.0	4.8	2.9–8.0
	Second	604	14.2	10.0–19.8	8.0	5.7–11.2
	Middle	600	16.9	11.8–23.5	11.0	7.4–16.0
	Fourth	496	27.1	18.1–38.5	13.4	8.8–20.0
	Highest	623	52.8	42.4–62.9	40.7	31.3–50.8
Maternal education	Any formal education	499	59.5	51.3–67.2	43.9	34.3–53.9
	None or informal	2540	16.9	12.6–22.3	10.3	7.9–13.3

(*Continued*)

Table 3. (*Continued*)

Variables	Responses	*n*	ANC4+		Facility delivery	
			%	95% CI	%	95% CI
Maternal age	15–24 years	1275	19.0	14.1–25.2	14.4	10.6–19.3
	25–34 years	1376	25.4	19.0–33.1	15.7	11.6–21.0
	35–49 years	388	31.3	22.5–41.7	18.4	13.1–25.3
Maternal occupation	Works outside home or student	1469	24.1	17.1–32.8	13.0	9.4–17.9
	No work outside home	1409	23.9	17.0–32.6	19.2	13.5–26.5
	Other	111	11.5	3.7–30.3	10.9	4.5–24.2
	Missing	50	—	—	—	—
Spousal occupation	Works outside home or student	2742	23.5	17.7–30.4	15.8	11.9–20.6
	No work outside home	149	17.4	10.1–28.3	9.8	4.7–19.4
	Other	98	32.2	17.6–51.3	22.4	11.1–39.8
	Missing	50				
Spousal education	Any formal education	2056	12.6	9.5–16.6	7.7	5.9–10.2
	None or informal	933	47.6	38.6–56.8	33.5	25.9–42.1
	Missing	50	—	—	—	—

[a]Likert-scale statements with 'Agree' and 'Confident' and 'Likely' include 'strongly or somewhat' in the responses.
—: not applicable; variable not included in the regression model for that outcome.
Point estimates were derived using weights to account for unequal probabilities of selection in the survey sample. Confidence intervals accounted for clustering in the complex survey design.

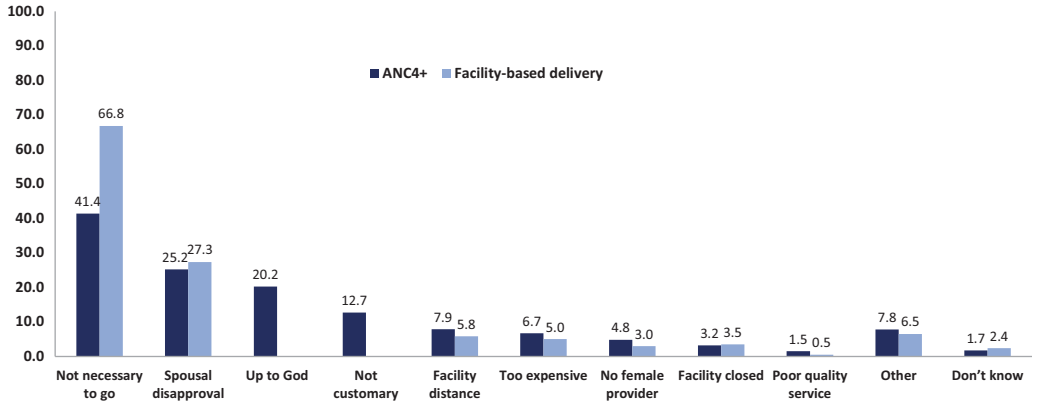

Figure 1. Women's reported reasons for non-use of ANC and facility-based delivery services among women who did not attend ANC4+ or give birth in a facility during their last pregnancy. Percentages are those who cited specific reasons for non-use of services. Note that the percentages do not sum to 100 since multiple responses were allowed.

points (95% CI: 0.00–0.07, p=0.029) if she reported that her spouse/partner supported her decision to attend ANC4+ (*social influence*). The following socio-demographic variables were also significantly associated with ANC4+ attendance in the adjusted analysis: household wealth, maternal employment, maternal education and spousal education.

Ideational associations with facility-based delivery

The psychosocial factors significantly associated with facility-based delivery were ANC knowledge, beliefs about health services quality, self-efficacy as well as spousal and health worker influence on decision-making (Table 4, Figure 2). After adjustment for other variables, the probability of giving birth in a facility increased 6 percentage points (95% CI: 0.03–0.09, p<0.001) if the respondent knew that women should receive four or more check-ups during pregnancy compared with those who were not aware (*knowledge*); increased 12 percentage points (95% CI: 0.09–0.15, p<0.001) if she believed that the health facility was the best place to deliver a baby (*beliefs*); decreased 4 percentage points (95% CI: 0.01–0.07, p=0.016) if she believed it was better to use a traditional provider than a health facility for ANC (*beliefs*); increased 15 percentage points (95% CI: 0.11–0.18, p<0.001) if she felt confident that she could get to a health facility for delivery (*self-efficacy*); increased 7 percentage points (95% CI: 0.04–0.11, p<0.001) if she reported that her spouse/partner supported her decision to give birth in a facility (*social influence*); increased 9 points (95% CI: 0.01–0.17, p=0.031) if she reported that a health provider supported her decision to give birth in a facility (*social influence*). The following socio-demographic variables were also significantly associated with facility-based delivery in the adjusted analysis: household wealth, maternal age, maternal education and spousal education.

Discussion

Across the study area, there were low levels of ANC4+ attendance and facility-based delivery among women aged 15–49 years during her last pregnancy in the past 2 years. The study findings suggest that cognitive, emotional and social psychosocial factors play an important role in the study women's pregnancy and childbirth decisions, which are shaped by the broader socioeconomic, cultural and health system contexts of the north-west region (Galadanci *et al.*, 2007; Fagbamigbe & Idemudia, 2015; Ntoimo *et al.*, 2020). Specifically, ANC knowledge and beliefs,

https://doi.org/10.1017/S0021932021000729 Published online by Cambridge University Press

Table 4. Ideational and socio-demographic associations with ANC4+ and facility-based delivery for women aged 15–49 years with a live birth in the past 2 years

		ANC4+				Facility delivery			
Statement or question	Responses	Average marginal effect	95% CI		*p*-value	Average marginal effect	95% CI		*p*-value
Ideational variables[a]									
How many times should a woman receive a check-up during pregnancy?	4 or more	0.16	0.12	0.19	<0.001	0.06	0.03	0.09	<0.001
	Other response	—	—	—	—	—	—	—	—
When should a pregnant woman first go to ANC?	'As soon as she thinks she is pregnant' or 'in the first trimester'	0.05	0.02	0.08	0.002	0.01	−0.02	0.04	0.626
	Other response	—	—	—	—	—	—	—	—
What are some benefits to the mother of ANC attendance?	Any benefit reported	0.16	0.10	0.23	<0.001	0.01	−0.05	0.08	0.671
	Other response	—	—	—	—	—	—	—	—
Pregnant women visiting ANC have safer pregnancies	Agree	0.05	0.01	0.10	0.021	0.04	0.00	0.09	0.064
	Disagree	—	—	—	—	—	—	—	—
	Don't know	−0.07	−0.16	0.02	0.130	−0.02	−0.11	0.06	0.635
Pregnant women only need ANC when sick	Agree	—	—	—	—	—	—	—	—
	Disagree	0.04	0.00	0.08	0.037	−0.01	−0.05	0.03	0.662
	Don't know	0.12	−0.06	0.31	0.190	0.04	−0.10	0.18	0.611
Only first-time pregnant women need ANC	Agree	—	—	—	—	—	—	—	—
	Disagree	0.03	−0.01	0.08	0.129	−0.01	−0.05	0.03	0.592
	Don't know	−0.01	−0.14	0.12	0.909	0.04	−0.07	0.15	0.519
The health facility is the best place to deliver a baby	Agree	0.04	0.01	0.08	0.006	0.12	0.09	0.15	<0.001
	Disagree	—	—	—	—	—	—	—	—
	Don't know	−0.04	−0.22	0.14	0.643	0.08	−0.06	0.23	0.276
It's better to use a traditional provider than a facility for ANC	Agree	—	—	—	—	—	—	—	—
	Disagree	0.01	−0.02	0.04	0.467	0.04	0.01	0.07	0.016
	Don't know	0.10	0.00	0.19	0.041	0.05	−0.04	0.14	0.255

(*Continued*)

Table 4. (*Continued*)

Statement or question	Responses	ANC4+				Facility delivery			
		Average marginal effect	95% CI		*p*-value	Average marginal effect	95% CI		*p*-value
It's important for a woman to discuss her pregnancy with her husband	Agree	0.01	−0.06	0.08	0.767	−0.04	−0.11	0.04	0.343
	Disagree	—	—	—	—	—	—	—	—
	Don't know	0.03	−0.19	0.25	0.794	0.12	−0.06	0.31	0.202
Feels confident she could get to a health facility for ANC4+ [or delivery]	Confident	0.15	0.11	0.20	<0.001	0.15	0.11	0.18	<0.001
	Uncertain	—	—	—	—	—	—	—	—
	Don't know	−0.01	−0.11	0.11	0.986	0.08	−0.03	0.20	0.165
Besides yourself, who else influences your decision about going to ANC4+ [or delivery]?	Partner	0.04	0.00	0.07	0.029	0.07	0.04	0.11	<0.001
	Other response	—	—	—	—	—	—	—	—
	Mother-in-law	0.00	−0.09	0.08	0.915	0.06	−0.02	0.14	0.154
	Other response	—	—	—	—	—	—	—	—
	Health provider	0.03	−0.05	0.11	0.473	0.09	0.01	0.17	0.031
	Other response	—	—	—	—	—	—	—	—
Socio-demographic variables									
Household wealth	Lowest	—	—	—	—	—	—	—	—
	Second	0.01	−0.04	0.05	0.726	0.00	−0.04	0.05	0.975
	Middle	0.00	−0.05	0.04	0.875	−0.02	−0.06	0.03	0.446
	Fourth	−0.01	−0.06	0.04	0.722	−0.01	−0.06	0.03	0.576
	Highest	0.06	0.01	0.12	0.020	0.05	0.00	0.11	0.042
Maternal education	None or informal education	—	—	—	—	—	—	—	—
	Any formal education	0.05	0.02	0.09	0.003	0.04	0.00	0.07	0.027
Maternal age	15–24 years	—	—	—	—	—	—	—	—
	25–34 years	0.01	−0.02	0.03	0.505	−0.02	−0.05	0.00	0.032
	35–49 years	0.02	−0.01	0.06	0.195	−0.02	−0.06	0.01	0.201

(*Continued*)

Table 4. (*Continued*)

Statement or question	Responses	ANC4+				Facility delivery			
		Average marginal effect	95% CI		*p*-value	Average marginal effect	95% CI		*p*-value
Maternal occupation	Works outside home or student	—	—	—	—	—	—	—	—
	No work outside home	−0.06	−0.09	−0.02	0.001	0.02	−0.01	0.06	0.102
Spousal occupation	Works outside home or student	—	—	—	—	—	—	—	—
	No work outside home	0.00	−0.06	0.06	0.938	0.00	−0.05	0.06	0.942
Spousal education	None or informal education	—	—	—	—	—	—	—	—
	Any formal education	0.03	0.00	0.06	0.037	0.04	0.01	0.07	0.011

[a]'Likert-scale statements with 'Agree' and 'Confident' include 'strongly or somewhat' in the responses.
—: Reference category.
Average marginal effect estimates were derived from mixed-effects logistic regression models adjusted for ideational and socio-demographic variables. All variables were included as fixed effects nested within cluster identifiers. The level of statistical significance was set to $p<0.05$.

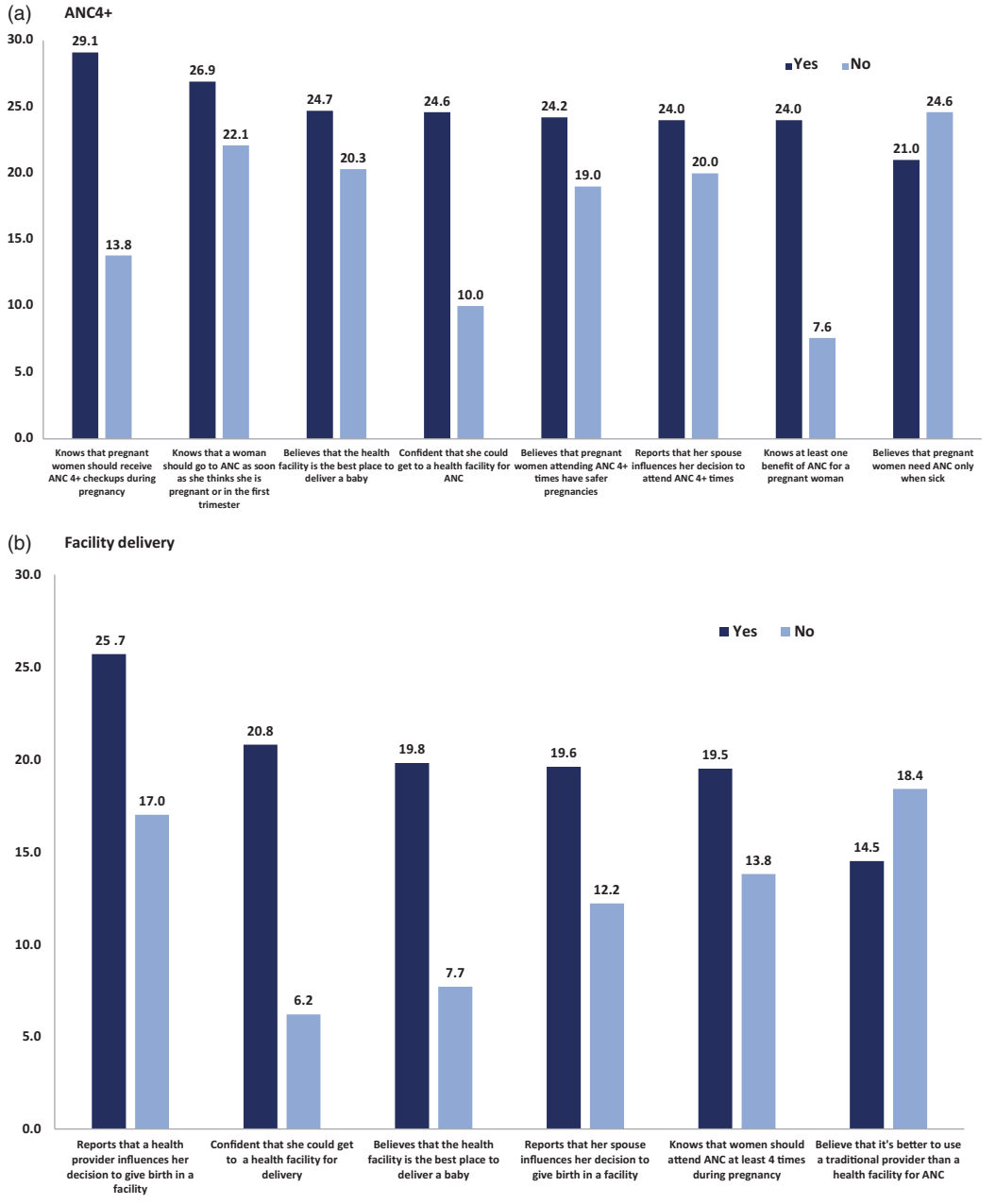

Figure 2. Predicted probabilities of a) ANC4+ and b) facility-based delivery among those with or without significant ideational characteristics. Note that the predicted probabilities were computed based on the average marginal effect estimates derived from mixed-effects logistic regression models adjusted for ideational and socio-demographic variables. All variables were included as fixed effects nested within cluster identifiers. Level of statistical significance was set to $p<0.05$.

self-efficacy in accessing services, spousal support in pregnancy and childbirth decisions and positive perceptions of maternal health services quality were found to be among the most important ideations for SBC programmes to target in north-western Nigeria in relation to improving ANC4+ attendance and facility-based delivery. Such efforts must by complemented by health

https://doi.org/10.1017/S0021932021000729 Published online by Cambridge University Press

system strengthening efforts and other programmes that address entrenched gender and social norms that reduce women's participation in health care decision-making.

Within the cognitive domain, knowledge of ANC timing and benefits was significantly associated with attending ANC4+ times and giving birth in a facility. This included knowing the recommended number of ANC check-ups and when to initiate the first ANC visit, as well as reporting at least one ANC benefit to herself. Indeed, it is well-recognized that raising knowledge about health behaviours, including pregnancy and childbirth, is an essential first step for health-promotion activities (Kincaid *et al.*, 2013). The present study results suggest that SBC programmes in north-western Nigeria may need to focus on increasing a woman's basic ANC knowledge, as well as promoting the benefits to herself/child of ANC and facility-based delivery in these communities in order to increase service uptake.

At the same time, SBC programmes must also go beyond knowledge to address the cognitive beliefs that have been shown to further impede progress. In this study, women who believed that pregnant women attending ANC4+ times had safer pregnancies were 1.3 times more likely to attend ANC4+ times than those who did not, while women who thought ANC was only for sick pregnant women had 17% lower likelihood of ANC4+ attendance. The perception that ANC is only necessary if illness complications arise aligns with previous research suggesting that women often perceive pregnancy as a normal condition and place low value on antenatal care when feeling well (Finlayson & Downe, 2013; Warri & George, 2020). It also dovetails with the most common reason cited by women in the present study for non-use of ANC services – a lack of perceived need. The SBC programmes may therefore need to reinforce the importance of ANC to women and children even during healthy pregnancies without complications. Women's beliefs about local health services quality were also associated with ANC4+ attendance and facility-based delivery, which underscores long-standing evidence that quality of health services is a main determinant of its use (Kruk *et al.*, 2014; Larson *et al.*, 2019).

Within the emotional dimension, self-efficacy was a significant ideational domain associated with ANC4+ attendance and facility-based delivery. Women who felt confident that they could get to a facility for ANC or delivery were 2.5 and 3.4 times more likely to attend ANC4+ times or to give birth in a facility than women who lacked such confidence. Indeed, inability to access facilities due to transport or other issues is a common barrier to service uptake (Bohren *et al.*, 2014). Yet, women's empowerment and confidence in their own ability to undertake the behaviour is an important behavioural influence itself (Ntoimo *et al.*, 2020) and further research should explore the complex reasons women may feel uncertain around accessing care for pregnancy and childbirth, including entrenched gender and cultural norms in this area, which reduce women's participation in health care decision-making more broadly (Babalola *et al.*, 2015; Ntoimo *et al.*, 2020).

Within the social dimension, supportive spousal influence on decision-making was significantly associated with both ANC4+ attendance and facility-based delivery, while health provider influence was only significantly related to giving birth in a facility. The important role of husbands in household decision-making in north-western Nigeria is well established (Oguntunde *et al.*, 2019; Ntoimo *et al.*, 2020) and this power dynamic is amplified by early marriage practices, polygyny and low female literacy and formal schooling (Wolf *et al.*, 2008). Some research suggests that men in this area may consider pregnancy and childbirth a woman's domain, and may not engage in decision-making, even if the wife is not empowered to make such decisions alone (Oguntunde *et al.*, 2019). Nevertheless, shared health care decision-making and male engagement in pregnancy and childbirth decisions have been shown to improve pregnancy outcomes (Danforth *et al.*, 2009; Yargawa & Leonardi-Bee, 2015). The current findings further underscore the important role of spousal support for uptake of maternal health services in this area. These results suggest that SBC programmes should place a high priority on male engagement in order to positively improve maternal health outcomes and must work within the context of gender and social norms that reduce women's empowerment in health care decision-making more broadly. Finally, health worker support was also found to have a positive influence on women's decision to give birth

https://doi.org/10.1017/S0021932021000729 Published online by Cambridge University Press

in a facility. Since providers are a conduit for positive health messaging through interpersonal communication with clients, encouraging providers to counsel women on the value of facility-based delivery during ANC visits may be an important channel for promoting behaviour change in the future. Such improvements in health care counselling must also be viewed in light of broader health system strengthening efforts that improve the availability and quality of maternal health care, which in turn improves community perceptions of, trust in and demand for these services.

The results presented in this paper should be viewed in light of some methodological limitations. First, associations found in cross-sectional studies do not imply causation, and importantly, there is potential for reverse causation such that performing a behaviour (e.g. giving birth in a facility) may create or reinforce an ideation (e.g. confidence in accessing a facility for delivery). Second, observational studies are prone to residual confounding from unmeasured variables, such as ideations that were not measured or facility-level variables that were not collected as part of this population-based survey. Third, self-reported attitudes may be affected by social desirability concerns or desires to please the interviewer, which could bias responses towards more agreeable ones. Respondents' attitudes may also vary depending on the respondent's disposition at the time of interview. Fourth, psychosocial metrics may not adequately capture the broadly defined ideational domain, which could lead to non-significant findings for an ideation despite its potential importance for pregnancy and childbirth decisions. Finally, the findings were derived from a community-based survey that aimed to gauge women's perceptions and practices in relation to maternal health services in order to inform an SBC programme in the study wards. These findings do not provide evidence of health services quality, male perceptions or other broader cultural or societal contextual information, which also greatly influence service uptake.

Overall, the study results indicate that improving pregnancy and childbirth practices in north-western Nigeria will require SBC programmes to consider addressing a wide range of psychosocial factors, including raising knowledge and dispelling myths, building women's confidence to access services, engaging spousal support in decision-making and improving perceived (and actual) maternal health services quality. These psychosocila factors are also heavily influenced by the broader socioeconomic, cultural and health system contexts of the north-west region. Such efforts must be complemented by broader health system strengthening efforts and other programmes that specifically address entrenched gender and social norms that reduce women's participation in health care decision-making. Ideational metrics provide important insights for programmes that aim to change health behaviours, including pregnancy and childbirth, and should be explored for other health areas as well.

Acknowledgments. The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Funding. The research was funded by the United States Agency for International Development (USAID) through the Breakthrough RESEARCH cooperative agreement AID-OAA-A-17-00018. The funders had no role in the study design, data collection and analysis, data interpretation, manuscript preparation or the decision to submit for publication.

Conflicts of Interest. The authors have no conflicts of interest to declare.

Ethical Approval. Ethical approval for this study was obtained from the National Health Research Ethics Committee in Nigeria [NHREC/01/01/2007-02/09/2019] and the Tulane University Institutional Review Board in Louisiana, USA [2019-1047]. Written informed consent to participate in the survey was obtained from all willing participants for the household and female questionnaires. Each participant signed or marked her thumbprint on the consent form to signify willingness to participate. All survey participants were married women and any respondent under 16 years was considered an emancipated minor not requiring parental consent.

Author Contributions. PLH and PCH designed and conceptualized the study. PLH and EWJ developed the study questionnaire, supervised fieldwork and data collection. EWJ, UA and PLH compiled, prepared and analysed data. EWJ, UA, DA, MO, SA-A, PCH and PLH contributed to interpretation of findings. EWJ wrote the first draft of the paper. EWJ, UA, DA, MO, SA-A, PCH and PLH reviewed, revised and contributed to writing the paper. All authors read and approved the final manuscript.

References

Adamu YM and Salihu HM (2002) Barriers to the use of antenatal and obstetric care services in rural Kano, Nigeria. *Journal of Obstetrics & Gynaecology* **22**(6), 600–603.

Aliyu AA and Dahiru T (2017) Predictors of delayed Antenatal Care (ANC) visits in Nigeria: secondary analysis of 2013 Nigeria Demographic and Health Survey (NDHS). *Pan African Medical Journal* **26**, 124–124.

Babalola S, John N, Ajao B and Speizer IS (2015) Ideation and intention to use contraceptives in Kenya and Nigeria. *Demogrphic Research* **33**, 211–238.

Beyeler N, Liu J and Sieverding M (2015) A systematic review of the role of proprietary and patent medicine vendors in healthcare provision in Nigeria. *PLoS One* **10**(1), e0117165.

Bohren MA, Hunter EC, Munthe-Kaas HM, Souza JP, Vogel JP and Gülmezoglu AM (2014) Facilitators and barriers to facility-based delivery in low- and middle-income countries: a qualitative evidence synthesis. *Reproductive Health* **11**(1), 71–71.

Danforth EJ, Kruk ME, Rockers PC, Mbaruku G and Galea S (2009) Household decision-making about delivery in health facilities: evidence from Tanzania. *Journal of Health, Population, and Nutrition* **27**(5), 696–703.

Doctor HV, Findley SE, Ager A, Cometto G, Afenyadu GY, Adamu F and Green C (2012) Using community-based research to shape the design and delivery of maternal health services in Northern Nigeria. *Reproductive and Health Matters* **20**(39), 104–112.

Efevbera Y and Bhabha J (2020) Defining and deconstructing girl child marriage and applications to global public health. *BMC Public Health* **20**(1), 1547.

Fagbamigbe AF and Idemudia ES (2015) Barriers to antenatal care use in Nigeria: evidences from non-users and implications for maternal health programming. *BMC Pregnancy Childbirth* **15**, 95.

Fagbamigbe AF and Idemudia ES (2017) Wealth and antenatal care utilization in Nigeria: policy implications. *Health Care for Women International* **38**(1), 17–37.

Fetohy EM (2004) Impact of a simple health education program about antenatal care on knowledge, attitudes, subjective norms and intention of pregnant women. *Journal of the Egyptian Public Health Assocociation* **79**(3–4), 283–310.

Filmer D and Pritchett L (1998) *Estimating Wealth Effects Without Expenditure Data – or Tears: An Application to Educational Enrollments in States of India*. World Bank, Washington, DC.

Finlayson K and Downe S (2013) Why do women not use antenatal services in low- and middle-income countries? A meta-synthesis of qualitative studies. *PLoS Medicine* **10**(1), e1001373.

Galadanci HS, Ejembi CL, Iliyasu Z, Alagh B and Umar US (2007) Maternal health in Northern Nigeria: a far cry from ideal. *BJOG* **114**(4), 448–452.

Government of Nigeria (2016) National Health Facility Survey 2016. Nigeria Federal Ministry of Health; Abuja, Nigeria.

Government of Nigeria (2017a) *Antenatal Care: An Orientation Package for Health Providers. Nigeria Federal Ministry of Health*, Abuja, Nigeria.

Government of Nigeria (2017b) *Demographics Statistics Bulletin*. National Bureau of Statistics, Abuja, Nigeria.

Government of Nigeria and DHS Program (2019) *Nigeria Demographic and Health Survey 2018*. Nigeria Statistical Bureau and DHS Program, Abuja, Nigeria, and Maryland, USA.

Ishola G, Fayehun F, Isiugo-Abanihe U, Segun T, Yusuf S, Orji B *et al.* (2017) Effect of volunteer household counseling in improving knowledge of birth preparedness and complication readiness of pregnant women in northwest Nigeria. *African Journal of Reproductive Health* **21**(1), 39–48.

Johansson EW, Hutchinson PL, Omoluabi E, Akinyemi A, Smith A, Welty JC *et al.* (2020) *Behavioral Sentinel Surveillance Survey in Nigeria: Baseline Technical Report*. Population Council, Washington, DC.

Kincaid D, Delate R, Storey J and Figeroa M (2013) *Closing the Gaps in Practice and in Theory: Evaluation of the Scrutinize HIV Campaign in South Africa*. Sage, Newbury Park, CA.

Kruk ME, Hermosilla S, Larson E and Mbaruku GM (2014) Bypassing primary care clinics for childbirth: a cross-sectional study in the Pwani region, United Republic of Tanzania. *Bulletin of the World Health Organization* **92**(4), 246–253.

Larson E, Gage AD, Mbaruku GM, Mbatia R, Haneuse S and Kruk ME (2019) Effect of a maternal and newborn health system quality improvement project on the use of facilities for childbirth: a cluster-randomised study in rural Tanzania. *Tropical Medicine and International Health* **24**(5), 636–646.

Larson, HJ, Jarrett C, Schulz WS, Chaudhuri M, Zhou Y, Dube E *et al.* (2015) Measuring vaccine hesitancy: the development of a survey tool. *Vaccine* **33**(34), 4165–4175.

Meh C, Thind A, Ryan B and Terry A (2019) Levels and determinants of maternal mortality in northern and southern Nigeria. *BMC Pregnancy and Childbirth* **19**(1), 417.

Ntoimo LFC, Okonofua FE, Aikpitanyi J, Yaya S, Johnson E, Sombie I *et al.* (2020) Influence of women's empowerment indices on the utilization of skilled maternity care: evidence from rural Nigeria. *Journal of Biosocial Science*, doi:10.1017/S0021932020000681.

Oguntunde O, Nyenwa J, Yusuf FM, Dauda DS, Salihu A and Sinai I (2019) The experience of men who participated in interventions to improve demand for and utilization of maternal and child health services in northern Nigeria: a qualitative comparative study. *Reproductive Health* **16**(1), 104–104.

Okedo-Alex IN, Akamike IC, Ezeanosike OB and Uneke CJ (2019) Determinants of antenatal care utilisation in sub-Saharan Africa: a systematic review. *BMJ Open* **9**(10), e031890.

Pedersen J and Liu J (2012) Child mortality estimation: appropriate time periods for child mortality estimates from full birth histories. *PLoS Medicine* **9**(8), e1001289.

Sageer R, Kongnyuy E, Adebimpe WO, Omosehin O, Ogunsola EA and Sanni B (2019) Causes and contributory factors of maternal mortality: evidence from maternal and perinatal death surveillance and response in Ogun state, Southwest Nigeria. *BMC Pregnancy Childbirth* **19**(1), 63.

Souza JP (2019) The Nigeria Near-Miss and Maternal Death Survey: collaborative research generating information for action. *BJOG* **126** (Supplement 3), 5–6.

Storey JD, Babalola SO, Ricotta EE, Fox KA, Toso M, Lewicky N and Koenker H (2018) Associations between ideational variables and bed net use in Madagascar, Mali, and Nigeria. *BMC Public Health* **18**(1), 484.

United Nations (2015) *Transforming Our World: The 2030 Agenda for Sustainable Development.* Resolution adopted by the General Assembly on 25th September 2015: A/RES70/1.2015. United Nations, New York.

Warri D and George A (2020) Perceptions of pregnant women of reasons for late initiation of antenatal care: a qualitative interview study. *BMC Pregnancy and Childbirth* **20**(1), 70.

World Health Organization (2015) *Trends in Maternal Mortality: 1990 to 2015*. WHO, Geneva.

World Health Organization (2016) *WHO Recommendations on Antenatal Care for a Positive Pregnancy Experience.* WHO, Geneva.

Wolf M, Abubakar A, Tsui S and Williamson N (2008) *Child Spacing Attitudes in Northern Nigeria.* Family Health International, Washington, DC.

Yargawa J and Leonardi-Bee J (2015) Male involvement and maternal health outcomes: systematic review and meta-analysis. *Journal of Epidemiology and Community Health* **69**(6), 604–612.

Yaya S, Okonofua F, Ntoimo L, Udenigwe O and Bishwajit G (2019) Men's perception of barriers to women's use and access of skilled pregnancy care in rural Nigeria: a qualitative study. *Reproductive Health* **16**(1), 86.

Cite this article: Johansson EW, Anaba U, Abegunde D, Okoh M, Abdu-Aguye S, Hewett PC, and Hutchinson PL (2023). Psychosocial influences on pregnancy and childbirth behaviours in north-western Nigeria: a cross-sectional analysis. *Journal of Biosocial Science* **55**, 131–149. https://doi.org/10.1017/S0021932021000729