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Determinants of continued maternal care seeking during pregnancy, birth and postnatal and associated neonatal survival outcomes in Kenya and Uganda: analysis of cross-sectional, demographic and health surveys data

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ABSTRACT

Objectives To examine how maternal and sociodemographic factors determine continued care-seeking behaviour from pregnancy to postnatal period in Kenya and Uganda and to determine associated neonatal survival outcomes.

Design A population-based analysis of cross-sectional data using multinomial and binary logistic regressions.

Setting Countrywide, Kenya and Uganda.

Participants Most recent live births of 24 502 mothers within 1–59 months prior to the 2014–2016 Demographic and Health Surveys.

Outcomes Care-seeking continuum and neonatal mortality.

Results Overall, 57% of the mothers had four or more antenatal care (ANC) contacts, of which 73% and 41% had facility births and postnatal care (PNC), respectively. Maternal/paternal education versus no education was associated with continued care seeking in majority of care-seeking classes; relative risk ratios (RRRs) ranged from 2.1 to 8.0 (95% CI 1.1 to 16.3). Similarly, exposure to mass media was generally associated with continued care seekin; RRRs ranged from 1.8 to 3.2 (95% CI 1.2 to 5.4). Care-seeking tendency reduced if a husband made major maternal care-seeking decisions. Transportation problems and living in rural versus urban were largely associated with lower continued care use; RRR ranged from 0.4 to 0.7 (95% CI 0.3 to 0.9). The two *lowest* care-seeking categories with no ANC and no PNC indicated the highest odds for neonatal mortality (adjusted OR 4.2, 95% CI 1.6 to 10.9). 23% neonatal deaths were attributable to inadequate maternal care attendance.

Conclusion Strategies such as mobile health specifically for promoting continued maternal care use up to postnatal could be integrated in the existing structures. Another strategy would be to develop and employ a brief standard questionnaire to determine a mother's continued care-seeking level during the first ANC visit and to use the information to close the care-seeking gaps. Strengthening the community health workers system to be an integral part of promoting continued care seeking could enhance care seeking as a stand-alone strategy or as a component of aforementioned suggested strategies.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ The national representativeness of the data and the large sample size of the study allowed for valid stratified analysis with implications for national policy developments to improve neonatal survival outcomes for countries in the sub-Saharan Africa region.

⇒ Recall bias may not be completely eliminated from the study since the data were collected retrospectively through interviews.

⇒ However, by selecting the most recent births and owing to the fact that childbirth is a special event not easily forgettable, the study findings reflect the reality with considerable validity.

⇒ The study was based on maternal attendance to care and not the actual obstetric services received; thus, aspects related to lack of drugs, inadequate facilities or quality of care were not captured in our study.

INTRODUCTION

In 2019, close to 7000 newborns worldwide died within their first 28 days of life (neonatal period), as per the United Nations Inter-Agency Group for Child Mortality Estimation.[1] Roughly three-quarters of these deaths occurred during childbirth and the first week of the neonatal period,[1,2] and the major causes included infections such as sepsis and pneumonia, birth complications and prematurity-related problems such as asphyxia and low birth weight.[3] Comprehensive antenatal care (ANC), skilled birth attendance and postnatal (afterbirth) care (PNC) have long been recognised as key strategies that profoundly contribute to newborn survival.[4,5] In 2015, 64% of women globally had four or more ANC contacts,[6] and prevalence of health facility births was 80% in 2019.[7] In high-income

countries such as Sweden, where neonatal death rate is among the lowest globally (1.4 deaths per 1000 live births, in 2019), almost all mothers obtain comprehensive ANC, facility births and PNC services.[8] However, in sub-Saharan African (SSA) and Southeast Asian countries, where over 70% of all neonatal deaths occur,[9] use of the components of care is relatively low and varies substantially.[10–12]

Accordingly, since 2005, the WHO has been advocating for the implementation of continuum of care strategy,[13] a concept that promotes continual access to care from prepregnancy to the first few weeks of after childbirth.[13 14] While several SSA countries including Kenya and Uganda report over 80% coverage of at least one ANC contact with a skilled provider,[15 16] late initiation of ANC visits, lower health facility births and very low PNC use still pose enormous challenges. A study in The *Lancet* reported that prevalence of early initiation of ANC contact (<14 weeks of gestation) was only 24% in SSA, much lower compared with 85% in high-income countries.[17] The challenge in a number of SSA countries, however, is that despite the removal of user fees for all maternal and child health service in many countries, a number of sociodemographic factors and maternal characteristics still remain critical determinants of care use that hinder or motivate choices and preferences in maternal care seeking.[18]

Andersen and Newman behavioural model of use of healthcare services has widely been used to identify factors that influence care-seeking behaviour.[19] The model outlines three main factors that interact to predict use of care, and they included societal, individual and health system determinants[19] (see diagrammatic details in online supplemental file 1). The model has been employed by studies to examine use of the different components of maternal and newborn care such as ANC,[20 21] childbirth[22] or PNC.[23] However, very few studies in SSA have assessed how factors in the Andersen and Newman model modify care-seeking behaviour along the continuum of care from pregnancy to postnatal period, and even much fewer within the context of free maternity policy.

A recent community-based study in Ethiopia showed that women with higher education, married women and those with autonomy in healthcare decision were likely to complete continuum of care.[24] Whereas the study provided critical findings, it considered only one ANC visit and not the WHO or Ministry of Health (MoH)-recommended number of contacts.[24] Another similar study by Oh *et al.* 2013 in Gambia also found a number of factors associated with maternal care-seeking continuum and early ANC visits.[25] However, the study lacked PNC estimates for facilities deliveries.[25] Another subnational study in Tanzania found, among other factors, knowledge or experience of pregnancy danger signs was associated with higher care seeking.[26] A 2019 Cochrane review of several qualitative studies found that influence by others, illness-free pregnancy, financial dependence and selective use of ANC are potential barriers to continual maternal care use.[27] The few existing studies on continuum of care seeking in SSA are very informative but limited in one way

or another, and none to our knowledge examined associated neonatal survival outcomes.

Kenya and Uganda are among the 10 countries in SSA countries with most neonatal deaths[28] and despite relatively free or subsidised maternity policy in both countries and relatively higher gross domestic product than some countries in the East Africa region such as Rwanda, neonatal mortality rates have declined much slower compared with Rwanda.[29 30] Thus, this study aimed to examine how sociodemographic and maternal factors influence care-seeking behaviour in the care-seeking continuum from pregnancy, childbirth to postnatal period in Kenya and Uganda. A secondary aim was to estimate the impact of levels of continued maternal care seeking on neonatal survival.

METHODS
Study settings
Kenya and Uganda have closely comparable demographics and are in relatively similar state of maternal healthcare policy and pathway towards achieving universal coverage. The total population in Kenya and Uganda as of 2016–2019 was about 90 million.[31 32] More than 70% of the populations live in the rural areas with agriculture as their main source of livelihood.[31 33 34] The sex ratio is approximately 1:1,[31 35] and general life expectancy at birth in 2016 was similar in both countries; for women, it was 64 and 67 years in Uganda and Kenya, respectively.[36] Maternal mean age at first childbirth is 19–20 years. Neonatal mortality rates in both countries were about 22 deaths per 1000 live births in 2016.[30] Like a number of countries in SSA, Kenya and Uganda provide free maternal care services in primary-level health facilities.[37] Although the goal of the free maternity programmes in Kenya and Uganda is to eliminate all maternity-related costs, due to inadequate or slow distribution of funding in some health facilities, certain hidden costs such as for ultrasound, access to hospital card and laboratory services among others are still incurred out-of-pocket.[38–42] Additionally, indirect expenses such as costs of transportation to the health facility are still challenges common among poor households.[39] Further, in Kenya, prior to June 2013, maternal services were partly free and partly subsidised.[43]

Data source and study design
We obtained the cross-sectional, population-representative, Demographic and Health Surveys (DHS) datasets for Kenya 2014 and Uganda 2016 after a formal request to the DHS secretariat. DHS collects sociodemographic, maternal and child health data across the whole country in a two-stage cluster sampling procedure. The DHS uses standard procedures and protocols that ensure complete anonymity of the respondents and adherence to international ethical standards for research. We used the data for the most recent live births, 1–59 months prior to the surveys. More details on data collection procedure can be accessed from DHS methodology and manuals.[44 45]

Table 1 Classification of continuum of care-seeking classes during the antenatal period, childbirth and within 28 days of postnatal period in Kenya and Uganda

	≥4 ANC visits	2–3 ANC visits	1 ANC visit	0 ANC visit
Health facility births				
PNC—yes	Highest	Higher	Seventh lowest	–
PNC—no	High	Moderately high	Sixth lowest	Third lowest
Birth outside of health facility				
PNC—yes	Slightly high	Moderately lower	Fifth lowest	Second lowest
PNC—No	Moderately low	Very low	Fourth lowest	Lowest

ANC, antenatal care; PNC, postnatal care.

Study variables

Outcome variables

Care-seeking continuum was the primary outcome variable. It constituted a combination of the number of ANC visits, health facility birth and at least one PNC contact within 28 days postpartum (after birth). Continuum of care seeking was categorised into 15 classes based on relative adherence to basic (modified) WHO and MoH recommendations for care attendance from pregnancy to postnatal period prior to 2016, that is, before the current WHO recommendation of 8 ANC visits. Since data for both countries were collected prior to the new WHO 2016 ANC recommendations, we used previous Focused ANC recommendations. A mother with a combination of four or more visits, health facility birth (skilled birth) and at least one PNC contact was classified in the *highest* category of care seeking, and those with least/no amount of care were categorised as the *lowest* class. The intermediate categories were classified on the basis of optimal and perceived descending level of care-seeking behaviour as *higher, high, moderately high, slightly high, moderately low, moderately lower, very low, seventh lowest, sixth lowest, fifth lowest, fourth lowest, third lowest, second lowest* and *lowest*, as shown in table 1.

The first component of classification was in accordance with the number of ANC visits a mother had; the second level was on the basis of whether or not a mother delivered at the health facility; and the last part of continuum of care was whether or not a mother had PNC visit within 28 days postpartum.

Neonatal mortality was a secondary outcome variable that was dichotomised into 'yes' (died) and 'no' (lived), depending on whether the neonate lived or not. The predictor variables for this outcome variable were the modified classes of care-seeking continuum discussed previously as the primary outcomes.

Independent variables

These constituted sociodemographic factors and maternal characteristics that were examined across all care-seeking continuum categories of the primary outcome variable. They included variables that the modified Andersen and Newman behavioural model for care use identified as predictors of care-seeking behaviour.[19] Further, the categorisation of these variables was also informed by a number of maternal and child health studies previously conducted in SSA. They included *maternal age*, which was initially grouped as 15–19, 20–24, 25–29, 30–34, 35–39, 40–44 and 45–49 years old, and we recategorised it into 15–24, 25–34 and 35–49 years years old, while *place of residence* remained as rural and urban.[46] *Marital status* was dichotomised into single or married.[47] A mother having a *problem with longer distance/transportation to nearest health facility* was classified as 'yes' if it was a problem and 'no' if it was not.[48] *Desire to have a newborn child, whether or not the mother was told about pregnancy complications*[49] *and having exposure to mass media*[50] were all categorised as 'yes' and 'no'. The variable *who ultimately makes maternal care-seeking decisions* was categorised as respondent (woman) alone, husband alone or joint decision.[51] *Education* was categorised as no education, primary education and secondary or higher.[52] *Parity* (number of children ever born) was categorised as primiparous (for first time mothers), para 2–3 (for those with two to three children) and para 4+.[46] *Wealth status* was classified into poor (poor/poorest), middle and rich (rich/richest).[52 53] The *wealth status* in DHS is indexed based on household cumulative living standards, taking into account assets possessed, water and sanitation facilities. *Place of residence* was classified into rural and urban.[53]

Mapping the predictor: outcome relationship using directed acyclic graphs (DAGs)

Prior to the analysis, the DAGs by Textor and colleagues[54] were used to map the predictors of both care-seeking behaviours and neonatal mortality on the basis of existing peer-reviewed evidence and to identify any confounding bias in our models. Online supplemental file 2, diagrams 1.a and b, illustrate the process. For diagram 1.b, the lower levels of care seeking are represented by a lack of a care component(s) that is/are major non-causal risk factor for neonatal mortality.

Data analysis

We used cross-tabulations to examine the distribution of mothers across variables and variable categories in the different levels of care-seeking continuum. We also investigated correlations between ANC visits and proportions of health facility childbirths and PNC visits. Multinomial logistic regression models examined the associations between sociodemographic and maternal factors and continued care seeking at different care-seeking classes/categories, with the *lowest* class as the reference group. The independent variables were mutually adjusted for each other.

Binary logistic regression was used to determine the odds ratios (OR) for the associations between the various classes of care-seeking continuum and neonatal mortality. For plausible and valid analysis, nine classes with satisfactory data were used in the overall mortality analysis with the *highest* class as the reference group. Low birthweight babies and multiple gestations are strong independent risk factors for neonatal death[55 56] and thus were excluded in the mortality analysis to obtain adjusted OR (aOR). The rest of the classes were not used owing to fewer numbers in certain neonatal mortality strata. Similarly, country-specific analysis resulted in elimination of more strata with fewer numbers. Further, the resulting significant aORs were used to estimate attributable risk fraction (AR) and population attributable risk fraction (PAR) for both countries combined. This was to determine proportion of neonatal deaths that would be prevented if mothers in a given lower level of care-seeking continuum had sought care at the *highest* class. We used Stata V.16 and Microsoft Excel (2021) for analysis and to generate graphical summaries of results. Sampling weights were applied, and we accounted for complex sampling design recommended by the DHS methodology guide. Missing data due to nonresponse were mostly negligible compared with the subpopulation sample sizes and relatively randomly spread across the variable subgroups; they were nevertheless omitted in our analysis. For the variable 'knowledge about pregnancy, birth complications', where data were missing for Uganda, the analysis was only performed for Kenya where plausible.

Estimating attributable neonatal mortality risk proportions associated with low levels of care-seeking continuum

The attributable risk proportions (AR) and population attributable neonatal mortality risk proportion (PAR) were obtain by the formulas $AR = [(OR1)/OR)] \times 100$ and $PAR = Pe * [(OR1)/OR)] \times 100$, respectively, where OR is the statistically significant aOR associated with that care-seeking class and Pe is the proportion of the total mortalities in that given care-seeking class.

Public and patient involvement

No patients or the public were directly involved in this study.

RESULTS

Table 2 and figure 1 indicate that over 95% of mothers had at least one ANC visit, and about 56% had four or more ANC contacts in Kenya and Uganda. Of those who had four or more ANC visits, 73% gave birth at a health facility and about 41% had newborn PNC check-up within 28 days after birth as shown in table 2.

The scatter plot in figure 2 shows a positive correlation between number of ANC visits and both proportions of facility births and PNC visits. Further, figure 3 shows that a single early ANC visit in the first or second trimester

Table 2 Distribution of mothers by continuum of care-seeking classes during the antenatal period, childbirth and within 28 days postnatal in Kenya and Uganda, using Demographic and Health Surveys 2014–2016 data, N=24 502

|	≥4 ANC visits, n=13 888	2–3 ANC visits, n=8744	1 ANC visit, n=775	0 ANC visit, n=1095
Health facility births				
PNC—yes	4961 (35.7)	2355 (26.9)	115	68 (6.2)
PNC—no	5179 (37.3)	2782 (31.8)	213	106 (9.6)
Birth outside of health facility				
PNC—yes	752 (5.4)	632 (7.2)	63	121 (11.1)
PNC—no	2996 (21.6)	2975 (34.0)	384	800 (73.1)

ANC, antenatal care; PNC, postnatal care.

increased the likelihood of health facility childbirth as opposed to late ANC visit in the third trimester.

Table 3 shows the distribution of maternal and socio-demographic characteristics by care-seeking behaviour from pregnancy to postnatal period. Majority (≥46%) of the mothers were between 25 and 34 years of age in all care-seeking categories. Overall, about 71% of the mothers lived in a rural setting, and 37% of all women had problems with distance to the nearest health facility. Roughly 30% and 57% of those who had the highest and the lowest care-seeking tendencies, respectively, indicated distance could be a hindrance to care seeking. Slightly over half of all the mothers had primary education. About 40% of the highest careseekers had secondary or higher education, while 60% of the lowest careseekers had no formal education. Similar trends were observed among their husbands/partners (education).

Table 4 shows the results of the multinomial regressions for the associations between independent factors and different classes of care-seeking continuum from pregnancy to childbirth and 28 days postnatal, with the *lowest* class being the reference category. Maternal primary or
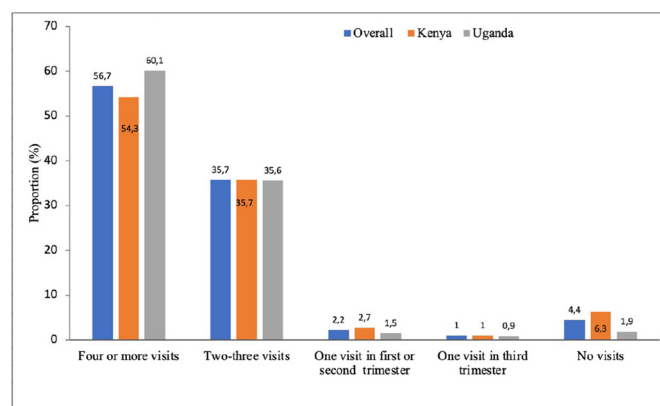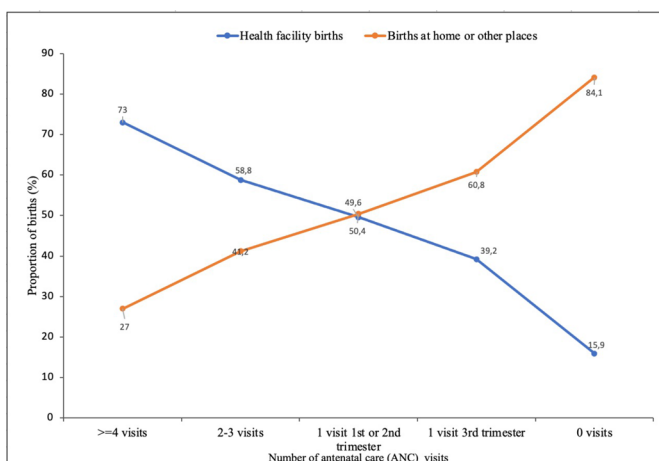

Figure 1 Proportions of antenatal care visits by number of antenatal care contacts in Kenya and Uganda, using Demographic and Health Surveys 2014–2016 data.
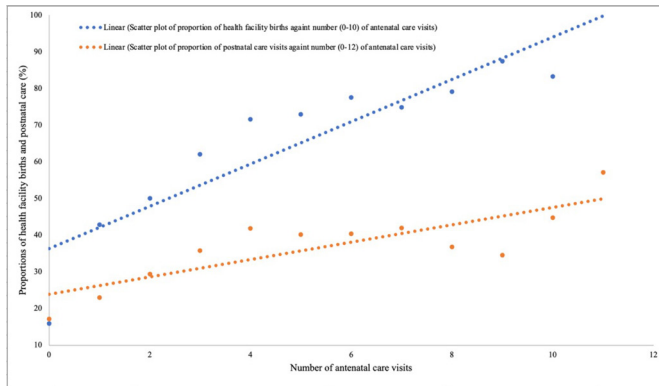
Figure 2 Scatter plot showing correlation between number of antenatal care visits and proportions of facility births and postnatal care visits in Kenya and Uganda, using Demographic and Health Surveys 2014–2016 data.

higher education levels compared with no formal education,were significantly associated with higher care-seeking behaviour in almost all care-seeking categories except among those who had one ANC visit/facility birth/no PNC (*sixth lowest*) or less; relative risk ratios (RRRs) ranged from 2.1 to 8.0 (95% CI 1.1 o 16.3). Similarly, trends were observed among those with husbands having primary education and above; RRRs ranged from 2.1 to 6.4 (95% CI 1.3 to 10.6). Generally, the higher the level of education, the higher the care-seeking tendency. Exposure to mass media (radio/television) was generally associated with higher care-seeking tendency; RRRs ranged from 1.8 to 3.2 (95% CI 1.2 to 5.4). There was minimal indication that desire to have a child improves care seeking, although high RRR to seek care were observed among those who had two or more ANC visits, but findings were not statistically significant except in the *high* category.

Problem with distance to the health facility (vs no problem) was largely a demotivating factor to care seeking. In six care-seeking categories, the RRRs ranged from 0.6 to 0.7 (95% CI 0.5 to 0.9), whereas in the remaining categories, *very low* to *lowest*, the association was marginally

Figure 3 Proportion of hospital and home births by number of antenatal care visits in Kenya and Uganda, using Demographic and Health Surveys 2014–2016 data.

not statistically significant; RRRs ranged from 0.6 to 1.1 (95% CI 0.3 to 1.4). Higher parity versus primiparous was not associated with care seeking except in a few care-seeking categories among those who had 2–3 ANC visits. Generally, being told about pregnancy and birth complications significantly increased the tendency to seek care in Kenya.

Older maternal age compared with young age was generally not significantly associated with care seeking at all levels of care-seeking continuum, RRRs ranged from 0.4 to 0.9 (95% CI 0.3 to 1.7), except marginally significant in *moderately high* and *seventh lowest* classes. Living in a rural area versus urban was significantly associated with lower care-seeking tendency in nine categories. The remaining care-seeking categories indicated lower tendency but not significant results. Care seeking was also notably hindered when the husband/partner rather than the woman made major decisions for maternal care seeking in about nine care-seeking categories. Being married showed variably and inconsistent associations with care seeking in most care-seeking classes, there was no significant association with care-seeking when compared with single mothers. Compared with the poor, the middle wealth status only showed significantly higher care-seeking tendency in the first four higher care-seeking classes and two other random classes; the rest were not statistically significant. Additionally, being rich indicated almost no significant association with care seeking. Figure 4 summarizes in a forest plot the selected (extremes) results from table 4.

Table 5 presents the ORs for the associations between continued care-seeking categories and neonatal mortality, with the *highest* category as the reference class. Figure 5 shows a forest plot of aOR for overall results in table 5. Overall, *third lowest* and *lowest* categories were associated with about ourfolds odds of neonatal mortality (aOR 4.2, 95% CI 1.6 to 10.9). For joint Kenya and Uganda, *moderately high* and *very low* levels of care seeking also showed significant higher odds of neonatal death; aOR ranged 1.9–2.4 for the two classes. However, the remaining two categories (*fourth lowest* and *moderately low*) did not indicate any statistically significant association with mortality. For Kenya only, *lowest*, *very low*, *moderately low*, *moderately high* and *high* versus *highest* were all significantly associated with neonatal deaths and neonates in the *lowest* class were six times likely to die. For Uganda, only *very low* category was significantly associated with neonatal death (aOR 1.7, 95% CI 1.1 to 2.7), and the *lowest* class showed higher odds but had a marginally not significant aOR 2.5 (95% CI 1.0 to 6.0). We observe that the proportion of Ugandan mothers seeking continued care at the highest level was more than twice (33.8%) that of Kenya (13.4%)

Still in table 5, in combined country findings, comparing *higher* and *moderately high* classes both with two to three ANC visits and facility childbirth, the only difference is lack of PNC attendance in the *moderately high* class, indicating that lack of PNC contributes significantly to neonatal deaths (aOR 2.2, 95% CI 1.4 to 3.4). Similarly, in Kenya, 16% of mothers were in this (*moderately high*)

Table 3 Distribution of maternal and sociodemographic factors, by continuum of care-seeking classes combining ANC visits, delivery and PNC in Kenya and Uganda, using Demographic and Health Surveys 2014–2016 data

Variables	≥4 ANC visits, n=13888				2–3 ANC visits, n=8744				1 ANC visit, n=775				0 ANC visit, n=1027		
	Highest (facility birth and PNC) n (%)	High (facility birth, no PNC) n (%)	Slightly high (no facility birth, PNC) n (%)	Moderately low (no facility birth, no PNC) n (%)	Higher (facility birth, PNC) n (%)	Moderately high (facility, no PNC) n (%)	Moderately lower (no facility birth, PNC) n (%)	Very low (no facility birth, no PNC) n (%)	7th lowest (facility, birth, PNC) n (%)	6th lowest (facility, birth, no PNC) n (%)	5h lowest (no facility birth, PNC) n (%)	4th lowest (no facility birth, no PNC) n (%)	3rd lowest (facility birth, no PNC) n (%)	2nd lowest (no facility birth, PNC) n (%)	Lowest (no facility birth, no PNC) n (%)
Maternal age (years)															
15–24	1625 (32.8)	1680 (32.4)	213 (28.3)	815 (27.2)	832 (35.3)	1001 (36.0)	159 (25.2)	778 (26.2)	51 (44.4)	77 (36.2)	20 (31.8)	123 (32.0)	43 (40.6)	36 (29.7)	189 (23.6)
25–34	2406 (48.5)	2513 (48.5)	315 (46.6)	1410 (47.1)	1064 (45.2)	1240 (44.6)	303 (47.9)	1385 (46.6)	35 (30.4)	91 (42.7)	17 (27.0)	160 (41.7)	41 (38.7)	52 (43.0)	360 (45.0)
35–49	930 (18.7)	986 (19.1)	189 (25.1)	771 (25.7)	459 (19.5)	541 (19.4)	170 (26.9)	812 (27.3)	29 (25.2)	45 (21.1)	26 (41.2)	101 (26.3)	22 (20.7)	33 (27.3)	251 (31.4)
Place of residence															
Urban	1669 (33.6)	2096 (40.5)	164 (21.8)	483 (16.1)	677 (28.8)	956 (34.4)	122 (19.3)	409 (13.8)	30 (26.1)	79 (37.1)	14 (22.2)	52 (13.5)	33 (31.1)	18 (14.9)	85 (10.6)
Rural	3292 (66.4)	3083 (59.5)	588 (78.2)	2513 (83.9)	1678 (71.3)	1826 (65.6)	510 (80.7)	2566 (86.2)	85 (73.9)	134 (62.9)	49 (77.8)	332 (86.5)	73 (68.9)	103 (85.1)	715 (89.4)
Distance to the nearest health facility is a big problem.															
No	3490 (70.3)	1561 (66.5)	472 (62.8)	876 (52.3)	1580 (67.1)	810 (62.9)	379 (60.1)	862 (50.5)	74 (64.4)	60 (63.2)	36 (57.1)	97 (47.1)	34 (68)	62 (51.2)	148 (42.8)
Yes	1471 (29.7)	785 (33.5)	280 (37.2)	798 (47.7)	775 (32.9)	477 (37.1)	252 (39.9)	844 (49.5)	41 (35.6)	35 (36.8)	27 (42.9)	109 (52.9)	16 (32.0)	59 (48.8)	198 (57.2)
Maternal education level															
No education	435 (8.8)	389 (7.5)	167 (22.2)	811 (27.1)	241 (10.2)	271 (9.8)	140 (22.2)	726 (24.4)	15 (13.0)	42 (19.7)	18 (28.6)	139 (36.2)	20 (18.9)	63 (52.0)	486 (60.8)
Primary	2535 (51.1)	2721 (52.5)	486 (64.6)	1789 (59.7)	1369 (58.2)	1645 (59.1)	399 (63.1)	1960 (65.9)	73 (63.5)	124 (58.2)	37 (58.7)	218 (56.8)	57 (53.8)	52 (43.0)	280 (35.0)
Secondary and higher	1991 (40.1)	2069 (40.0)	99 (13.2)	396 (13.2)	745 (31.6)	866 (31.1)	93 (14.7)	289 (9.7)	27 (23.5)	47 (22.1)	8 (12.7)	27 (7.0)	29 (27.3)	6 (5.0)	34 (4.3)
Partner/husband education level															
No education	255 (6.1)	128 (6.5)	118 (16.9)	276 (19.1)	142 (7.4)	68 (6.5)	98 (16.8)	259 (17.5)	7 (8.4)	17 (23.0)	13 (23.2)	39 (23.8)	4 (13.8)	52 (49.5)	173 (55.0)
Primary	1860 (44.6)	991 (50.3)	401 (57.5)	815 (56.5)	1011 (52.4)	590 (56.2)	348 (59.8)	938 (63.5)	46 (55.4)	39 (52.7)	32 (57.1)	96 (58.5)	19 (65.5)	43 (41.0)	109 (35.3)
Secondary and higher	2059 (49.3)	851 (43.2)	179 (25.6)	352 (24.4)	777 (40.2)	392 (37.3)	136 (23.4)	280 (19.0)	30 (36.1)	18 (24.3)	11 (19.6)	29 (17.7)	6 (20.7)	10 (9.5)	27 (8.7)
Knowledge about pregnancy, birth complications (only Kenya)															
No	537 (32.8)	319 (39.1)	348 (47.4)	286 (63.4)	341 (45.6)	250 (53.7)	349 (55.6)	351 (66.9)	29 (64.4)	23 (50.0)	44 (69.8)	63 (75.9)	–	–	–

Continued

Table 3 Continued

Variables	≥4 ANC visits, n=13888 Highest (facility birth and PNC) n (%)	High (facility birth, no PNC) n (%)	Slightly high (no facility birth, PNC) n (%)	2–3 ANC visits, n=8744 Moderately low (no facility birth, no PNC) n (%)	Higher (facility birth, PNC) n (%)	Moderately high (facility birth, no PNC) n (%)	Moderately lower (no facility birth, PNC) n (%)	Very low (no facility birth, no PNC) n (%)	1 ANC visit, n=775 7th lowest (facility birth, PNC) n (%)	6th lowest (facility birth, no PNC) n (%)	5h lowest (no facility birth, PNC) n (%)	4th lowest (no facility birth, no PNC) n (%)	0 ANC visit, n=1027 3rd lowest (facility birth, no PNC) n (%)	2nd lowest (no facility birth, PNC) n (%)	Lowest (no facility birth, no PNC) n (%)
Yes	1099 (67.2)	496 (60.9)	386 (52.6)	165 (36.6)	407 (54.4)	216 (46.3)	279 (44.4)	174 (33.1)	16 (35.6)	23 (50.0)	19 (30.2)	20 (24.1)	–	–	–
Desire to have a child															
No	142 (8.7)	215 (9.2)	97 (12.9)	206 (12.3)	249 (10.6)	153 (11.9)	120 (19.0)	257 (15.1)	24 (20.9)	22 (23.2)	18 (28.6)	40 (19.4)	7 (14.0)	29 (24.0)	48 (13.9)
Yes	1496 (91.3)	2132 (90.8)	654 (87.1)	1469 (87.7)	2106 (89.4)	1133 (80.1)	512 (81.0)	1449 (84.9)	91 (79.1)	73 (76.8)	45 (71.4)	166 (80.6)	43 (86.0)	92 (76.0)	298 (86.1)
Who ultimately makes care-seeking decisions															
Respondent alone	1337 (32.7)	548 (28.6)	229 (36.6)	461 (32.2)	600 (31.9)	343 (33.0)	172 (33.0)	416 (28.9)	28 (34.2)	14 (19.4)	16 (36.4)	49 (30.2)	10 (35.7)	18 (22.2)	61 (20.7)
Both	1776 (43.5)	834 (43.4)	236 (37.8)	600 (41.9)	834 (44.3)	437 (42.1)	186 (35.7)	612 (42.4)	32 (39.0)	36 (50.0)	13 (29.6)	56 (34.6)	8 (28.6)	31 (38.3)	134 (45.6)
Husband alone	973 (23.8)	537 (28.0)	160 (25.0)	370 (25.9)	448 (23.8)	258 (24.9)	163 (31.3)	414 (28.7)	22 (26.8)	22 (30.6)	15 (34.1)	57 (35.2)	10 (35.7)	32 (39.5)	99 (33.7)
Parity															
Primiparous	1293 (26.1)	1388 (26.8)	96 (12.8)	324 (10.8)	555 (23.6)	715 (25.7)	68 (10.8)	295 (9.9)	32 (27.8)	53 (24.9)	10 (15.9)	53 (13.8)	28 (26.4)	13 (10.7)	98 (12.3)
Para 2–3	1877 (37.8)	2113 (40.8)	287 (38.2)	988 (33.0)	855 (36.3)	1061 (38.1)	219 (34.7)	906 (30.5)	28 (24.4)	72 (33.8)	16 (25.4)	108 (28.1)	33 (31.1)	36 (29.8)	200 (25.0)
Para 4+	1791 (36.1)	1678 (32.4)	369 (49.0)	1684 (56.2)	945 (40.1)	1006 (36.2)	345 (54.6)	1774 (59.6)	55 (47.8)	88 (41.3)	37 (58.7)	223 (58.1)	45 (42.5)	72 (59.5)	502 (62.7)
Wealth status															
Poor	1785 (36.0)	1739 (33.6)	497 (66.1)	1953 (65.2)	994 (42.2)	1181 (42.5)	446 (70.6)	2108 (70.9)	52 (45.2)	106 (49.8)	50 (47.2)	285 (74.2)	43 (68.3)	103 (85.1)	684 (85.5)
Middle	854 (17.2)	1031 (19.9)	132 (17.6)	556 (18.5)	457 (19.4)	565 (20.3)	127 (20.1)	498 (16.7)	24 (20.9)	44 (20.7)	20 (18.9)	60 (15.6)	10 (15.9)	15 (12.4)	51 (6.4)
Rich	2322 (46.8)	2409 (46.5)	123 (16.4)	487 (16.3)	904 (38.4)	1036 (37.2)	59 (9.3)	369 (12.4)	39 (33.9)	63 (29.6)	36 (34.9)	39 (10.29)	10 (15.9)	3 (2.5)	65 (8.1)
Marital status															
Single	859 (17.3)	880 (17.0)	123 (16.4)	435 (14.5)	464 (19.7)	403 (20.6)	109 (17.3)	458 (15.4)	33 (28.7)	55 (25.8)	19 (30.2)	90 (23.4)	38 (35.9)	39 (32.2)	123 (15.4)
Married	4102 (82.7)	4299 (83.0)	629 (83.6)	2561 (85.5)	1891 (80.3)	1558 (79.5)	523 (82.7)	2517 (84.6)	82 (72.3)	158 (74.2)	44 (69.8)	294 (76.6)	68 (64.1)	82 (67.8)	677 (84.6)
Mass media exposure															
No	804 (16.2)	484 (20.6)	733 (14.1)	521 (18.7)	204 (27.1)	993 (33.2)	176 (27.9)	1105 (37.1)	26 (22.6)	56 (26.3)	17 (27.0)	170 (44.3)	27 (25.5)	61 (50.4)	508 (36.6)

Continued

Table 3 Continued

| Variables | ≥4 ANC visits, n=13888 | | | | 2–3 ANC visits, n=8744 | | | | 1 ANC visit, n=775 | | | | 0 ANC visit, n=1027 | | |
	Highest (facility birth and PNC) n (%)	High (facility birth, no PNC) n (%)	Slightly high (no facility birth, PNC) n (%)	Moderately low (no facility birth, no PNC) n (%)	Higher (facility birth, PNC) n (%)	Moderately high (facility birth, no PNC) n (%)	Moderately lower (no facility birth, PNC) n (%)	Very low (no facility birth, no PNC) n (%)	7th lowest (facility birth, PNC) n (%)	6th lowest (facility birth, no PNC) n (%)	5h lowest (no facility birth, PNC) n (%)	4th lowest (no facility birth, no PNC) n (%)	3rd lowest (facility birth, no PNC) n (%)	2nd lowest (no facility birth, PNC) n (%)	Lowest (no facility birth, no PNC) n (%)
Yes	4157 (83.8)	1871 (79.4)	4446 (85.9)	2261 (81.3)	548 (72.9)	2001 (66.8)	456 (72.1)	1870 (62.9)	89 (77.4)	157 (72.7)	46 (73.0)	214 (55.7)	79 (74.5)	60 (49.6)	291 (36.4)

ANC, antenatal care; PNC, postnatal care.

category (aOR 3.4, 95% CI 1.6 to 7.4). In Uganda, only about 8% of mothers were in this category. It can generally be observed that care-seeking tendencies are higher in Uganda compared with Kenya, with mothers seeking care at highest level more than doubles that of Kenya (33.8% vs 13.4%). Similarly, at the *lowest* level, Uganda is more than thrice lower than Kenya (1.5% vs 5.6%)

Figure 6 shows that, overall, for both Kenya and Uganda, 23% of neonatal deaths were attributable to inadequate maternal care seeking during pregnancy, childbirth and 28 days postnatal period in Kenya and Uganda. Insufficient care seeking within the *lowest* and *third lowest* care-seekers accounted for almost three-quarters (75%) of neonatal deaths in those groups. About 9% of neonatal deaths in Kenya and Uganda could be attributable to home births, no PNC visits and inadequate ANC visits.

DISCUSSION

Although 95% of mothers initiated the first ANC visit in Kenya and Uganda, only about 20% completed recommended (modified) care attendance of four or more ANC visits, health facility birth and at least one PNC visit within 28 days after birth. Despite the relatively free or subsidised maternity costs in first level facilities in Uganda and Kenya, several factors still exert profound influence on care-seeking behaviour along the continuum of care that consequently impact neonatal survival. Overall, being educated indicated the highest odds of continual care seeking, and parental education was two to eight times associated with continued care seeking in most of the care-seeking categories. The higher the education level, the higher tendency to seek care. Our results concur with other studies that have shown associations between education and uptake of ANC,[57 58] institutional birth[57 59] and PNC.[60] Further, consistent with our findings, studies have reported higher use of obstetric care among mothers exposed to mass media.[61] Being told of pregnancy complications also improved care seeking (in Kenya). Over 23% of neonatal deaths in Kenya and Uganda would be prevented if mothers adhered to recommended care attendance. Desire to have a child, parity and being married did not show any consistent associations with continued care-seeking behaviour. Advance maternal age indicated lower tendency to seek care, but the findings were not statistically significant.

Conversely, a husband as the main or joint decision maker concerning maternal health care seeking was generally a significant demotivating factor to care seeking among the women in Kenya and Uganda. Although our study could not examine this further, other studies have shown that gender inequality, negative sociocultural factors and women's financial marginalisation tend to hinder women's independent decision making in healthcare especially in low-income and middle-income (LMIC) settings.[62 63] Over 80% of the mothers in this study were married and over 70% lived in rural areas, meaning most women are housewives with subsistence farming as

Table 4 Multinomial logistic regression showing relative risk ratios for the associations between maternal and sociodemographic factors and maternal continuum of care-seeking behaviour in Kenya and Uganda, using Demographic and Health Surveys 2014–2016 data
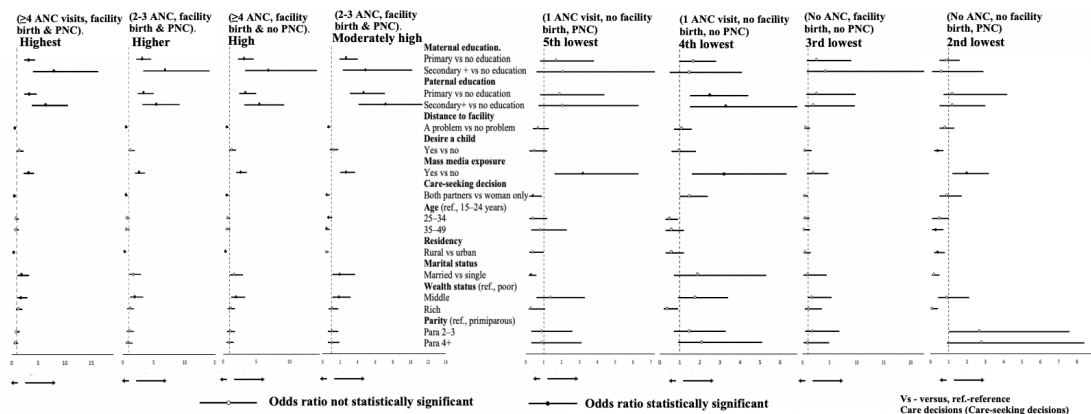
Versus lowest (no ANC, no facility birth, no PNC) care-seeking level, 95% CI

Variables	Highest (≥4 ANC visits, facility birth and PNC)	Higher (2–3 ANC visits, facility birth, PNC)	High (≥4 ANC visits, facility birth, no PNC)	Moderately high (2–3 ANC visits, facility birth, no PNC)	Slightly high (≥4 ANC visits, no facility birth, PNC)	Moderately low (≥4 ANC visits, no facility birth, no PNC)	Moderately lower (2–3 ANC visits, no facility birth, PNC)	Very low (2–3 ANC visits, no facility birth, no PNC)	7th lowest (1 ANC visit, facility birth, PNC)	6th lowest (1 ANC visit, facility birth, no PNC)	5th lowest (1 ANC visit, no facility birth, PNC)	4th lowest (1 ANC visit, no facility birth, no PNC)	3rd lowest (no ANC visit, facility birth, no PNC)	2nd lowest (no ANC visit, no facility birth, PNC)
Maternal education level														
No education	Ref.	Ref.	Ref.	Ref.	Ref	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Primary	3.2 (2.3 to 4.4)	3.2 (2.2,4.6)	3.4 (2.4 to 4.9)	2.7 (1.9 to 4.0)	2.1 (1.5 to 3.1)	2.3 (1.6 to 3.2)	2.1 (1.5 to 3.2)	2.8 (2.0 to 4.0)	2.6 (1.2 to 5.7)	1.5 (0.7 to 3.0)	1.7 (0.8 to 3.8)	1.7 (1.0 to 2.8)	2.6 (0.8 to 9.0)	0.9 (0.5 to 1.6)
Secondary and higher	8.0 (4.0 to 16.3)	6.9 (3.3 to 14.1)	6.9 (3.4,14.2)	4.9 (2.3 to 10.2)	2.5 (1.2 to 5.4)	3.1 (1.5 to 6.4)	3.9 (1.8 to 8.4)	2.9 (1.7 to 4.9)	3.4 (1.1 to 10.7)	1.7 (0.5 to 5.4)	2.1 (0.6 to 8.2)	1.5 (0.5 to 4.1)	4.3 (0.8,23.0)	0.6 (0.1 to 2.9)
Partner/husband education level														
No education	Ref.	Ref.	Ref.	Ref.	Ref	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Primary	3.3 (2.4 to 4.7)	3.4 (2.4 to 5.0)	3.6 (2.5 to 5.3)	4.7 (3.1 to 7.1)	2.6 (1.8 to 3.9)	2.1 (1.5 to 3.1)	2.7 (1.8 to 4.0)	2.7 (1.9 to 3.8)	3.4 (1.3 to 8.7)	1.9 (0.9 to 4.1)	1.9 (0.8 to 4.4)	2.5 (1.5 to 4.4)	–	1.2 (0.7 to 2.2)
Secondary and higher	6.4 (3.8 to 10.6)	5.5 (3.2 to 9.2)	6.2 (3.7 to 10.6)	7.2 (4.1 to 12.7)	3.7 (2.1 to 6.5)	3.0 (1.8 to 5.1)	3.4 (1.9 to 6.0)	2.9 (1.7 to 4.9)	6.0 (2.1 to 17.4)	2.3 (0.9 to 6.1)	2.1 (0.7 to 6.3)	3.3 (1.5 to 6.9)	–	1.2 (0.5 to 3.0)
Distance to the nearest health facility is a big problem.														
No	Ref.	Ref.	Ref.	Ref.	Ref	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Yes	0.6 (0.5 to 0.8)	0.6 (0.5 to 0.8)	0.7 (0.5 to 0.9)	0.7 (0.5 to 0.9)	0.6 (0.5 to 0.8)	0.8 (0.6 to 1.0)	0.7 (0.5 to 0.9)	0.8 (0.6 to 1.1)	0.7 (0.4 to 1.2)	0.6 (0.3 to 1.0)	0.7 (0.4 to 1.3)	1.1 (0.7 to 1.6)	0.6 (0.3 to 1.4)	0.8 (0.5 to 1.3)
Desire to have a child														
No	Ref.	Ref.	Ref.	Ref.	Ref	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Yes	1.5 (1.0 to 2.2)	1.3 (0.9 to 2.0)	1.6 (1.1 to 2.4)	1.2 (0.8 to 2.0)	1.3 (0.8 to 2.0)	1.4 (1.0 to 2.2)	0.9 (0.5 to 1.3)	1.3 (0.9 to 2.0)	0.7 (0.3 to 1.4)	0.8 (0.4 to 1.7)	0.5 (0.2 to 1.2)	1.0 (0.6 to 1.8)	0.5 (0.2 to 1.7)	0.4 (0.2 to 0.7)
Mass media exposure														
No	Ref.	Ref.	Ref.	Ref.	Ref	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Yes	2.6 (2.0 to 3.2)	1.7 (1.3 to 2.2)	2.1 (1.7 to 2.8)	1.1 (1.0 to 1.7)	2.0 (1.6 to 2.5)	1.2 (0.9 to 1.6)	1.5 (1.2 to 1.9)	1.8 (1.4 to 2.4)	2.9 (1.6 to 5.4)	1.6 (0.9 to 3.0)	3.2 (1.6 to 6.3)	1.5 (1.0 to 2.4)	2.0 (0.8 to 4.8)	2.0 (1.2 to 3.2)
Told about pregnancy, birth complications (only Kenya) versus very low care-seeking level														
No	–	–	–	–	–	–	Ref.	–	–	–	–	–	–	–
Yes	–	–	–	–	–	–	1.5 (1.2 to 1.9)	–	–	–	–	–	–	–
Who ultimately makes care-seeking decisions														
Respondent alone	Ref.	Ref.	Ref.	Ref.	Ref	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Both	0.5 (0.4 to 0.8)	0.6 (0.4 to 0.8)	0.6 (0.4 to 0.9)	0.5 (0.4 to 0.8)	0.5 (0.3 to 0.7)	0.5 (0.4 to 0.8)	0.5 (0.3 to 0.7)	0.7 (0.5 to 0.9)	0.5 (0.3 to 0.9)	1.3 (0.6 to 2.5)	0.4 (0.2 to 0.9)	0.5 (0.3 to 0.9)	0.4 (0.1 to 1.0)	0.9 (0.5 to 1.7)
Husband alone	0.5 (0.4 to 0.7)	0.5 (0.4 to 0.7)	0.7 (0.5 to 0.9)	0.5 (0.3 to 0.7)	0.5 (0.3 to 0.7)	0.5 (0.3 to 0.7)	0.7 (0.4 to 1.0)	0.7 (0.5 to 0.9)	0.5 (0.3 to 1.0)	1.1 (0.5 to 2.5)	0.6 (0.3 to 1.4)	0.7 (0.4 to 1.2)	0.7 (0.3 to 1.8)	1.1 (0.6 to 2.2)

Continued

Table 4 Continued

Variables	Highest (≥4 ANC visits, facility birth and PNC)	Higher (2-3 ANC visits, facility birth, PNC)	High (≥4 ANC visits, facility birth, no PNC)	Moderately high (2-3 ANC visits, facility birth, no PNC)	Slightly high (≥4 ANC visits, no facility birth, PNC)	Moderately low (≥4 ANC visits, no facility birth, no PNC)	Moderately lower (2-3 ANC visits, no facility birth, PNC)	Very low (2-3 ANC visits, no facility birth, no PNC)	7th lowest (1 ANC visit, facility birth, PNC)	6th lowest (1 ANC visit, facility birth, no PNC)	5th lowest (1 ANC visit, no facility birth, PNC)	4th lowest (1 ANC visit, no facility birth, no PNC)	3rd lowest (no ANC visit, facility birth, no PNC)	2nd lowest (no ANC visit, no facility birth, PNC)
Maternal age (years)														
15–24	Ref.	Ref.	Ref.	Ref.	Ref	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
25–34	0.9 (0.6 to 1.3)	0.7 (0.5 to 1.1)	0.6 (0.4 to 1.0)	0.6 (0.4 to 0.9)	0.9 (0.5 to 1.3)	0.6 (0.4 to 0.9)	0.9 (0.6 to 1.5)	0.6 (0.4 to 1.0)	0.4 (0.2 to 0.8)	0.8 (0.3 to 1.7)	0.4 (0.2 to 1.2)	0.5 (0.3 to 0.9)	0.5 (0.2 to 1.3)	0.5 (0.1 to 1.0)
35–49	0.8 (0.5 1.3)	0.6 (0.4 to 1.0)	0.6 (0.4 to 1.0)	0.5 (0.3 to 0.8)	0.9 (0.5 to 1.5)	0.5 (0.3 to 0.8)	0.8 (0.5 to 1.5)	0.6 (0.4 to 1.1)	0.4 (0.1 to 0.9)	0.9 (0.3 to 2.4)	0.8 (0.3 to 2.3)	0.6 (0.3 to 1.2)	0.3 (0.1 to 1.4)	0.3 (0.1 to 0.7)
Place of residence														
Urban	Ref.	Ref.	Ref.	Ref.	Ref	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Rural	0.4 (0.2 to 0.6)	0.4 (0.2 to 0.6)	0.3 (0.2 to 0.5)	0.4 (0.3 to 0.7)	0.4 (0.2 to 0.6)	0.7 (0.4 to 1.1)	0.4 (0.2 to 0.6)	0.7 (0.4 to 1.1)	0.3 (0.2 to 0.7)	0.2 (0.1 to 0.4)	0.4 (0.2 to 1.0)	0.6 (0.3 to 1.2)	0.5 (0.2 to 1.5)	0.4 (0.2 to 0.8)
Marital status														
Single	Ref.	Ref.	Ref.	Ref.	Ref	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Married	1.9 (1.1 to 3.3)	1.7 (1.0 to 3.0)	2.0 (1.2 to 3.5)	2.0 (1.1 to 3.7)	0.6 (0.3 to 1.0)	2.4 (1.3 to 4.3)	0.5 (0.3 to 1.0)	1.6 (0.9 to 2.8)	1.5 (0.5 to 4.5)	1.9 (0.6 to 6.9)	0.3 (0.1 to 0.6)	1.9 (0.7 to 5.3)	1.0 (0.2 to 4.5)	0.2 (0.1 to 0.5)
Wealth status														
Poor	Ref.	Ref.	Ref.	Ref.	Ref	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Middle	1.8 (1.1 to 3.0)	2.0 (1.2 to 3.3)	2.2 (1.3 to 3.6)	1.9 (1.1 to 3.2)	1.3 (0.8 to 2.2)	1.9 (1.2 to 3.2)	1.3 (0.8 to 2.2)	1.5 (0.9 to 2.6)	2.7 (1.3 to 5.6)	2.6 (1.2 to 5.9)	1.4 (0.6 to 3.3)	1.8 (0.9 to 3.4)	1.7 (0.5 to 5.4)	0.9 (0.4 to 2.1)
Rich	1.3 (0.8 to 2.0)	1.2 (0.7 to 1.8)	1.2 (0.8 to 1.9)	1.1 (0.7 to 1.8)	0.4 (0.2 to 0.7)	0.8 (0.5 to 1.3)	0.2 (0.1 to 0.3)	0.6 (0.4 to 0.9)	1.1 (1.5 to 2.4)	1.3 (0.6 to 2.9)	0.3 (0.1 to 1.1)	0.4 (0.2 to 0.9)	1.2 (0.4 to 3.6)	0.1 (0.0 to 0.4)
Parity														
Primiparous	Ref.	Ref.	Ref.	Ref.	Ref	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Para 2–3	0.9 (0.6 to 1.5)	1.1 (0.6 to 1.8)	1.1 (0.6 to 1.7)	1.1 (0.6 to 1.8)	1.6 (0.9 to 2.8)	1.7 (1.0 to 2.9)	2.0 (1.1 to 3.6)	1.9 (1.1 to 3.2)	1.1 (0.5 to 2.7)	0.9 (0.3 to 2.3)	0.9 (0.3 to 2.6)	1.5 (0.7 to 3.3)	1.9 (0.5 to 6.8)	2.7 (1.0 to 7.6)
Para 4+	0.7 (0.4 to 1.2)	0.9 (0.5 to 1.6)	0.9 (0.5 to 1.6)	1.1 (0.6 to 1.9)	2.2 (0.6 to 2.2)	2.3 (1.3 to 4.0)	1.6 (0.8 to 3.1)	2.5 (1.4 to 4.5)	1.9 (0.7 to 5.2)	0.9 (0.3 to 2.7)	0.9 (0.3 to 3.1)	2.1 (0.9 to 5.1)	1.0 (0.2 to 4.9)	2.8 (0.9 to 8.4)

Predictor variables mutually adjusted for each other.
ANC, antenatal care; PNC, postnatal care; ref., reference.

Figure 4 Showing relative risk ratios for the associations between maternal and sociodemographic factors and maternal continuum of care-seeking behaviour in Kenya and Uganda, using Demographic and Health Surveys 2014–2016 data. ANC, antenatal care; PNC, postnatal care.

source of livelihood. Thus, maternal dependency on the husbands to seek care revolves mainly around financial support for repeated transportation and minor hospital expenses, and this can hinder a woman's decision to seek care. This partly explains why being married did not indicate consistent significance to care seeking.

Also, congruent with our findings, a systematic review in Africa by Dahab and Sakellariou reported lack of women autonomy in health decisions as major hindrance to maternity care seeking.[64] However, a study in Nepal with a similar social setting reported that a complex balance between a woman's independence in maternity decision

Table 5 Crude and aORs for the association between classes of care-seeking behaviour in continuum of care and neonatal mortality in Kenya and Uganda, using Demographic and Health Surveys 2014–2016 data

Classes of care-seeking behaviour	Overall crude OR (95% CI) n=22 538	Overall aOR* (95% CI)	Proportion of the total in Kenya (%) n=12 579	Kenya only aOR* (95% CI)	Proportion of the total in Uganda (%) n=9959	Uganda only aOR* (95% CI)
Highest (≥4 ANC visits, health facility birth, yes PNC)	Ref.	Ref.	13.4	Ref.	33.8	Ref.
Higher (2–3 ANC visits, Health facility birth, yes PNC), mis=47	1.5 (1.0 to 2.4)	1.3 (0.7 to 2.2)	6.1	1.4 (0.4 to 4.2)	16.3	0.9 (0.5 to 1.5)
High (≥4 ANC visits, health facility birth, no PNC), mis=72	1.5 (1.0 to 2.2)	1.5 (1.0 to 2.3)	29.8	2.9 (1.4 to 6.0)	15.6	1.0 (0.6 to 1.7)
Moderately high (2–3 ANC visits, health facility birth and no PNC), mis=33	2.4 (1.6 to 3.7)	2.2 (1.4 to 3.4)	16.0	3.4 (1.6 to 7.4)	8.4	1.6 (0.9 to 2.7)
Moderately low (≥4 ANC visits, no facility birth, no PNC), mis=44	1.3 (0.8 to 2.1)	1.3 (0.8 to 2.2)	14.5	2.6 (1.2 to 5.9)	12.4	0.8 (0.4 to 1.4)
Very low (2–3 ANC visits, no facility birth, no PNC), mis=48	1.9 (1.3 to 2.8)	1.9 (1.3 to 2.9)	14.7	2.8 (1.3 to 6.2)	12.0	1.7 (1.1 to 2.7)
4th lowest (1 ANC visit, no health facility births, no PNC), mis=2	2.2 (0.7 to 6.7)	2.2 (0.7 to 7.3)	2.1	–	1.2	–
3rd lowest (no ANC, health facility births and no PNC), mis=2	7.8 (3.5 to 17.5)	4.2 (1.6 to 10.9)	0.5	–	0.4	–
Lowest (no ANC, no facility births and no PNC), mis=17	4.5 (2.5 to 7.8)	4.2 (2.3 to 7.8)	5.6	6.0 (2.6 to 13.6)	1.5	2.5 (1.0 to 6.5)

Due to non-response, proportionally (relatively random) distributed across all strata.
*Adjusted/restricted to birth weight ≥2500 g and singleton births.
ANC, antenatal care; aOR, adjusted OR; mis, missing; PNC, postnatal care.
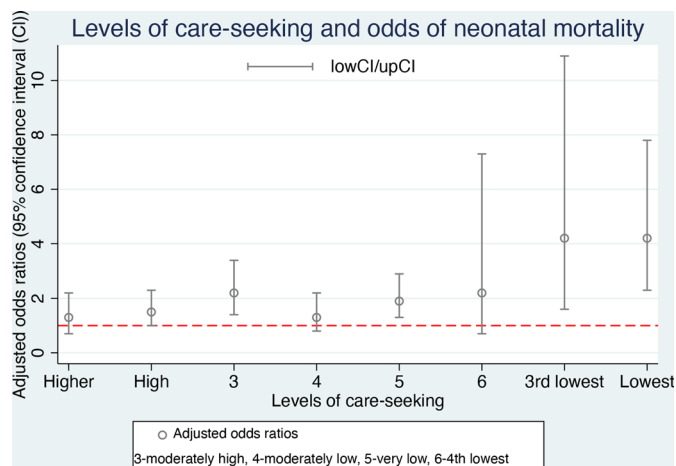
Figure 5 Forest plot showing adjusted ORs between continued care-seeking behavioural classes/levels and neonatal mortality, using Kenya and Uganda, 2014–2016 Demographic and Health Surveys data.

making and the husband's involvement can enhance maternity care seeking.[65] Living in rural compared with urban areas and longer distance to the nearest health facility largely indicated lower tendency to care seeking; this was especially true (significant) among relatively high care-seeking classes. However, the associations were not statistically significant among mostly lower careseekers. In agreement with most of our findings, two systematic reviews also found longer distance to health facility[64] and rural residency[58] as factors that impede care seeking. Being rich did not show any significant association with higher tendency to seek care as would be expected; however, the use of cumulative living standard and assets possessed to determine wealth status does not translate to having liquid cash, readily available to support care seeking. Further research on a valid method to determine wealth status that incorporates monetary availability could be explored.
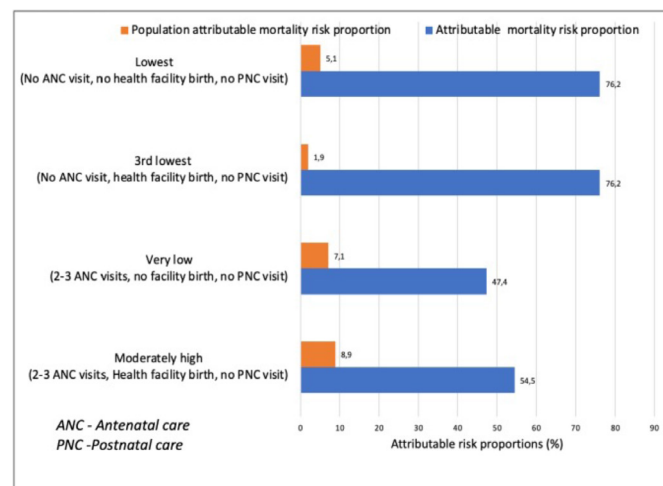
Figure 6 Attributable and population attributable neonatal mortality risk proportion for lower categories of care seeking in Kenya and Uganda, using Demographic and Health Surveys 2014–2016 data.

The far-reaching impacts of maternal and sociodemographic factors on the maternal care-seeking continuum necessitate both short-term and long-term solutions with overarching implications for policy improvements. The 2030 Sustainable Development Goals 4, 5 and 10, which focus on inclusive education and gender equality and reducing inequalities, resonate closely with most of the recommendations emanating from our findings. In the long term, strengthening education for all with purposeful emphasis on maternity care seeking should be integrated into the educational curriculum. A recent systematic review in SSA recommended female education as a strong enabling factor for ANC visits.[20] Improving knowledge and skills for all will inculcate women-led maternal health decision making and create a supportive social environment that would enhance completion of the care-seeking continuum. In the short term, health promotion for maternal care seeking among pregnant or nursing mothers will improve use and consequently greater neonatal survival.

The positive correlations between ANC and facility birth and PNC found in figure 2 indicate that even the first contact with health personnel can improve continued care use, and these findings concur with other studies.[66 67] The *third lowest* and *lowest* categories with no ANC, no PNC and only facility birth in the *third lowest* class accounted for 76% of within-category neonatal deaths each and a total of 7% deaths in the total population. Even though these two lowest categories had the highest within-category attributable mortality risks, they contributed relatively lower population attributable deaths partly because there were rather fewer mothers in these categories. In comparison, the mothers in the *very low* and *moderately high* categories with two to three ANC visits, no PNC plus facility birth only in the *moderately high* class accounted for relatively lower within-category deaths each (50%); however, they accounted for more neonatal deaths in the Kenya/Uganda population (16%) since relatively more mothers were in this category.

Given the findings in figure 5, the results of the first three care-seeking classes (*higher, high,* and *moderately high*) and last two classes (*third lowest* and *lowest*) seem to corroborate theoretical expectations in the 'hierarchy' of consequences of inadequate care seeking. However, the odds for neonatal mortality in class 4 (*moderately low*) and class 6 (*fourth lowest*) were not statistically significant for neonatal deaths as would be expected. Notably, in table 5, the moderately low with ≥4 ANC visits and no facility birth and no PNC showed significant association with neonatal death in Kenya but not in Uganda. A possible explanation would be that the quality of ANC given in Uganda was perhaps better and protective than that in Kenya. We could not deduce any possible explanations from our findings for why the OR in the fourth lowest compared with the highest class was not statistically significance despite the low level of care received.

Further, in table 5, the only difference in care-seeking between *higher* and *moderately high* categories (vs *highest*

class) is lack of PNC in the latter class. Thus, the statistical significance in the odds for mortality in the *moderately high* class and not in the *higher* class reveals that PNC could be very protective and is critical for neonatal survival. Our findings show that PNC is the least attended-to component of care continuum. WHO and other studies also agree that PNC is a crucial phase yet most neglected part of care.[68 69] We recommend strategies that enhance PNC use in Kenya and Uganda. One such strategy would be to emphasise PNC right from the first ANC contact, which has not been the case. PNC attendance existed only in the checklists for fourth ANC visit in the focused ANC recommendations in both Kenya and Uganda.[70 71] This implied that majority of mothers with less than four ANC visits got very limited information that could induce PNC attendance. The current WHO guidelines for eight ANC visits recommend emphasis on continuity of care including PNC; however, it is not clear on how PNC use would be promoted during ANC visits in non-midwife-led continuity of care models such as Kenya and Uganda and other LMIC if it is not clearly specified.[72] The twice higher proportion of Uganda women in the *highest* category than Kenya could be attributable to the fact that Uganda's abolition of user fees in 2001 took place much earlier than in Kenya (2013).

Although it was not possible for our study to determine attributable mortality risks for each specific care component, nonetheless, we can deduce that over 23% of neonatal deaths in Kenya and Uganda could be avoided through basic maternal and newborn care recommendations prior to 2016. We can also reason that if Kenya and Uganda would fully implement the current WHO recommendations of eight ANC visits, it would lead to higher rates of facility births and ensure PNC as indicated in figure 2, then much higher proportions of neonatal deaths would be eliminated.

For mothers with problems with distance to the nearest health facility, strengthening, structuring and funding the community health workers (CHWs) strategy to engage families, community and health facilities could help align the care-seeking continuum especially for PNC that is currently poorly attended. The village health workers (VHTs) in parts of Uganda, for example, have achieved profound improvement in promoting maternal care seeking.[73] However, high attrition rate is a major challenge to CHW programmes such as VHTs in Uganda due to poor governmental support.[74] Given the readily available telephone communication in East Africa, the integration of a mobile health (mHealth) programme specifically for maternal care-seeking in the existing mHealth structure in Kenya[75] and Uganda[76] is another viable approach. A cost-free two-way mHealth messaging approach could facilitate follow-up, counter sociodemographic barriers and profoundly improve continued care seeking. Engaging the CHW in this endeavour would be feasible with minimal extra investment.

Studies in Kenya and Uganda reported increased use of ANC and delivery services due to free maternity policy.[77–79] Reports evaluating impacts of free maternity policies in Kenya and Uganda highlight increase of ANC coverage and health facility births, but almost no mention is made of the impact on PNC.[40 80] Other studies have reported that free maternity policy increased mainly facility births.[81 82] The universal health policy in Uganda and the *Linda mama* strategy[83] in Kenya advocate for universal access to quality maternity health services but do not offer transportation for poor mothers or health providers in/to remote areas, yet most mothers are rural dwellers. Additionally, there are hidden hospital charges due to underfunding or delayed distribution of funds.[39 41 43]

Another worthwhile strategy to improve continued maternity care use among mothers would be to develop a standard questionnaire or a protocol for estimating the level of continued care seeking based on a brief interview of the mother at first ANC visit. The results could be used to determine the degree of follow-up that can be employed to close the care-seeking gap. Such questionnaires have previously been used in to assess health seeking behaviour in sexually transmitted diseases, for example.[84] It could be based on identified cluster of items including sociodemographic factors that impact care-seeking behaviours that after prolonged testing, and validation could be shortened using factor analysis. Previous maternity history of care-seeking continuum could also be used to improve such a standard. Poor care-seeking mothers can then be enrolled in a messaging list or maternity mHealth programme. This can be a less-costly health promotion strategy that could easily be integrated in ANC set-up in low-resource healthcare settings.

Methodological considerations

The large sample size of the maternal and child data of the latest Kenya and Uganda DHS, which are nationally representative, allowed for valid stratified analysis for deeper understanding of neonatal health and survival. The study is thus externally valid and generalisable in other similar settings. Like many cross-sectional surveys, recall bias may not be completely eliminated from the study. Nonetheless, by selecting the most recent live births for analysis and because childbirth is a special occurrence that mothers may not easily forget within a short period of time, our findings considerably reflect the reality of maternal care and associated neonatal survival in these countries.

A strength to our study was the use of directed acyclic graphs that enabled us to explicitly map the predictor–outcome relationship for well-guided analysis and identification of possible confounders. Our study could not examine other factors such as poor attitude of nurses and lack of information on healthcare services offered, which have been found by both quantitative and qualitative studies to hinder care use in LMIC countries.[85 86] Another limitation to our study was that inadequate facilities and drugs have also been associated with poor care seeking, but our data did not capture these specific aspects.[87] In

addition, the cross-sectional survey design of the DHS dataset does not allow collection of data on quality of care. Our study did not incorporate factors such as intimate partner violence (IPV), which is prevalent in many countries. IPV is known to be associated with poor care-seeking behaviour.[88] Further studies can investigate this.

CONCLUSION

Further multicountry large-scale population-based research and systematic reviews could enable development and use of a brief standard questionnaire to determine a mother's continued care-seeking level during the first ANC visit and use the information to close the care-seeking gaps where it is most needed. This is especially viable in LMIC with limited health workforce. Similar standard questionnaires have been used previously in other areas to assess care-seeking behaviour.[89 90] The use of mHealth specifically for promoting continued maternal care use up to postnatal can be integrated in the existing structures. Strengthening the existing CHW system to be an integral part of promoting continued maternal care-seeking could enhance care seeking as a stand-alone strategy or as a component of the aforementioned suggested strategies.

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