Scientific Research Publishing

Open Journal of Obstetrics and Gynecology, 2026, 16(1), 17-34
https://www.scirp.org/journal/ojog
ISSN Online: 2160-8806
ISSN Print: 2160-8792

Factors Associated with the Completion of the Continuum of Maternal, Neonatal and Child Care in 11 Sub-Saharan African Countries: A Multilevel Analysis of Demographic and Health Survey Data

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How to cite this paper: Dillah, C., Patedjore, T.P., Lougue, S., Kpebo, D. and Kouanda, S. (2026) Factors Associated with the Completion of the Continuum of Maternal, Neonatal and Child Care in 11 Sub-Saharan African Countries: A Multilevel Analysis of Demographic and Health Survey Data. *Open Journal of Obstetrics and Gynecology*, **16**, 17-34.
https://doi.org/10.4236/ojog.2026.161003

Received: November 21, 2025
Accepted: January 1, 2026
Published: January 4, 2026

Abstract

Introduction: The utilization of the continuum of maternal, neonatal and child care is recognized as a key strategy for reducing this burden. However, most studies on the continuum of care have focused on pregnancy, childbirth and postpartum care, without considering childhood immunization as part of the continuum of care, and countries with high maternal mortality are not often considered. The aim of this study was to identify the factors explaining the completion of the continuum of maternal, neonatal and infant care in 11 sub-Saharan African countries with high maternal mortality. **Population and methods**: Using data from recent demographic and health surveys in 11 sub-Saharan African countries with high maternal mortality, we carried out a secondary analysis including 42401 mother-child pairs. Using Stata software version 16.1, we performed a descriptive analysis of all variables, followed by a multilevel regression analysis to identify individual and contextual factors associated with the completion of the continuum of maternal, neonatal and infant care. **Results:** The level of completion of the continuum of care was 9.56%. The factors that were positively associated with the completion of the continuum of care were: age (OR = 1.47 [1.01 - 2.13] for women aged 35 - 49 years), education level (OR = 1.59 [1.05 - 2.41] for secondary/higher education), household wealth index (OR = 1.37 [1.12 - 1.66] for high wealth), media exposure (OR = 1.43 [1.12 - 1.84]), autonomy in healthcare decision-making (OR = 1.48 [1.17 - 1.87]), and cesarean section delivery (OR = 1.60 [1.38 - 1.86]). The intraclass correlation coefficient, proportional change in variance and median odds ratio were 15.11%, 30.95% and 2.08%, respectively. **Conclu-**

sion: The level of completion of the continuum of maternal, neonatal and child care remains low in sub-Saharan African countries. The use and completion of the continuum of maternal, neonatal and child care services are imperative for reducing the burden of avoidable mortality in the mother-child pairs.

Keywords

Continuum of Maternal, Neonatal and Child Care, Sub-Saharan Africa, Multilevel Analysis

1. Background

Maternal, neonatal and infant mortality is a health and development problem worldwide, especially in developing countries [1]. Complications throughout pregnancy, childbirth and the postnatal period are the most common causes of death among women of childbearing age in those countries [1] [2]. In 2020, the maternal mortality rate in sub-Sahara African (SSA) was estimated to be 545 maternal deaths per 100,000 live births [3]. Despite many efforts, SSA remains the region of the world with the highest maternal mortality rate, accounting for 70% of maternal deaths worldwide, and the risk of maternal death is 1/4 among women of childbearing age [3]. In 2021, there were an estimated 5 million infant deaths, 47% of which occurred during the neonatal period [4]. Most of this infant mortality can be prevented through timely management of the infant's conditions [5]. The launch of the Sustainable Development Goals (SDGs), the World Health Organization (WHO) and its partners committed to reducing maternal mortality rates to less than 70 per 100,000 live births, and neonatal and infant mortality to less than 12 and 25 per 1000 live births, respectively [6] [7].

Many strategies have been implemented to reduce maternal, neonatal and infant mortality, such as prenatal care, skilled attendance at delivery, emergency neonatal obstetric care, essential newborn care, family planning, drug availability and immunization [8] [9]. Among these strategies, the continuum of maternal, newborn and child of care (MNC CoC) has been recognized as a key strategy for improving maternal, newborn and child health and wellness. The MNC CoC provides for the health needs of women before, during and after pregnancy as well as infant and child care throughout the life cycle [10]. The success of each MNC CoC step depends on the previous step, starting with prenatal care and continuing with the other steps of the MNC CoC [11]. Failure to provide appropriate care at any step of the MNI CoC can result in less favorable maternal, newborn and child health outcomes [12]. Substantial progress has been made in the use of the service that constitutes MNC CoC. In a study including 81 countries with high maternal, neonatal and child mortality, 90% of pregnant women received prenatal care, 72% of women delivered in the health facility, and 59% and 42% had postnatal care for mothers and babies within 6 weeks, respectively [13]; however, these data show a

regression in the coverage of each step. The MNC CoC completing concept has been used to improve in the health of mothers, newborns and children [14]. It is a framework for reducing maternal, neonatal and child morbidity and mortality [15]. Previous studies have shown that 99% coverage could avert 41% to 72% of neonatal deaths worldwide [16]; and reduce the maternal mortality ratio by 17% [17]. In addition, the results of a study carried out in India [18] showed that neonatal and child mortality rates were lower (10 and 15 per 1000 live births, respectively) for women who completed MNC CoC.

In SSA, a few studies have been conducted on MNC CoC completion using nationally representative data [14] [19]-[21], but few have focused on countries with high maternal mortality. In addition, previous studies have focused mainly on antenatal care, delivery in a healthcare facility and postnatal care without any particular emphasis on child health. To improve children's health status, it is important to include interventions concerning child health services in MNC CoC studies.

Thus, the present study was initiated with the aim of examining the full use of MNC CoC, from antenatal care to child immunization, including institutional delivery and postnatal care. Then, multilevel logistic regression modelling was used to determine the influence of individual and contextual characteristics on MNC CoC completion.

2. Methods

Data source: Data from the demographic and Health Survey (DHS) between 2014 and 2021 of 11 SSA countries with maternal mortality ratios above 500/100,000 live births according to global estimates from 2000 to 2017 [7] were used. These countries include Central Africa (Cameroon, Chad), East Africa (Burundi, Tanzania) and West Africa (Gambia, Guinea, Liberia, Mali, Mauritania, Nigeria Sierra Leone). DHS are cross-sectional household surveys conducted at the national level of the country whose methodology has been extensively described elsewhere [22]. In all the countries selected for our study, the sample was based on a stratified (urban/rural), two-stage sample (cluster and household), with the exception of Mauritania, where the sample was stratified with three-stage sampling. This secondary analysis focused on women of childbearing age (15 - 49) who had a live-birth in the five years preceding the survey and whose child was at least 12 months old at the time of the survey.

Conceptual framework: Based on the literature review and various factors associated with MNC CoC, we built a conceptual framework, based on the model proposed by Owilli (2016) [23], which was originally developed, to analyze the factors associated with each stage of MNC CoC (**Figure 1**). This framework illustrates the influence of individual, family, community and children's characteristics on CoC. To this end, we have added the availability of health services, human resources, governance and health politics, which are also factors that can influence the completion of the MNC CoC.

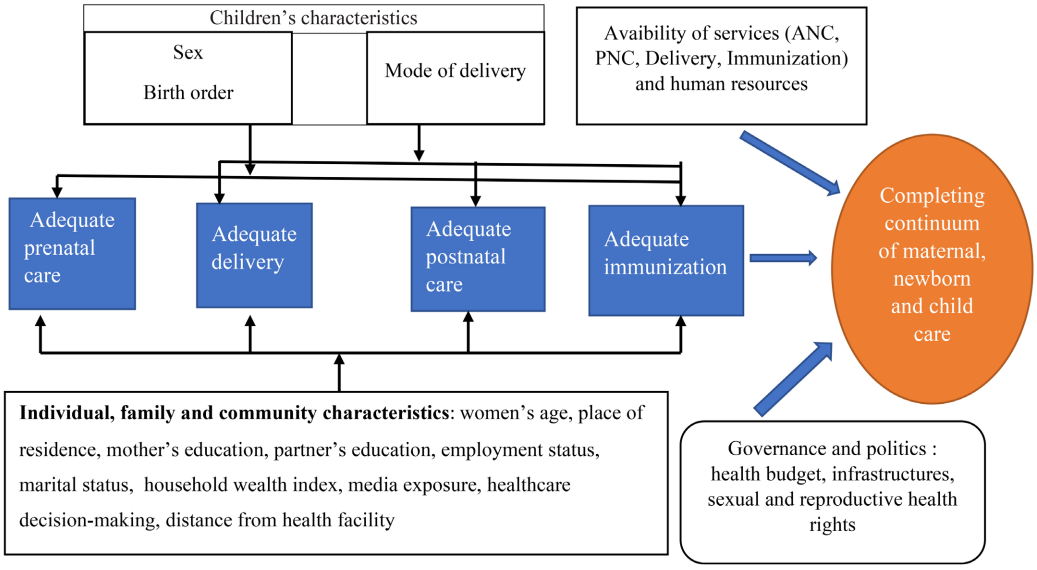

Figure 1. Conceptual framework.

Dependent variable: Our variable of interest was the completion of the continuum of maternal, newborn and child care. It has been constructed as a composite variable, including the following indicators:

- At least four antenatal visits (ANC4+) were made by a skilled health provider at a health facility. In the DHS, this question was answered by: Did you consult anyone for prenatal care for this pregnancy? If YES, during this pregnancy, how many times did you receive prenatal care? For this study, we considered a minimum of 4 contacts contrary to the current WHO (2016) recommendation of a minimum of 8 contacts [2], as some data in this study precede this recommendation.
- Delivery in a health facility. This indicator is used as a proxy for delivery assisted by a skilled health provider (doctor, nurse/midwife, matron/health worker). The DHS asked: Where did you give birth to (Name)?
- At least one postnatal visit. A postnatal visit was considered to be a health check-up by a skilled health provider that a woman and her newborn had received after delivery. In the DHS, the following questions are asked: Did anyone check your state of health after you delivered (NAME)? Who examined your health? How long after delivery for the mother? For the child, how many hours, days or weeks after the birth of (NAME) did the first check-up take place? Who examined (NAME)'s state of health at that time? In this analysis, we considered only women who delivered at a health facility.
- The immunization coverage of children aged 12 to 59 months was assessed on the basis of 4 vaccines: Bacillus Calmette-Guerin (BCG), diphtheria-tetanus-pertussis 3 (DTP3), poliomyelitis 3 (Polio3) and the measles vaccine. In the DHS, several questions are asked for this information, including: Has (NAME) ever had any vaccines to prevent disease, including vaccines received on the day of a national immunization campaign? Please tell me if (NAME) has had

any of the following vaccines? In this study, a child is considered fully vaccinated when he or she received all of the following vaccines: BCG, DTP3, Polio3 and the measles vaccine.

These 4 CoC indicators were used to construct a binary variable coded: 1 for MNC CoC completion (at least 4 ANC, delivery in health facility, at least 1 PNC and full vaccination) and 0 otherwise.

This dependent variable with four indicators differs from previous studies on MNI CoC which focused on prenatal care, assisted deliveries and immediate postnatal care. This study includes childhood complete immunization which a major factor in the child health.

The independent variables: included the following:

- Individual characteristics (level 1 variables): mother's age, mother's education, partner's education, employment status, marital status, wealth level, healthcare decision-making, distance to care facility, sex, birth order, mode of delivery and media exposure. The media exposure variable was constructed from the variables reading newspapers, listening radio and watching television.
- Contextual characteristics (level 2 variables): place of residence (urban, rural) and country of residence.

Data management and analysis: The data were cleaned, recoded and analyzed using STATA 16.1 software. The data were weighted to ensure survey representativeness using the sampling weight (v005), primary sampling unit (v021) and stratum variable (v023) [22]. Descriptive statistics were used for measuring the MNC CoC completion. A bivariate analysis was performed to test the statistical significance between the independent variables and the dependent variable using simple logistic regression. Unadjusted odds ratios (ORs), 95% confidence intervals (CI) and p-values were calculated. Significant independent variables with p-values less than or equal to 0.2 were included in the multivariate analysis. In the multilevel analysis, 4 models were built:

- Model 0: empty model containing no variables and specifying only the random intercept. This model assessed the presence of a possible contextual dimension in the MNC CoC completion;
- Model 1: with individual variables only;
- Model 2: with contextual variables only;
- Model 3: final model including all variables (both individual and contextual).

In all models, fixed effects results are expressed as adjusted ORs with 95% CI. Random effects results were measured using the intraclass correlation coefficient (ICC), which measures the proportion of variation in CoC completion between countries; the median odds ratio (MOR), which shows the degree to which the individual probability of completion of the MNC CoC is determined by the context; and the proportional change in variance (PCV), which indicates the proportion of individual variation in completion CoC attributable to context [24] [25].

The different models were compared using the AIC (Akaike information criterion) and the BIC (Bayesian information criterion). The receiver operating characteristic (ROC) curve was also assessed.

3. Results

3.1. Characteristics of Sample

Table 1 shows the characteristics of the sample. A total of 42,401 mother-child pairs were included in the study. At the time of the survey, more than two thirds of the study participants were aged 20 - 34 years (68.99%) and lived in rural areas (67.26%), while approximately half of the respondents had no level of education (48.33%). More than one third (37.66%) of women felt that they had problems with distance from healthcare facilities (Table 1).

Table 1. Characteristics of the study participants.

Variables	N = 42,401	Percentage
Country, year		
Cameroon, 2018	2845	6.71
Chad, 2014/2015	6665	15.72
Burundi, 2016/2017	4161	9.81
Tanzania, 2017	3328	7.85
Gambia, 2019	2551	6.02
Guinea, 2018	2259	5.33
Liberia, 2019/2020	1774	4.18
Mali, 2018	2913	6.87
Mauritania, 2019/2021	3246	7.66
Nigeria, 2018	9831	23.19
Sierra Leone, 2019	2828	6.67
Maternal age in year		
15 - 19	2713	6.40
20 - 34	29,252	68.99
35 - 49	10,436	24.61
Residence		
Rural	13,880	32.74
Urban	28,521	67.26
Marital status		
Single	4503	10.62
Married/In union	37,898	89.38
Paid employment status		
Yes	16,394	38.66
No	26,007	61.34

Continued

Women's level education		
No	20,492	48.33
Primary	11,135	26.26
Secondary/higher	10,774	25.41
Partner's level education		
No	22,671	53.47
Primary	8315	19.61
Secondary/higher	11,415	26.92
Wealth index		
Poor	18,520	43.68
Medium	8585	20.25
Rich	15,296	36.07
Media exposure[a]		
No	21,459	50.64
Yes	20,920	49.36
Autonomy in healthcare decision-making[b]		
Woman not involved	20,742	54.73
Woman only	4004	10.57
Woman with someone	13,152	34.70
Distance from care facility[c]		
No problem	23,708	62.34
A big problem	14,322	37.66
Ordre of last birth		
≥6	10,311	24.32
3 to 5	16,601	39.15
1 to 2	15,489	36.53
Sex of child		
Male	21,672	51.11
Female	20,729	48.89
Mode of delivery[d]		
Vaginal delivery	40,729	96.30
Cesarean section	1563	3.70

[a] = missing = 22 (0.05%), [b] = missing = 4503 (10.62%), [c] = missing = 4371 (10.31 %), [d] = missing = 109 (0.26%).

3.2. Elements of the Continuum of Care

Table 2 shows whether or not the elements of the continuum of care. According to the MNC CoC coverage, more than half (54.22%) of the mother-child pairs had received 4 or more antenatal care, 59.69% had given birth in health facilities, 24.13% had received postnatal care, and only 9.56% (95% IC [9% - 10%] of the mother-child pairs had completed the MNC CoC.

Table 2. Reception of elements of the continuum of care.

Variables	N = 42,401	Percentage
ANC		
0	6933	16.35
1 to 3 ANC	12,479	29.43
ANC 4+	22,989	54.22
Place of delivery		
Out of healthcare facilities	17,092	40.31
In a healthcare facility	25,309	59.69
Postnatal care		
No	32,170	75.87
Yes	10,231	24.13
Full immunization		
Yes	18,309	43.18
No	24,092	56.82
Completion of the continuum of care		
No	38,346	90.44
Yes	4055	9.56

Figure 2 shows the level of the completion of the MNC CoC by country. The levels were very low in Chad (2.63%) and Burundi (2.83%).

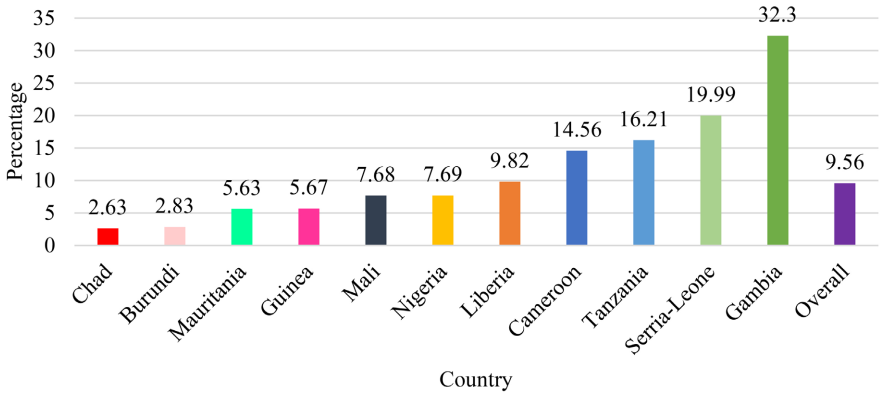

Figure 2. Level of MNC CoC completion by country.

3.3. Using the Elements of the Continuum of Care

Table 3 shows the use of the elements of the MNC CoC. According to the receipt of the different care components of the MNC CoC, 17.94% of the mother-child pairs had not received any recommended care, and less than one third (28.69%) had received 3 components (Table 3).

Table 3. Utilization of the elements of the maternal, newborn and child continuum of care.

Parts of continuum of care received	N = 42,401	Percentage
No	7605	17.94
1	7247	17.09
2	11,328	26.72
3	12,166	28.69
4	4055	9.56
Total	42,401	100

3.4. Factors Associated with the Continuum of Maternal, Neonatal and Child of Care

Table 4 shows the factors associated with the completion of the MNC CoC. In the final model, the following variables were positively associated with the completion of the MNC CoC: maternal age (AOR = 1.47; 95% CI [1.01 - 2.13] for 35 - 49 years olds), mother's secondary/higher education level (AOR = 1.59; 95% CI [1.05 - 2.41]), partner's secondary/higher education level (AOR = 1.34; 95% CI [1.06 - 1.70]), high wealth index (AOR = 1.37; 95% CI [1.12 - 1.66]), media exposure (AOR = 1.43; 95% CI [1.12 - 1.84]), autonomy in healthcare decision-making (AOR = 1.48; 95% CI [1.17 - 1.87]) and first rank of birth (1 to 2: AOR = 1.41; 95% CI [1.14 - 1.76]; 3 to 5: AOR = 1.25; 95% CI [1.01 - 1.56]). Women who had difficulty accessing healthcare facilities were less likely to complete the CoC (AOR = 0.79; 95% CI [0.68 - 0.92]).

Table 4. Individual and contextual level factors associated with the MNC CoC completion.

Variables	Empty model	Model 1	Model 2	Final model
		AOR (95% CI)	AOR (95% CI)	AOR (95% CI)
FIXED EFFECTS				
Maternal age in year				
15 - 19		Ref		Ref
20 - 34		1.15 [0.90 - 1.47]		1.25 [0.97 - 1.60]
35 - 49		1.19 [0.83 - 1.69]		**1.47 [1.01 - 2.13]***

Continued

Women's level education		
No	Ref	Ref
Primary	1.18 [0.87 - 1.60]	1.16 [0.86 - 1.56]
Secondary/higher	**1.74 [1.08 - 2.79]**	**1.59 [1.05 - 2.41]***
Partner's level education		
No	Ref	Ref
Primary	1.24 [0.95 - 1.61]	1.19 [0.92 - 1.55]
Secondary/higher	**1.43 [1.10 - 1.81]****	**1.34 [1.06 - 1.70]***
Paid employment status		
Yes	Ref	Ref
No	1.15 [0.99 - 1.35]	1.15 [0.96 - 1.37]
Wealth index		
Poor	Ref	Ref
Medium	1.11 [0.84 - 1.47]	1.09 [0.89 - 1.34]
Rich	**1.47 [1.05 - 2.06]***	**1.37 [1.12 - 1.66]****
Media exposure[a]		
No	Ref	Ref
Yes	**1.43 [1.12 - 1.82]****	**1.43 [1.12 - 1.84]****
Autonomy in healthcare decision-making[b]		
No	Ref	Ref
Yes	**1.40 [1.17 - 1.87]****	**1.48 [1.17 - 1.87]****
Ordre of last birth		
Superior to 6	Ref	Ref
3 to 5	**1.24 [1.01 - 1.55]***	**1.25 [1.01 - 1.56]****
1 to 2	**1.41 [1.13 - 1.76]****	**1.41 [1.14 - 1.76]****

Continued

Sex of child				
Male	Ref			Ref
Female	**0.92 [0.86 - 0.99]***			0.93 [0/87 - 1.00]
Mode of delivery[d]				
Vaginal delivery	Ref			Ref
Cesarean section	**1.64 [1.39 - 1.93]*****			**1.60 [1.38 - 1.86]*****
Distance from care facility[c]				
No problem	Ref			Ref
A big problem	**0.79 [0.66 - 0.94]***			**0.79 [0.68 - 0.92]****
Residence				
Rural			Ref	Ref
Urban			1.91 [0.98 - 3.73]	1.05 [0.61 - 1.82]
Africa region				
Central Africa			Ref	Ref
East Africa			1.22 [0.20 - 7.23]	0.96 [0.18 - 5.16]
West Africa			1.64 [0.43 - 6.26]	1.73 [0.47 - 6.29]
Random Effects				
Intercept variance	0.84 (0.36)	0.66 (0.25)	0.56 (0.15)	0.58 (0.18)
CCI %	20.40	16.87	14.55	15,11
MOR	2.41 [1.53 - 2.75]	2.18 [1.55 - 2.81]	2.04 [1.64 - 2.45]	2.08 [1.61 - 2.54]
CPV %	Ref	21.42	33.33	30.95
Model statistics				
Log likelihood	−12162.107	−9628.3475	−12032.945	−9627.1313
AIC	24,328	19276.69	24075.89	19276.26
BIC	24,345	19360.98	24119.17	19368.97

*p < 0.05, **p < 0.01 and ***p < 0.001, indicate significant differences. AOR, Adjusted Odds Ratio. CI, Confidence Interval.

4. Discussion

The concept of completing the MNC CoC must satisfy women's health needs before, during, and after pregnancy, as well as infant and child care. This study is

one of the first to examine the completion of the MNC CoC in 11 sub-Saharan African countries with maternal mortality rates above 500 deaths per 100,000 live births, with the objective of measuring the level of completion and identifying the associated factors.

In our sample, only 9.7% [9% - 10%] of mother-child pairs had completed the MNC CoC, with high disparities between countries, ranging from 2.63% in Chad to 32.32% in Gambia.

Evidence from previous studies in Asia, notably Cambodia, India, Bangladesh and Nepal, showed that 59.8%, 39%, 30.5% and 41% of women, respectively, completed the MNC CoC [26]-[29]. In SSA, 3 multi-country studies [14] [30] [31] have shown that 13.9%, 24.95%, and 35.64%, respectively, had completed the MNC CoC.

The low level of MNC CoC completion found in our study could be explained by the fact that, we were interested in the 11 SSA countries with high maternal mortality. The low level of MNC CoC completion in these 11 countries could explain the high risk of maternal and child mortality, as many women and their children miss out on key interventions at different touchpoints along the MNC CoC. In 2016 Owili [23], in their study of MNC CoC associations, demonstrated that the use of antenatal care services is linked to the use of delivery care, and that delivery care is associated with the use of postnatal care, including childhood immunization. Thus, the use of services at each point of the MNC CoC could be an opportunity to promote continuous and comprehensive use of care, respecting the different stages of the MNC CoC to safeguard the wellness of the mother-child pair. Another reason for this difference lies in the operational definition of our outcome variable, which includes 4 indicators of the MNC CoC, including immunization, unlike all previous studies with the exception of the study by Kothavale [27] which was conducted in India in 2021, where the completion level was 39%. These disparities in results can also be explained by regional differences in the accessibility of healthcare services, socio-economic characteristics and variations in healthcare policies.

The results of this study showed that the greater maternal age at last birth was, the greater the likelihood of completing the MNC CoC. Multi-country studies [14] [30] in SSA have shown a positive correlation between maternal age and the use of maternal care services. Teenagers are less likely to receive ongoing MNC health care than older women. Similar to our findings, studies have shown that women over 35 years old are more likely to use delivery and postnatal care services than are those between 20 - 35 years old [31]. This result could be explained by the fact that some women in this age group have had negative experiences with early, frequent or too close pregnancies, and have decided to be followed by a skilled attendant to receive all the care needed. Pregnant older women are at increased risk of developing complications such as hypertension and pre-eclampsia during pregnancy [32] as well as teenage mothers [33], but their lack of maternity experience and limited access to information about the benefits of care across the continuum

of care may hinder their use of maternal, neonatal and child health services. The likelihood of older women using health services could also be explained by a certain awareness and wisdom on their part.

The results of this study showed that the probability of completing MNC CoC was significantly greater for women with a high level of education. Other studies [14] [26] [34]-[36] have also documented the positive impact of education on MNC CoC. Women with a high level of education are more likely to acquire knowledge and information about the advantages of the different types of essential care a woman needs to benefit from throughout the MNC CoC. Women whose partners had higher/secondary education were more likely to have completed MNC CoC than their uneducated congeners. This could be attributed to the role played by husbands/partners in Africa, dominated by a patriarchal system (decision-making on healthcare, distribution of resources for healthcare use). Thus, education could encourage people to question negative societal or traditional norms, and promote the use of modern healthcare. Husbands/partners who are educated are also more likely to have discussions with their partners about the benefits of using maternal and child health services. Therefore, developing and sharing educational messages on maternal, newborn and child health in local languages with uneducated men and women could improve their level of knowledge on the subject.

The study also identified the household wealth index as a predictor of the completion of MNC CoC. Households in the highest wealth quintile were more likely to complete the MNC CoC than households in the lowest wealth quintile. Despite maternal, newborn and child health care being cost-free in most developing countries, poor households are likely to face other obstacles, such as lack of transport or having to pay for transport costs, while wealthier households are less confronted with these obstacles and are able to pay additional costs related to different provisions (drugs or complementary tests, ect.). It is therefore necessary to design and implement specific interventions for poor and vulnerable women.

Having some autonomy in healthcare decision-making is shown in our study to be positively associated with the completion of MNC CoC. Other authors have reported similar results [14] [36]. This may be because women who have some autonomy in healthcare decision-making are more likely to seek and receive care for themselves and their children when they want it. For women lacking autonomy when seeking health care, we believe it is important to develop initiatives such as the "school for husbands" and other influential family members such as mothers-in-law and grandmothers, to facilitate access to ongoing health care services. In addition, women need to be sensitized and motivated to take ownership of their own and their children's health needs. Promoting women's empowerment and gender equality (SDG5) could be a strategy to promote the use of maternal, newborn and child health services.

The media are an important way of disseminating information about maternal and child health, improving knowledge and inducing behavior change in women and their partners in terms of the use of health services [37]. The present study

revealed that women exposed to media have a greater chance of completing the MNC CoC than those who are not exposed. Many previous studies have reported the same results [20] [27] [34] [38]. This could be explained by the media being used for mass awareness campaigns, sometimes through the use of local languages. As a result, women who are exposed to it are likely to benefit educational messages about the advantages of maternal, newborn and child care, which can lead them to change their behavior in favor of a positive attitude and motivate them to make the decision to use it.

Previous studies have shown that the higher children's birth rank is, the lower the attendance and use of maternal, newborn and child health services [39] [40], as demonstrated by our present study. This result could be explained by the fact that, for this first child, parents are very happy and motivated to seek out the right care for themselves and their children. Over time, as the number of children increases, they tend to have some experience with maternal and child health care, and sometimes indulge in unsafe care practices. This finding calls for reproductive health professionals to step up family planning awareness campaigns, to encourage women to limit the number of children, and to enable mother-child pairs to benefit from ongoing maternal, newborn and child health care. This result seems to contradict the age of the mothers. Indeed, there are older women whose last child is their first, and there are others whose last children may belong to higher birth ranks. This observed result suggests that additional research should be conducted to better understand the relationship between the completion of MNI CoC, maternal age, and birth order.

5. Strengths and Limitations

This study has a number of limitations that are worth highlighting. First, it is a study whose data were collected for the last 5 years prior to the survey, so it is subject to memory bias when collecting information on maternal, newborn and child healthcare. Second, it was not possible to study certain factors, such as quality of care, women's satisfaction, pregnancy-related maternal complications and contextual factors related to health facilities (human resources, infrastructure, equipment) due to the absence of these data in DHS surveys. However, these factors could affect the completion of MNC CoC. Third, the design of our study is cross-sectional, and allowed us to establish the relationship between the MNC CoC and the different explanatory variables, but we cannot establish causality.

Despite these limitations, the robustness of this study should also be noted, which lies in the national representativeness of the data from each country included in the study, and in the use of multilevel model analysis. These results could be generalized and will be of interest to the programs, policies and health decision makers in the countries of interest.

6. Conclusion

The continuum of care is an approach that ensures that every mother-child pair

receives continuous essential care throughout pregnancy, delivery, the postnatal period and childhood. The level of the maternal, newborn and child continuum of care is very low in sub-Saharan Africa, particularly in countries with high maternal mortality. To improve the completion of the MNC CoC, governments and technical and financial partners need to establish appropriate multisectoral approaches, taking into account individual and contextual characteristics. The implementation of effective interventions to increase the utilization of MNC CoC remains a key strategy for the well-being of mothers and children and is an imperative for improving the survival of women newborns and children.

Acknowledgements

Human Reproductive Program (HRP) to finance our Master's degree.

DHS program for the availability of data for this study.

Ethical Considerations

For this study, the databases were obtained following a request to the DHS program, which, after a favorable opinion, allowed us to download the various databases from which we had carried out an analysis of the dataset. The downloaded databases do not identify the survey participants, so anonymity and confidentiality are respected. Approval from the Ethics and Research Committees was required in each country before implementing the various surveys.

Conflicts of Interest

None.

Note

The datasets generated and/or analysed during the current study are available in: http://www.dhsprogram.com/

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Abbreviations

SSA:	Sub-Saharan Africa
MNC CoC:	Continuum of maternal, newborn and child care
WHO:	World Health Organization
SDG:	Sustainable Development Goals
DHS:	Demographic and Health Survey
ANC:	Antenatal Care
PNC:	Postnatal Care