



Research Article

Evolution of Exclusive Breastfeeding Practices According to Continuous Demographic and Health Surveys (DHS-C) from 2010-2011 to 2019 and Associated Factors in Senegal

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Abstract

Introduction: The first two years of a child's life are particularly important. Inadequate breastfeeding practices during this period considerably compromise the health, development and survival of infants, children and mothers. Several studies have assessed the impact of breastfeeding on infant mortality. The objectives of our study were to investigate changes in exclusive breastfeeding practices during the first six months of life according to DHS data from 2010-2011 to 2019 and to identify the various associated factors. **Methodology:** This is a quantitative analysis of secondary data based on cross-sectional data from the DHS from 2010-2011 to 2019 on changes in exclusive breastfeeding practices for infants under six months of age. Our study focused on women aged 15 to 49 years interviewed during the DHS and residing in Senegal at the time of the various surveys who had children under two years of age. Data were collected on exclusive breastfeeding rates in different years, the socio-demographic and gynecological characteristics of mothers, and the characteristics of newborn children. A multivariate analysis was performed to identify factors associated with exclusive breastfeeding. **Results:** showed that exclusive breastfeeding rates remained below 50% from 2010-11 to 2019. Analysis by region showed a disparity between the different regions. The associated factors were: ethnic group: Wolof are less likely to practice EBF with an adjusted AOR of 0.59 with a CI₉₅: [0.38, 0.90], maternal literacy: mothers who could not read were less likely to perform EBF with an adjusted AOR of 0.71 and a CI₉₅: [0.53-0.95], birth order: mothers with 6 or more children were more likely to perform EBF, with an AOR of 3.20 and a CI₉₅: [1.68-6.17], maternal occupation: Working mothers were less likely to practice EBF than non-working mothers, with an AOR of 0.60 and a CI₉₅ [0.46-0.79], access to the media: Mothers with access to the media were less likely to practice assisted fertilization, with an AOR of 0.57 and a CI₉₅: [0.37-0.90] and use of modern contraception: Mothers using modern contraception

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were less likely to practice exclusive breastfeeding, with an AOR of 0.53 and a CI₉₅: [0.38-0.72]. Conclusion: Despite all the efforts made by the Senegalese government and its technical and financial partners, rates are still low. To strengthen the practice of exclusive breastfeeding, it is important and urgent to design and implement innovative evidence-based interventions covering the different levels of the socio-ecological model (individuals, families, communities and public policies).

Keywords

Evolution, Exclude Breastfeeding, Associated Factors, DHS 2010-2019, Senegal

1. Introduction

Malnutrition, in the form of undernutrition, is on the increase among young children throughout the world. Nearly 149.2 million children under the age of 5 are stunted, 45.4 million are wasted and 38.9 million are overweight [1]. The consequences of malnutrition in children during the first 1000 days of life are disastrous, with high mortality and morbidity rates, as well as immune deficiencies in children in developing countries [2]. Despite positive economic growth in West and Central Africa, the number of stunted children under five increased from 23 to 29 million between 2000 and 2018. In addition, the region is home to around 4.9 million children suffering from severe acute malnutrition [3, 4]. Several studies have shown that around 2.7 million of annual child deaths are attributable to undernutrition, or 45% of all child deaths [2, 5]. Infant and young child feeding is a crucial area for improving child survival and promoting healthy growth and development. The first 2 years of a child's life are particularly important because optimal nutrition during this period will reduce undernutrition, morbidity and mortality, and the risk of chronic disease, and contribute to better overall development. [6, 7]. Breastfeeding is one of the few interventions whose survival benefits extend across the entire childhood continuum: newborn, infant and early childhood. Breastfeeding is crucial for child survival and health and has substantial benefits for mothers and infants of all socio-economic classes. There is ample evidence of the importance of breastfeeding for the short- and long-term health of mothers and children. The 2016 edition of the Lancet Breastfeeding series states that the evidence for breastfeeding is stronger than ever and that recent epidemiological and biological findings over the past decade extend the known benefits of breastfeeding for women and children [8].

The World Health Organization (WHO) and the United Nations Children's Fund (UNICEF) recommend early initiation of breastfeeding, exclusive breastfeeding for the first 6 months of life and continued breastfeeding until two years of age or beyond [6, 9]. Overall, these recommendations affect only a minority of infants and children: only 44% of infants start breastfeeding within one hour of birth and 40% of all infants under 6 months are exclusively breastfed. By the age of two, 45% of children are still being breastfed [10, 11].

Inadequate breastfeeding practices significantly compromise the health, development and survival of infants, children and mothers. A number of studies have evaluated the impact of breastfeeding on infant mortality. According to the Lancet series, suboptimal breastfeeding is estimated to be responsible for 1.4 million child deaths, and 77% of child deaths are due to non-exclusive breastfeeding in the first six months of life. [5, 6] Recent analyses show that sub-optimal breastfeeding practices, including non-exclusive breastfeeding, are the cause of 11.6% of deaths in children under 5 years of age, corresponding to 804,000 deaths in 2011 [2]. The Bellagio Child Survival Series, published in The Lancet in 2003, identified optimal breastfeeding as the key intervention that could prevent up to 13% of deaths in children under 5 [12].

According to the series of studies on breastfeeding published in The Lancet, if breastfeeding became almost universal, 823,000 deaths in children under five and 20,000 maternal deaths from breast cancer would be prevented each year. Breastfeeding promotes brain development, reduces the risk of obesity in children and protects women from ovarian cancer and also diabetes [13, 14]. Thus optimal breastfeeding practices are one of the best interventions to reduce infant mortality [15].

The benefits of exclusive breastfeeding have been observed in women and children in all countries, rich and poor alike. Breastfeeding has many positive long-term effects on the health of breastfed children and their mothers [16]. Breastfeeding reduces the risk of childhood obesity [17, 18], type I diabetes [19], type II diabetes [18], cardiovascular disease in later life [20] and the risk of premenopausal breast cancer in the mother [21].

Optimal breastfeeding and complementary feeding practices have been shown to be extremely effective for the harmonious development of children. Optimally implemented, these practices can reduce mortality and stunted growth in young children by around 20% [11, 22]. They are also an investment in the development of human capital, and beneficial to a country's economy. Every dollar invested in breastfeeding generates \$35 in economic benefits [23]. It is therefore essential to promote appropriate feeding practices during pregnancy and the first years of life. Breastfeeding is essential to achieving global

goals for nutrition, health and survival, economic growth and ecological sustainability. In developing countries, the absence of breastfeeding, especially exclusive breastfeeding in the first six months of life, is a major risk factor for morbidity and mortality for infants and children, especially following diarrhea disease or acute respiratory infection.

In West and Central Africa, only three out of 10 babies under six months are exclusively breastfed. Seven out of 10 infants receive liquids and foods in addition to breast milk during their first six months of life, contributing to malnutrition, illness and even child deaths. Most breastfed babies receive other liquids and foods, in most cases water is given [24]. The highest risk of inappropriate feeding during the first 6 months of life occurs in developing countries, where 96% of total infant mortality is due to sub-optimal breastfeeding [23].

In Senegal, according to the results of the 2017 Demographic and Health Survey (DHS), 42% of children under six months of age are exclusively breastfed, with a median duration of 2 months [25]. Despite the efforts of the government and its technical and financial partners, this situation has remained virtually unchanged over the past 10 years, according to data from the Demographic and Health Surveys conducted between 2010 and 2019 [26, 27].

The objectives of our study are therefore to

- 1) To study changes in exclusive breastfeeding practices in the first six months of life according to data from the Demographic and Health Survey from 2010 to 2019.
- 2) To identify the different factors associated with exclusive breastfeeding practices in the first six months of life in Senegal.

2. Study Framework

The study was carried out in Senegal, which has 14 regions and 16,705,608 inhabitants in 2020, the majority of whom are young people with an average age of 19. It is made up of the following ethnolinguistic groups: Wolof, Séréres, Poulars, Mandingues, Diolas and Soninké. Women make up 50.23% of the population and the total fertility rate is estimated at 4.93 children per woman [28]. The school enrolment rate between 2014 and 2018 fell from 85.5% to 80.9 for primary education and 50.2 to 43.7 for secondary education [29, 30]. Senegal's Gross Domestic Product (GDP) posted growth of more than 5% in 2019 [31]. With agriculture, exports and infrastructure investments undertaken as part of the Emerging Senegal Plan being the main drivers of this economic growth. In 2020, under the impact of COVID-19, growth slowed sharply to an estimated 1.3%. With almost half the population (46.7%) living below the national poverty line, economic growth has not translated into an improvement in the well-being of the Senegalese population [32]. Senegal's Human Development Index (HDI) for 2018 stands at 0.514, placing the country 166th out of 189 countries and territories. [33]

Maternal and infant/child mortality indicators show downward trends, with an estimated maternal mortality ratio

of 236 deaths per 100,000 live births in 2017 [25]. As for infant mortality, it fell from 72 ‰ in 2010 to 37 ‰ in 2019 [27]. According to DHS 2019 data, access to antenatal care is satisfactory in Senegal with almost 98% of pregnant women having received antenatal care from qualified health personnel. According to place of residence, 99.4% of women in urban areas and 96.5% of women in rural areas received antenatal care from qualified health personnel. In terms of economic well-being quintile, 99.9% of women in the highest quintile and 92.8% of women in the lowest quintile received antenatal care from qualified health personnel. In 2019, 80% of births took place in a health facility, and 74% of births were attended by skilled health personnel. [27].

The nutritional situation of women of childbearing age reflects their dietary vulnerability, manifested by the coexistence of multiple micronutrient deficiencies. According to the latest estimates for 2017, just over one in two women of childbearing age is anemic [25], most often due to iron deficiency [34]. These micronutrient deficiencies are compounded by the coexistence of two forms of malnutrition: energy deficiency in 23% of women and overweight/obesity in 7% of women [35].

As for children under five, in 2019, 8% and 18% suffer from wasting and stunting respectively [27]. Anemia affects 71% of children. Zinc deficiency affects 50.1% and vitamin A deficiency 24.4% [34]. This worrying nutritional situation in children under 5 may be partly due to sub-optimal infant and young child feeding practices. Although breastfeeding remains universal in Senegal, with 98% of children being breastfed, the practice of breastfeeding in accordance with international and national recommendations remains sub-optimal, as the results of the DHS 2019 showed that among children aged 6-23 months, only 10% were fed the minimum acceptable diet for their age. According to the DHS 2019, early initiation of breastfeeding within the first hour after birth was achieved in 30% of newborns and breastfeeding was exclusive for only 41% of infants under six months of age. The minimum food intake is acceptable for only one child in 10; the diets of these young children are characterized by poor diversification of foods (23.3%) and an insufficient number of meals (36.9%) [27]. Sweet snacks are beginning to play an important role in the diets of these young children, regardless of whether they live in urban or rural areas. [35]

3. Materials and Methods

3.1. Type of Study

We conducted out a quantitative analysis of secondary data based on cross-sectional data from the EDS- continuous from 2010-2011 to 2019 on changes in exclusive breastfeeding practices for infants under six months of age and the factors associated with this.

3.2. Study Population

Our study focused on women aged 15-49 who were interviewed during the Demographic and Health Survey Continuous (DHS-c) and who had children aged 0-59 months living with their mother and residing in Senegal at the time of the various surveys.

With regard to the question of exclusive breastfeeding, the population studied was women aged 15-49 with children under two years old.

3.3. Sampling

For the 2010-2011 and 2017 DHSs, representativeness was up to the level of the 14 regions [25, 28], and for the 2012-2013, 2014, 2015, 2016, 2018 and 2019 DHSs [27-29, 31-37, 38, 39] representativeness was at the level of the large Central, Southern, Northern and Western zones of the country.

The sample was based on a two-stage stratified random sample for all DHS. However, the number of clusters used as the primary sampling unit differs from year to year. For the 2010-2011 DHS and the 2017 DHS, the primary sampling unit is made up of 400 clusters. For the 2012-2013, 2014, 2015, 2016 and 2019 DHSs, the primary sampling unit consists of 200 clusters. These clusters were drawn from the list of Enumeration Zones (EZ) established during the 2013 General Census of Population and Housing, Agriculture and Livestock (GCPHAL) [33]. Secondary units are households. For all DHSs, the same number of households is drawn for each cluster. There are 22 households per cluster. A count of households in each of these clusters provided a list of households from which a sample of 22 households per cluster was drawn in the second stage, in both urban and rural areas, with a systematic draw of equal probability. In each household, all women aged 15 to 49 were interviewed. In addition, in a sub-sample of one household in two, all men aged 15-59 were eligible to be surveyed. Our study focused on women aged 15-49 who were interviewed during the various DHSs. With regard to exclusive breastfeeding, for each woman aged 15-49, the survey covered the last-born child under the age of two living with the mother and residing in Senegal at the time of the various surveys. For the 2010-2011 and 2017 DHSs, at least 8,800 households were surveyed, and for the other years, at least 4,400 households were selected. All women aged 15-49 living in the selected households or present the night before the interview were eligible to be interviewed.

The table 1 shows the number of households selected, the number of households surveyed, the household response rate, the number of eligible women, the number of women surveyed, the response rate among women aged 15-49 and the number of women aged 15-49 with children under two. (see Table 1)

3.4. Data Collection

3.4.1. Data Collection Tools

Four questionnaires were used in the DHS-c: the household questionnaire, the women's questionnaire, the men's questionnaire, and the specific biomarker questionnaire for anthropometric measurements.

The household questionnaire was used to record all household members and to identify women, men and children eligible for individual interviews and/or anthropometric measurements. Information on household characteristics and data on the situation of children were collected.

The individual women's questionnaire was used to record information from women aged 15-49. The individual questionnaire for men aged 15-59 was identical to that used for women aged 15-49. The biomarker questionnaire was used to record anthropometric data (weight and height) collected from children under 5 years of age.

With regard to data collection, the questionnaires used were based on the model questionnaires of The DHS Program [40] and were adapted to take account of the demographic and health problems appropriate to Senegal.

Four questionnaires were used in the DHS-c of 2017 and 2018: the household questionnaire, the women's questionnaire, the men's questionnaire, and the specific biomarker questionnaire for anthropometric measurements.

For the DHS 2010-2011, 2019, 2014, 2015 and 2016, three questionnaires were used: a household questionnaire, an individual questionnaire for women aged 15-49 and an individual questionnaire for men aged 15-59. For the 2012-2013 DHS, two questionnaires were used: a household questionnaire and an individual questionnaire for women aged 15-49.

The content of the different questionnaires was identical for all the DHSs.

The household questionnaire was used to record all household members and visitors who had slept the night before the interview, along with certain socio-demographic characteristics. The questionnaire was also used to identify women, men and children eligible for individual interviews and/or anthropometric measurements. It was also used to collect information on household characteristics.

The individual women's questionnaire was used to record information from women aged 15-49 who were residents or visitors the night before the interview.

The individual men's questionnaire is independent of the women's questionnaire, but most of the questions asked of men aged 15-59 are identical to those asked of women aged 15-49.

The biomarker questionnaire records anthropometric data (weight and height) collected from children under 5.

Once the collection tools had been finalized, the survey protocol and questionnaires were sent to the National Ethics

Committee for Health Research (NECHR) for analysis and approval. For the DHS 2017, the NECHR authorized the survey by letter N 0035 Ministry of Health and Social Action / Directorate of Planning, Research and Statistics / National Ethical Committee for Health Research (MHSA/DPRS/NECHR), dated 3 April 2017. This survey also obtained the visa of the ICF Ethics Committee (Institutional Review Board).

3.4.2. Data Collected

The following data were collected:

Independent variable: practice of exclusive breastfeeding

Characteristics of mothers: mother's age, place of residence, religion, ethnic origin, household wealth quintile, mother's level of education, literacy, early marriage, age 1st marriage, polygamy, Household Size, Occupation of mothers', Mother's health care decision, Time taken to search for water, Access to media, distance travelled to seek healthcare,.

Gyneco-obstetrical characteristics: Prenatal consultation, place of delivery, delivery by a qualified person, Use modern contraception, Césarienne.

Characteristics of newborn: Birth rank sex, birth weight.

These independent variables were chosen on the basis of a literature review. [41]

3.4.3. Data Processing

Data was collected using tablet PCs. After validation of the data in the field, the data files were transferred to the National Agency for Statistics and Demography (NASD) central office in Dakar by Census District (CD). These data files were then recorded, compiled and processed on a central computer. The data from each CD was checked and a single file of audited data was created after the files from all the RDs had been registered and approved. The recording, checking and compilation of the data were carried out by two IT specialists recruited for the purposes of DHS- continuous. Once the files had been merged, the last errors detected were dealt with the support of ICF International's IT experts.

3.5. Data Analysis

A secondary analysis of DHS-c data from 2010-2011 to 2019 was carried out to study changes in exclusive breastfeeding indicators in Senegal.

To determine the factors associated with exclusive breastfeeding, we used data from the DHS 2017. We proceeded as follows:

- 1) Descriptive analysis was used to study changes in data on exclusive breastfeeding practices at the national and regional levels, based on the results of the DHSs from 2010-2011 to 2019. For qualitative variables, frequencies were calculated and for quantitative variables, means and standard deviations were calculated.
- 2) Bivariate analysis: This was done to determine the re-

lationship between the dependent variable EBF and the independent variables. A significance level of 5% was used to determine the relationship between the dependent variable and the independent variables.

- 3) Multivariate analysis: a multivariate logistic regression analysis using data from the DHS-c 2017 to identify the main factors associated with EBF. The dependent variable was the proportion of children aged 0-6 months exclusively breastfed. We then estimated the Adjusted Odds Ratios (AOR) using the logistic regression model. A Wald test was performed to compare the multivariate model with a null model.

For the logistic regression analysis, pre-selection of predictors was not employed as our aim was to assess the association of all factors used in the study, so all factors were introduced simultaneously. The Bayesian Information Criterion (BIC) and the likelihood ratio test [42], statistical tests that compare the null model with the multivariate model, were calculated for all models. Both statistical tests had p-values of less than 0.05, confirming the statistical validity of the multivariate model. Model goodness-of-fit was investigated using the Hosmer and Lemeshow test [43].

3.6. Limits

These are due to the fact that this is a secondary analysis and there are missing data for some variables.

3.7. Ethical Considerations

Ethically, the information provided in the study was confidential and kept in a safe place at the Ministry. The selected individuals will not be identified in the results and presentation of the data. Their names will not appear on any documents.

Participation in the study for those surveyed was free and voluntary. An informed consent form was offered to the participants, read and approved. It provided all the information needed to understand and make a decision to participate. No form of financial or material incentive or compensation was given to participants.

4. Results

Our study focused on women aged 15-49 interviewed during the DHS and having children aged 0-59 months living with their mother and residing in Senegal at the time of the various surveys. For the question of exclusive breastfeeding, the analysis focused on the sample of women aged 15-49 with children under the age of two living in Senegal at the time of the DHS. For the 2010-2011 DHS, the sample comprised 4502 women, for 2012-2013: 2512, for 2014: 2377, for 2015: 2399, for 2016: 2312, for 2017: 4368, for 2018: 2434 and for 2019: 2336.

4.1. Evolution of Exclusive Breastfeeding from 2010-2011 to 2019

4.1.1. Evolution of Exclusive Breastfeeding at the National Level

Exclusive breastfeeding rates have remained below 50%

from 2010-11 to 2019. After a steady decline from 2010-11 to 2015, from 38.6% to 33%, we note an increase of 3 percentage points between 2015 and 2016, then an increase of 9 percentage points between 2016 and 2018. In 2019, the rate fell by 4.4 percentage points between 2018 and 2019 (see Figure 1).

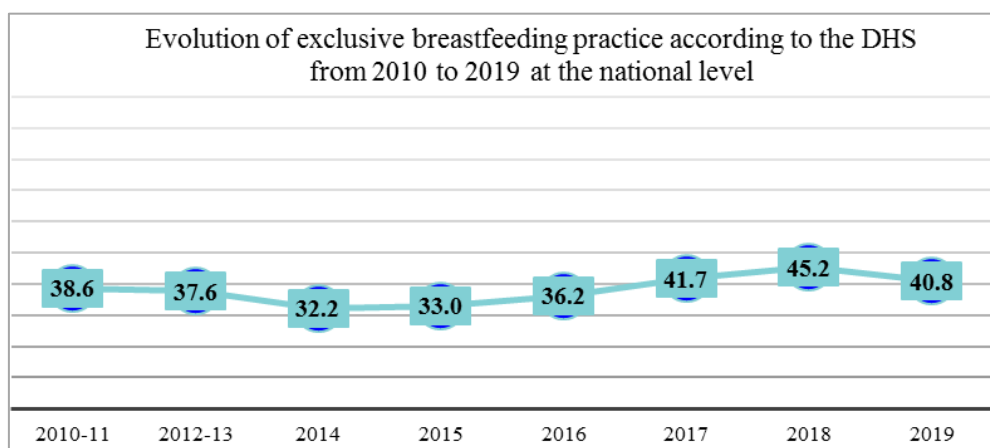


Figure 1. Changes in the practice of exclusive breastfeeding from 2010 to 2019, DHS-C 2010-11 to 2019.

4.1.2. Evolution of Exclusive Breastfeeding at the Regional Level

The analysis by region was only carried out for DHSs from 2010-2011 to 2017, as regional data were not available for

2019. (Figure 2)

The Diourbel and Matam regions show constant rates between the different years. The Kédougou region has the highest rates of all regions. The other regions show irregular trends.

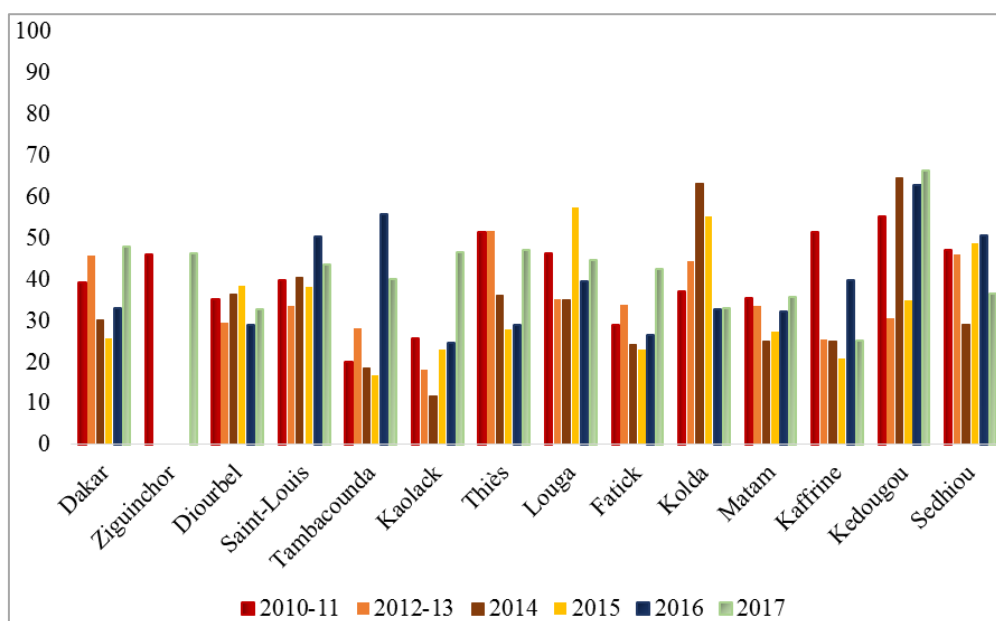


Figure 2. Trends in EBF at regional level (DHS, 2010-2011 to 2017).

4.1.3. Ranking of Regions According to the National Average for 2010-2017

The national average breastfeeding rate for 2010-2011 to 2017 is 38%. Table 3 shows the average exclusive breastfeeding rates by region over the period 2010-11 to 2017. The

Kédougou region has the highest average rate. The ranking of regions according to regional averages puts Kaolack, Fatick, Tambacounda, Kaffrine, Matam and Diourbel at the bottom of the scale. The other regions have rates above the national average.

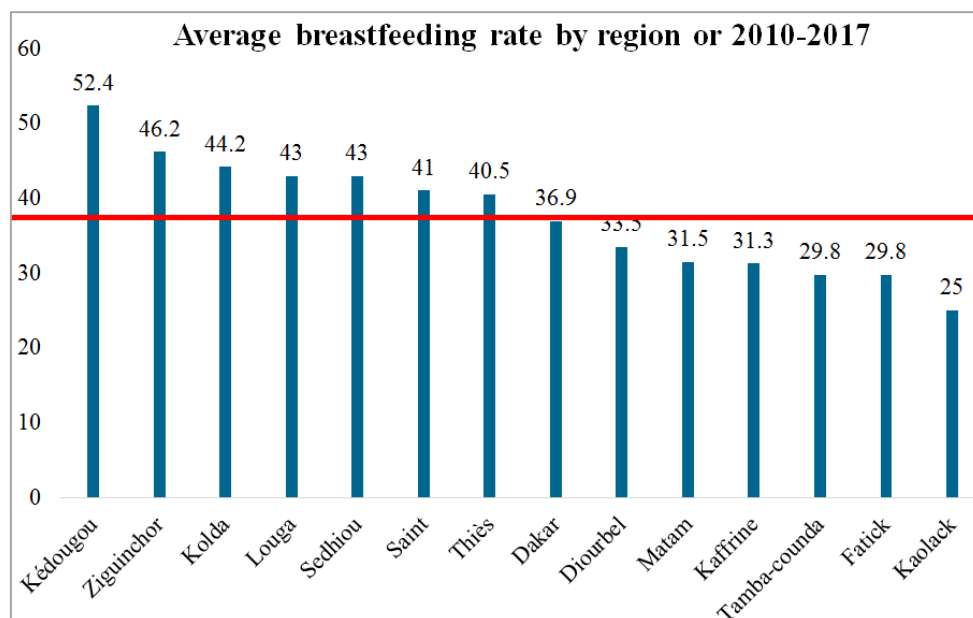


Figure 3. Regional averages for 2010-2017 and ranking of regions according to the national average for 2010-2017.

4.2. Descriptive Results According to the DHS 2017 Data

(i). Socio-Demographic Characteristics of Mother

The socio-demographic characteristics of the mother are summarized in Table 2. The average age was 28.6 years, with a standard deviation of 6.9. The 25-29 age group (25.2%) is the most represented, followed by the 20-24 age group (22.5%). The majority of women live in rural areas (64.1). Almost all of them are Muslims (97.4). Wolof is the most represented ethnic group (36.2). The poor and poorest represent 46.7% of our sample. Around 60% of women have received no education and almost 66% cannot read. Early marriage before the age of 18 occurred among 44.5% of the women and 12.7% married before the age of 15. Around 73% of women were in polygamous marriages, and households of more than 8 people were the most common, at 74.2%. A further 47% of mothers had no occupation. The decision to seek care came from the husband in almost 75% of cases, 91.8% had access to the media and 28.4% travelled more than 15 km to access care.

(ii). Distribution of Gyneco-Obstetrical Characteristics of Mother

Almost 50% of mothers had performed four or more PNCs. 76.3% of mothers gave birth in a public facility, 70.6% were

assisted during delivery by qualified personnel, 70.8% used modern contraception and only 5.7% of mothers received caesarean section. (See table 3)

(iii). Distribution of Child Characteristics

In our study, the majority of children (24.7%) were born in the first row. The sex ratio was 1.02 and 90.3% had a birth weight of 2500g or more. (See table 4)

4.3. Analysis Result

(i). Bivariate Analysis

The results of the bivariate analysis are presented in table 5. The average age was higher among women who did not practice EBF ($p=0.032$).

The practice of exclusive breastfeeding is associated with:

- 1) Women's literacy: mothers who know part or all of a sentence are more likely to practice EBF ($p=0.027$).
- 2) Assistance during childbirth by qualified personnel, those who are assisted are more likely to practice EBF with a $P=0.028$.
- 3) Mothers' occupation: those without an occupation were more likely to practice EBF than those with an occupation ($p<0.001$).
- 4) Access to the media, mothers who did not have access to the media practiced EBF more than those who did, with a $P=0.003$.

- 5) Use of modern contraceptives: mothers who did not use modern contraceptives practiced BEF more than mothers on contraceptives, with $P < 0.001$.
- 6) Mode of delivery: mothers who had a vaginal delivery were more likely to use EBF ($P = 0.022$).

(ii). Multivariate Analysis

Multivariate analysis enabled us to determine the factors associated with practicing exclusive breastfeeding. (See [table 6](#)). The results showed the factors associated with the practice of breastfeeding:

Mother's age: mother's age is not associated with exclusive breastfeeding.

- 1) Group ethnic: les Wolof ont moins de chance de pratiquer l'EBF avec AOR ajusté de 0.59 avec un IC95: [0.38, 0.90].
- 2) Mothers' literacy: mothers who cannot read are less likely to practice EBF with an AOR of 0.71 and CI95: [0.53-0.95].
- 3) Birth order: mothers with 6 or more children were more likely to practice EBF, with an AOR of 3.20 and CI95: [1.68-6.17].
- 4) Maternal occupation: working mothers were less likely to practice EBF than non-working mothers, with an AOR of 0.60 and a CI95 of [0.46-0.79].
- 5) Access to the media: mothers with access to the media were less likely to practice EBF, with an AOR of 0.57 and a CI95: [0.37-0.90].
- 6) Use of modern contraception: Mothers who use modern contraception are less likely to practice exclusive breastfeeding, with an AOR of 0.53 and a CI95: [0.38-0.72].

5. Discussion

5.1. Evolution of Exclusive Breastfeeding in Senegal According to the DHS from 2010-2011 to 2019

Breastfeeding contributes to the health of both mother and child. Today, the benefits of breastfeeding are well documented in the literature, and its protective effect depends on its duration and exclusivity [44, 45]. In Senegal, breastfeeding is common practice. However, the results of our study show that the rate of exclusive breastfeeding is fluctuating according to DHS data from 2010-2011 to 2019. Senegal is below WHO standards for exclusive breastfeeding for the first six months of childhood. Over the past ten years, exclusive breastfeeding has remained suboptimal for more than half of infants under six months of age in Senegal. Exclusive breastfeeding has improved in recent years, but efforts are still needed to enable the majority of infants to benefit from this practice and for the country to reach the 2025 global target of all countries reaching at least 50% [46].

There are also disparities between regions. The regions of

Kaolack, Fatick, Tambacounda, Kaffrine, Matam and Diourbel are below the national average. This situation could be explained by the level of poverty in these regions, but also by the heat levels in these regions, which vary between 39 and 42 degrees. Mothers in these regions, even if they don't give their children from 0 to 6 months soft or solid food, very often give them water, an act they justify by saying that with the heat, they don't have enough milk and the child is often thirsty. So, in the challenge of achieving equitable development results for all Senegal's children, these regions are becoming priorities for all programs to promote, protect and support breastfeeding.

Boubacar G., in a study of factors associated with the practice of exclusive breastfeeding among mothers of children aged 6 to 12 months in the commune of Kaolack (Senegal), found that out of 400 women surveyed, 51.8% practiced exclusive breastfeeding in accordance with WHO recommendations [47]. This rate is higher than the average rate of EBF in the Kaolack region. Another study carried out in the city of Thiès showed an EBF rate of 41.5%, which is higher than the average rate for the region found in our study [48]. The prevalence of exclusive breastfeeding in Senegal is lower than in Burundi, Eritrea, Kenya and Uganda, which are among the continent's champions, with rates of over 60%. However, Senegal has higher rates than Côte d'Ivoire (12%) and Nigeria (17%) [49].

5.2. Factors Associated with Exclusive Breastfeeding

In this study, maternal age was not associated with exclusive breastfeeding. This result is similar to that of the study carried out in Côte d'Ivoire, which also showed that age had no statistically significant relationship with the practice of exclusive breastfeeding [41].

The results showed that ethnic group was associated with the practice of EBF: Wolofs were less likely to practice EBF with an adjusted AOR of 0.59 with a 95% CI: [0.38, 0.90]. However, the study conducted by Alive & Thrive and UNICEF on the actors influencing exclusive breastfeeding and other infant feeding practices during the first six months of life in West and Central Africa showed no association with ethnicity [50].

The practice of EBF was associated with the mother's level of literacy. Mothers who could not read were less likely to practice EBF, with an AOR of 0.71 and an IC₉₅: [0.53-0.95]. This result tends to differ from the reality in developing countries for many years, where newborns of illiterate mothers were 1.9 times more likely to be breastfed than those whose mothers had attended seven years of school [51]. However, results from Alive & Thrive and UNICEF showed that higher levels of maternal education were positively associated with exclusive breastfeeding practices [50].

The practice of EBF was associated with the mother's level of literacy. Mothers who could not read were less likely to practice EBF, with an AOR of 0.71 and an IC₉₅: [0.53-0.95]. This result tends to differ from the reality in developing

countries for many years, where newborns of illiterate mothers were 1.9 times more likely to be breastfed than those whose mothers had attended seven years of school [51]. However, results from Alive & Thrive and UNICEF showed that higher levels of maternal education were positively associated with exclusive breastfeeding practices [50].

With regard to the order of birth of children, mothers with 6 or more children were more likely to practice EBF, with an AOR of 3.20 and a CI_{95} : [1.68-6.17]. This can be explained by the fact that these multiparous mothers very often attend health facilities for prenatal consultations, deliveries and postnatal consultations. Access to quality health services encourages exclusive breastfeeding. Breastfeeding advice and support are essential for improving breastfeeding practices. Antenatal and postnatal care provide an opportunity to advise pregnant women and mothers on infant and young child feeding, and particularly on early initiation of breastfeeding and exclusive breastfeeding for up to six months, and its advantages and benefits for both mother and child. This result is corroborated by other authors who emphasize in the literature that professional support has a positive impact on breastfeeding mothers [51]. Support from healthcare professionals is a key factor in the success of breastfeeding [52]. In fact, support received at three days of life is associated with continued breastfeeding [53]. Beake S. et al report that a structured breastfeeding support program has a positive effect on breastfeeding rates [54]. In Mali, too, a study showed that advice given during pregnancy and the postpartum period had a protective effect on EBF (OR = 0.64) [55]. It is important that professionals are willing to talk to parents and do not pressure them to make an informed choice about how to feed their child.

The mother's occupation: working mothers were less likely to practice EBF than non-working mothers, with an AOR of 0.60 and a CI_{95} of [0.46-0.79]. This result is similar to that of Grummer who also found in his study that children living in households of higher socio-economic status were significantly less likely to be breastfed [56]. This could be explained by the fact that working mothers have less time to devote to feeding their child and tend to use breast-milk substitutes.

Mothers with access to the media were less likely to breastfeed, with an OR of 0.57 and an IC_{95} of [0.37-0.90]. Mothers with access to the media were less likely to practice EBF, which could be explained by exposure to inopportune advertising using all channels to promote breast-milk substitutes. A multinational study on the impact of the marketing of infant formula on infant feeding decisions and practices, commissioned by the WHO and UNICEF and based on the experience of more than 8,500 women and over 300 health professionals in eight countries (South Africa, Bangladesh, China, Mexico, Morocco, Nigeria, South Africa, the United Kingdom and Vietnam) showed that more than half (51%) of parents and pregnant women are exposed to aggressive marketing of breast-milk substitutes, which very often contravenes international infant-feeding standards [57].

Regarding the use of modern contraception: mothers who

use modern contraception are less likely to practice exclusive breastfeeding, with an AOR of 0.53 and an IC_{95} : [0.38-0.72]. This could be explained by the fact that women who use contraception have professional occupations that may reduce the amount of time they spend at home, thus hindering the practice of exclusive breastfeeding. Grummer also found that the increase in contraceptive use and changes in childbearing patterns contributed to a reduction in breastfeeding [56].

6. Conclusions

Breastfeeding is essential to give every child the best start in life and to ensure good health. However, the study analyzed the evolution of breastfeeding rates according to the DHS data in Senegal, which enabled us to see the level of achievement of the indicators and the factors associated with the practice of exclusive breastfeeding. Despite all the efforts made by the Senegalese government and its technical and financial partners, rates are still low. In Senegal, efforts still need to be made in terms of exclusive breastfeeding in relation to the World Health Assembly's global targets for 2025, which call for all countries to achieve a rate of at least 50%. The study showed that several factors were associated with the practice of breastfeeding. These include ethnicity, mother's literacy, child's birth rank, mother's occupation, access to the media and use of modern contraceptives. To strengthen the practice of exclusive breastfeeding, it is important and urgent to design and implement innovative evidence-based interventions targeting the different levels of the socio-ecological model (individuals, families, communities and public policies).

Abbreviations

- AOR: Adjusted Odds Ratios
- BIC: Bayesian Information Criterion
- CD: Census District
- DHS-c: Demographic and Health Survey Continuous
- DHS: Demographic and Health Survey
- DPRS: Direction of Planning Research and Statistics
- EZ: Enumeration Zones
- GCPHAL: General Census of Population and Housing, Agriculture and Livestock
- GDP: Gross Domestic Product
- HDI: Human Development Index
- MHSA: Ministry of Health and Social Action
- NASD: National Agency for Statistics and Demography
- NECHR: National Ethics Committee for Health Research
- UNICEF: United Nations Children's Fund
- WHO: World Health Organization

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Data Availability Statement

The data is available from the corresponding author upon reasonable request.

Conflicts of Interest

The authors declare no conflicts of interest.

Appendix

Table 1. Distribution of number of households selected, the number of households interviewed, the household response rate, the number of eligible women aged 15-49, the number of women aged 15-49 interviewed, response rate for women aged 15-49, and the number of women aged 15 to 49 with children under two years old.

DHS surveys	2010-2011	2012-2013	2014	2015	2016	2017	2018	2019
Number of households selected	8212	4 399	4 400	1 846	4 708	8 800	4 708	4 708
Number of households surveyed	7902	4 175	4 231	1 754	4 437	8 380	4 592	4 538
Household response rate (%)	98,40	98,70	98,70	98,20	98,60	98,30	99,40	99,10
Number of eligible women	16931	9 042	8 831	3 367	9 244	17 586	9 673	8 998
Number of eligible women surveyed	15688	8 636	8 488	3 244	8 865	16 787	9 414	8 649
Response rate for eligible women (%)	92,20	95,50	96,10	96,30	95,90	95,50	97,30	96,1
Number of women aged 15-49 with children under two surveyed	4502	2512	2377	2399	2312	4416	2434	2336

Table 2. Distribution of socio-demographic characteristics of mothers.

Socio-demographic characteristics	Frequency absolute N=4368	Frequency Relative (%)
Mother's age		
15-19	377	8.6
20-24	985	22.5
25-29	1,102	25.2
30-34	976	22.3

Socio-demographic characteristics	Frequency absolute N=4368	Frequency Relative (%)
35-39	601	13.8
40-44	268	6.1
45-49	58	1.3
Place of residence (4367)		
rural	2,798	64.1
urban	1,57	35.9
Religion		
Muslim	4,255	97.4
Chistian	112	2.6
Unknow	1	
Ethnic group		
Wolof	1,583	36.2
Poular	1,207	27.6
Serere	793	18.2
Mandingue/Soc é	264	6.0
Autres	522	11.9
Household wealth quintile		
poorest	1,068	24.4
poorer	975	22.3
middle	901	20.6
richer	751	17.2
richest	674	15.4
Mother's level of education		
No eduque	2,614	59.9
Primary	935	21.4
Secondary	696	15.9
High	122	2.8
Literacy		
Able to read only parts of or Whole sentence	1,486	34.2
Cannot read	2,853	65.8
Unknown	29	
Early marriage		
No	2,348	55.5
Yes	1,881	44.5
Unknown	139	
Age 1st marriage		
Before 15 years	537	12.7
15-17 years	1,344	31.8

Socio-demographic characteristics	Frequency absolute N=4368	Frequency Relative (%)
From age 18	2,348	55.5
Unknown	139	
Polygamy		
Non	2,982	72.9
Oui	1,107	27.1
Unknown	279	
Household Size		
Large household (>8)	3,243	74.2
Medium household (≤ 8 and > 5)	745	17.1
Small household (≤ 5)	380	8.7
Occupation of mothers'		
Non	1,923	46.8
Oui	2,186	53.2
Unknown	259	
Mother's health care decision		
Husband	3,057	74.6
Wife herself	954	23.3
Someone else	70	1.7
Other	15	0.4
Unknown	272	
Time taken to search for water		
On site	2,604	62.7
At least One hour	1,462	35.2
Less than an hour	86	2.1
Unknown	216	
Access to media		
Yes	4,008	91.8
No	360	8.2
Distance travelled to seek healthcare		
more than 15 km	1,241	28.4
less than 15 km	3,127	71.6

Table 3. Gyneco-obstetrical characteristics of mother.

Gyneco-obstetrical characteristics	Frequency absolute	Frequency Relative (%)
Prenatal consultation (PNC)		
4PNC++	1,84	49.5
Less than 4 PCN	1,799	48.4

Gyneco-obstetrical characteristics	Frequency absolute	Frequency Relative (%)
No visit PCN	76	2.0
Unknown	653	
Place of delivery		
Public	3,321	76.3
Home	808	18.6
Private	165	3.8
Other	56	1.3
Unknown	18	
Delivery assistance by qualified personnel		
Yes	3,084	70.6
No	1,284	29.4
Use modern contraception		
Yes	3,094	70.8
No	1,274	29.2
Cesarean delivery		
No	4,119	94.3
Yes	248	5.7
Unknown	1	

Table 4. Distribution of Child characteristics.

Child characteristics	Frequency absolute	Frequency Relative (%)
Birth rank		
1 rank	1,079	24.7
2 rank	847	19.4
3 rank	658	15.1
4 rank	544	12.5
5 rank	394	9.0
≥ 6 rank	845	19.4
Sex		
Male	2,207	50.5
Female	2,161	49.5
Birth weight		
≥ 2500g	2,714	90.3
< 2500 g	292	9.7
Unknown	1,362	

Table 5. Facteurs associés à la pratique de l'allaitement maternel exclusive.

Independent variables	Exclusive breastfeeding practice		p-value
	No N = 3887	Yes N = 481	
Mother's average age and standard deviation	28.7 Ecart type:6.9	27.8 Ecart type:7.0	0.032
Mother's age			0.7
15-19	328 (86.8%)	50 (13.2%)	
20-24	872 (88.6%)	112 (11.4%)	
25-29	974 (88.4%)	128 (11.6%)	
30-34	883 (90.5%)	93 (9.5%)	
35-39	534 (88.8%)	67 (11.2%)	
40-44	243 (90.6%)	25 (9.4%)	
45-49	53 (90.6%)	6 (9.4%)	
Place of residence			0.7
Rural	2,485 (88.8%)	313 (11.2%)	
Urban	1,402 (89.3%)	168 (10.7%)	
Religion			0.11
Chistian	94 (83.5%)	19 (16.5%)	
Muslim	3,793 (89.1%)	462 (10.9%)	
Unknown	1	0	
Ethnic group			0.2
Autres	446 (85.5)	76 (14.5)	
Mandingue/Soc é	235 (89.1)	29 (10.9)	
Poular	1,072 (88.8)	135 (11.2)	
Serere	722 (91.1)	71 (8.9)	
Wolof	1,412 (89.2)	171 (10.8)	
Household wealth quintile			0.9
Middle	802 (89.0%)	99 (11.0%)	
Poorer	860 (88.2%)	115 (11.8%)	
Poorest	957 (89.7%)	110 (10.3%)	
richer	664 (88.4%)	87 (11.6%)	
richest	604 (89.6%)	70 (10.4%)	
Mother's level of education			0.2
High	108 (88.3%)	14 (11.7%)	
No eduque	2,353 (90.0%)	261 (10.0%)	
Primary	822 (88.0%)	113 (12.0%)	
Secondary	603 (86.6%)	93 (13.4%)	
Unknown	0	0	
Literacy			0.027
Able to read only parts or whole sentence	1,295 (87.2%)	190 (12.8%)	

Independent variables	Exclusive breastfeeding practice		p-value
	No N = 3887	Yes N = 481	
Mother's average age and standard deviation	28.7 Ecart type:6.9	27.8 Ecart type:7.0	0.032
Cannot read	2,570 (90.1%)	284 (9.9%)	0.5
Unknown	22	7	
Early marriage			
No	2,081 (88.6%)	267 (11.4%)	0.8
Yes	1,680 (89.3%)	200 (10.7%)	
Unknown	126	13	
Age at first marriage			0.8
Under 15	478 (89.0)	59 (11.0)	
15-17 years old	1,202 (89.5)	141 (10.5)	
From age 18	2,081 (88.6)	267 (11.4)	0.3
Unknown	126	13	
Birth rank			
1 rank	950 (88.1)	129 (11.9)	0.6
2 rank	772 (91.2)	75 (8.8)	
3 rank	575 (87.4)	83 (12.6)	
4 rank	487 (89.6)	57 (10.4)	0.5
5 rank	354 (89.8)	40 (10.2)	
≥ 6 rank	748 (88.5)	97 (11.5)	
PreNatal Consultation (PNC)			0.5
4 PNC ++	1,625 (88.3)	216 (11.7)	
Less than 4 PNC	1,597 (88.8)	202 (11.2)	
No PNC	70 (91.8)	6 (8.2)	0.028
Unknown	595	57	
Place of delivery			
Other	51 (90.6)	5 (9.4)	0.3
Home	730 (90.3)	78 (9.7)	
Private	151 (91.6)	14 (8.4)	
Public	2,942 (88.6)	379 (11.4)	0.028
Unknown	13	5	
Birth assistance by qualified personnel			
No	1,165 (90.7)	119 (9.3)	0.3
Yes	2,722 (88.3)	362 (11.7)	
Polygamy			
No	2,634 (88.4)	347 (11.6)	0.3
Yes	994 (89.7)	114 (10.3)	

Independent variables	Exclusive breastfeeding practice		p-value
	No N = 3887	Yes N = 481	
Mother's average age and standard deviation	28.7 Ecart type:6.9	27.8 Ecart type:7.0	0.032
Unknown	259	20	
Household Size			0.7
Large household (>8)	2,877 (88.7)	366 (11.3)	
Medium household (≤ 8 and > 5)	671 (90.1)	74 (9.9)	
Small household (≤ 5)	339 (89.2)	41 (10.8)	
Mother's occupation			<0.001
No	1,645 (85.6)	278 (14.4)	
Yes	2,000 (91.5)	187 (8.5)	
Unknown	242	17	
Mother's health care decision			0.8
Other	14 (93.3)	1 (6.7)	
Woman herself	848 (88.9)	106 (11.1)	
Husband	2,708 (88.6)	349 (11.4)	
Someone else	65 (92.1)	6 (7.9)	
Unknown	253	19	
Time taken to find water			0.9
At least one hour	1,303 (89.1)	159 (10.9)	
Less than an hour	76 (88.4)	10 (11.6)	
On site	2,327 (89.4)	277 (10.6)	
Unknown	181	35	
Media access			0.003
No	303 (84.2)	57 (15.8)	
Yes	3,584 (89.4)	424 (10.6)	
Distance travelled to seek healthcare			0.3
More than 15 km	1,115 (89.8)	127 (10.2)	
Less than 15 km	2,772 (88.7)	354 (11.3)	
Use contraception moderne			<0.001
No	2,695 (87.1)	399 (12.9)	
Yes	1,193 (93.6)	82 (6.4)	
Caesarean section			0.022
No	3,652 (88.7)	467 (11.3)	
Yes	234 (94.5)	14 (5.5)	
Unknown	1	0	
Sex			0.9
Female	1,922 (89.0)	239 (11.0)	

Independent variables	Exclusive breastfeeding practice		p-value
	No N = 3887	Yes N = 481	
Mother's average age and standard deviation	28.7 Ecart type:6.9	27.8 Ecart type:7.0	0.032
Male	1,965 (89.0)	242 (11.0)	0.8
Birth weight			
≥ 2500 g	2,381 (87.7)	333 (12.3)	
<2500 g	258 (88.3)	34 (11.7)	
Unknown	1,249	114	

Table 6. Factors associated with not practicing Exclusive Breastfeeding.

Characteristic	AOR ^I	95% CI ^I
Age of Mother		
45-49	—	—
15-19	2.47	0.61, 12.8
20-24	2.56	0.73, 12.1
25-29	2.70	0.82, 12.3
30-34	1.68	0.53, 7.49
35-39	1.64	0.52, 7.29
40-44	0.75	0.21, 3.64
Ethnie		
Serere	—	—
Autres	0.58	0.35, 0.95
Mandingue/Soc é	0.86	0.48, 1.55
Poullar	0.84	0.54, 1.30
Wolof	0.59	0.38, 0.90
Literacy		
Able to read only parts of sentence or whole sentence	—	—
Cannot read	0.71	0.53, 0.95
Birth rank		
1	—	—
2	1.18	0.76, 1.83
3	1.54	0.94, 2.53
4	1.71	0.97, 3.02
5	1.82	0.95, 3.47
A partir de 6	3.20	1.68, 6.17
Mother's occupation		
Non	—	—

Characteristic	AOR [†]	95% CI [†]
Oui	0.60	0.46, 0.79
Media access		
Non	—	—
Oui	0.57	0.37, 0.90
Use contraception moderne		
Non	—	—
Oui	0.53	0.38, 0.72
Birth weight		
Non (>=2,5Kg)	—	—
Oui (<2,5 kg)	0.71	0.43, 1.12

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Biography



Maty Diagne Camara is a public health specialist, nutritionist and assistant professor at Cheikh Anta Diop University in Dakar. She holds a doctorate in medicine from Cheikh Anta Diop University in Dakar, a certificate of specialization in public health and a master's degree in public health with a nutrition option. She has 20 years' experience in public health. She was head doctor of a health district before joining the Health and Development Institute at Cheikh Anta Diop University in Dakar. She coordinates the Master's degree in Public Health/Nutrition, specializing in nutrition. She is also head of the Food and Nutrition Division at Senegal's Ministry of Health and Social Action, where I have been coordinating food and nutrition projects and programs since 2013. She is a member of the Senegalese Association of Public Health Professionals (PHPS) and the Senegalese Association of Nutrition and Food.

Research Field

Maty Diagne Camara: Infant and Young Child Feeding; Dietary Diversification in Pregnant Women; Routine Vitamin Supplementation in Children 6-59 Months of Age; Factors Associated with Low Birth Weight; Management of Children with Severe Acute Malnutrition

Ibrahima Ndiaye: Factors Associated with the Completion of Antenatal Care

Boubacar Gueye: Factors associated with practice of exclusive breastfeeding

Aboubacry Dramé Neonatal mortality according to DHS data in Senegal

Oumar Bassoum: Determinants of hepatitis B vaccine administration at birth in Senegal. Evaluation of prescription indicators for pediatric outpatient consultations Senegal. Vaccination against tuberculosis, poliomyelitis and hepatitis B Podor district, Senegal. Coverage Timeliness Birth Dose Vaccination Sub-Saharan Africa. Assessment general public's knowledge antibiotic use bacterial resistance