ARTICLE | OPEN ACCESS

Discovery

To Cite:
Ndiaye O. Determinants of under-five mortality in Senegal: a longitudinal analysis of Demographic and Health Survey data from 2005 to 2023. *Discovery* 2026; 62: e35d3337
doi:

Author Affiliation:
Health Economist, Cheikh Anta Diop University of Dakar; Laboratory for the Analysis of Economic and Social Policies, Dakar, Senegal

*Corresponding author:
Oumy Ndiaye.
Health Economist, Cheikh Anta Diop University of Dakar; Laboratory for the Analysis of Economic and Social Policies, Dakar, Senegal
Postal address: B.P. 5005, Dakar-Fann, Sénégal. Telephone: +221777875537. Fax: +221 33 825 28 83. E-mail: Oumy3.ndiaye@gmail.com; Oumy3.ndiaye@ucad.edu.sn

Peer-Review History
Received: 09 April 2026
Reviewed & Revised: 18/May/2026 to 12/October/2026
Accepted: 29 October 2026
Published: 09 November 2026

Peer-Review Model
External peer-review was done through double-blind method.

Discovery
pISSN 2278–5469; eISSN 2278–5450

© The Author(s) 2026. Open Access. This article is licensed under a Creative Commons Attribution License 4.0 (CC BY 4.0)., which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license, and indicate if changes were made. To view a copy of this license, visit http://creativecommons.org/licenses/by/4.0/.

Determinants of under-five mortality in Senegal: a longitudinal analysis of Demographic and Health Survey data from 2005 to 2023

Oumy Ndiaye*

ABSTRACT

Child mortality before the age of five is still a public health concern in Senegal. This study examines the factors associated with under-five mortality using data from the 2023 Continuous Demographic and Health Survey (DHS-C), which initially covered approximately 39,490 individuals and 1,300 variables. The analysis began with a description of the data, followed by chi-square tests to explore the relationships between child mortality and selected characteristics. A multivariate logistic regression model was then fitted to assess which factors remained associated with under-five mortality after accounting for the other variables included in the model. The results show that several demographic, reproductive, and socioeconomic characteristics are significantly associated with mortality. Birth spacing is a particularly important factor: an interval of 24-35 months is associated with a 41.8% reduction in the odds of death, while an interval of at least 36 months is associated with a 59.2% reduction. Girls also have 17.9% lower odds of dying than boys. Moreover, children from middle- and high-wealth households have 17.0% and 40.9% lower odds of dying, respectively, than those from poor households. Maternal education also plays an important role, with a 39.5% reduction in the odds of death when the mother has reached the secondary level. This article thus highlights the major role of reproductive and socioeconomic factors in child survival. It underscores the importance of birth spacing, maternal education, and improved household living conditions in reducing under-five mortality in Senegal.

Keywords: Mortality, Infant-juvenile, Senegal, Logit

1. INTRODUCTION

Under-five mortality is a major public health issue and an essential indicator of the health, social, and economic conditions in which populations live. It is defined as the probability that a child born alive will die before their fifth birthday, and it is generally expressed per 1,000 live births. This indicator is widely used to assess the level of human development, the quality of health systems, and inequalities in access to care.

Globally, substantial progress has been made over the past three decades. Under-five mortality has declined considerably over the past decades, falling from 93.5

deaths per 1,000 live births in 1990 to 37.4 in 2024, a reduction of around 60%. However, this progress has not been enough to prevent millions of deaths. In 2024, approximately 4.9 million children died before reaching the age of five, representing nearly 13,300 deaths each day. Many of these deaths were caused by conditions that can be prevented or treated.

The situation is particularly concerning in sub-Saharan Africa, where child mortality remains higher than in any other region. In 2024, the under-five mortality rate stood at 71.2 deaths per 1,000 live births, almost twice the global average. The region also accounted for around 60% of all deaths among children under five, meaning that approximately one in every fourteen children died before their fifth birthday. These deaths are commonly associated with respiratory infections, malaria, diarrheal diseases, prematurity and complications during childbirth.

In West and Central Africa, the situation also remains worrying. This subregion alone accounts for nearly 1.9 million deaths of children under five each year, the highest mortality burden on the African continent. Countries such as Nigeria, Mali, Guinea, and Niger still show very high mortality levels, mainly because of poverty, territorial inequalities, low coverage of maternal and child health services, and insufficient access to safe drinking water and sanitation.

In Senegal, mortality among children and adolescents has declined over the years, although the survival of young children remains a public health concern. Data from the 2023 Continuous Demographic and Health Survey (EDS-C) show that 40 children out of every 1,000 live births die before reaching the age of five. This represents an improvement compared with the 49 deaths per 1,000 live births recorded for the period 2009-2013. The survey also reports an infant mortality rate of 31 deaths per 1,000 live births and a mortality rate of 9 per 1,000 among children aged one to four years.

Despite this progress, the figures vary across population groups. Under-five mortality is estimated at 45 deaths per 1,000 live births in rural areas, compared with 31 in urban areas. Differences are also observed between boys and girls, with rates of 45 and 34 deaths per 1,000 live births, respectively. These gaps suggest that children's chances of survival may depend on a combination of individual characteristics, household circumstances and living conditions.

The central question of this study is: **what are the main factors associated with under-five mortality in Senegal?**

With this in mind, this paper draws on data from the 2023 C-DHS to analyze the factors associated with under-five mortality. The general objective is to identify and analyze the main determinants of the death of children before their fifth birthday.

1.1. Literature review

To better understand the determinants of infant and under-five mortality, this literature review draws on the main explanatory theories as well as on the results of empirical work carried out in different contexts.

1.1.1. Theoretical review

The analytical framework of Mosley and Chen (1984)

The analytical framework developed by Mosley and Chen (1984) is one of the main theoretical references for the study of the determinants of under-five mortality in developing countries. The authors argue that socioeconomic factors, such as parents' level of education, household income, place of residence, or cultural characteristics, do not act directly on child survival. Their influence operates through so-called "proximate" or "intermediate" determinants, which directly affect the child's health status.

According to this framework, these proximate determinants fall into five categories: maternal factors (mother's age, birth order, birth interval), environmental contamination (access to safe drinking water, sanitation, and hygiene), nutritional deficiencies, injuries, and prevention practices and health services (vaccination, antenatal care visits, assistance at delivery, etc.). Reducing infant mortality therefore necessarily requires improving these intermediate determinants. This framework is now commonly used in studies relying on data from the Demographic and Health Surveys (DHS).

Caldwell's maternal education theory (1979)

In his study on the role of education in the decline of child mortality, Caldwell (1979) highlights the importance of the mother's level of education in improving child survival. According to this author, education enables mothers to acquire the knowledge needed to adopt behaviors that are favorable to their children's health.

Indeed, an educated mother is more likely to use health services, follow the vaccination schedule, quickly recognize signs of illness, adopt better hygiene and nutrition practices, and make informed decisions about the care of her child. Education also fosters greater autonomy in decisions relating to family health. This theory thus explains why maternal education is regularly identified as a major determinant of infant and under-five mortality in the empirical literature.

Becker's human capital theory (1965)

The human capital theory developed by Becker (1965) considers health as a form of capital in which individuals and households can invest in order to improve their well-being and productivity. From this perspective, expenditure on health, food, education, or prevention constitutes an investment likely to increase children's chances of survival.

When applied to infant and under-five mortality, this theory emphasizes how a household's financial situation can influence a child's chances of survival. Families with sufficient resources are generally better positioned to pay for healthcare, provide adequate food, keep their children's vaccinations up to date, and maintain healthier living conditions. By contrast, limited financial means can make it difficult for poorer households to obtain medical care and meet their children's basic needs. These constraints may expose children to a greater risk of illness and death. Household economic conditions are therefore an important factor to consider when examining differences in child survival.

The World Health Organization (WHO) framework on the social determinants of health (2008)

The framework of social determinants of health, formalized and promoted by the World Health Organization's Commission on Social Determinants of Health in 2008, offers a more comprehensive view of health inequalities. According to this approach, the health status of populations mainly depends on the conditions in which individuals are born, grow up, live, work, and age. For the WHO, differences in mortality are not explained solely by medical factors but also by the unequal distribution of economic resources, education, employment, infrastructure, and health services. Today, this framework is widely used to analyze child and adolescent mortality disparities in low- and middle-income countries.

It distinguishes between structural determinants and intermediate determinants. Structural determinants refer to the social position of households, including their wealth level, parents' education level, their professional status, and their place of residence. These factors directly influence living conditions and access to resources that promote health. Intermediate determinants, on the other hand, relate to material living conditions—such as housing, access to clean water, sanitation, nutrition, and health services—which more directly affect the child's health.

In this research, this theoretical framework helps explain why children from the poorest households or living in rural areas often face a higher risk of mortality. The variables relating to wealth class, place of residence, education level, and the mother's economic activity thus reflect the social inequalities likely to influence child survival. The WHO approach therefore complements Mosley and Chen by placing greater emphasis on the mechanisms of social inequality that precede biological determinants.

1.1.2. Empirical review

The empirical literature on under-five mortality highlights the diversity of factors likely to influence child survival. Over the years, several studies have analyzed this phenomenon using different databases and methodological approaches in order to identify the main demographic, socioeconomic, and health determinants of child mortality.

This section outlines some reference studies that have helped enrich knowledge on this issue.

In their study entitled "*Demographic Determinants of Infant and Early Child Mortality: A Comparative Analysis*", Hobcraft et al. (1985) examine the demographic determinants of infant and under-five mortality in developing countries. To do so, the authors use data from the World Fertility Survey covering 39 developing countries. Using multivariate regression models, they analyze the influence of demographic and socioeconomic characteristics on child survival. The results show that the mother's age at birth, birth order, birth interval, and maternal education are the main factors associated with child mortality. In particular, short birth intervals considerably increase the risk of death, whereas a high level of maternal education significantly improves children's chances of survival.

Subsequently, Anand and Ravallion (1993), in their study entitled "*A Comparison of Empirical Models on Determinants of Infant Mortality: A Cross-National Study on Africa*", examine the factors explaining differences in infant mortality between African countries. To this end, they use cross-sectional data covering 28 African countries and estimate several regression models to assess the influence of socioeconomic and health variables. The results reveal that per capita income, school enrollment, and access to health services contribute significantly to reducing infant mortality. By contrast, some variables, such as public health expenditure and access to safe drinking water, lose their significance once the other explanatory factors are taken into account. The authors thus conclude that progress in child survival requires simultaneous improvement of economic, educational, and health conditions.

A few years later, Wang (2003), in a study entitled "*Determinants of Child Mortality in LDCs: Empirical Findings from Demographic and Health Surveys*", analyzes the determinants of child mortality in the least developed countries. The author uses DHS data from more than 60 low-income countries. To achieve this objective, econometric models are applied to the DHS data, while urban and rural

contexts are compared. The results show that improved household income, access to electricity, vaccination of children during their first year of life, and increased public health expenditure contribute to significantly reducing infant and under-five mortality. However, the study stresses that these effects are less pronounced in rural areas, where inequalities in access to health infrastructure remain significant.

From a more specific perspective, Omariba et al. (2007), in their study "*Determinants of Infant and Child Mortality in Kenya: An Analysis Controlling for Frailty Effects*", seek to identify the determinants of infant and under-five mortality in Kenya. The authors use data from the 1998 Kenya Demographic and Health Survey. To account for unobserved heterogeneity among children, they estimate a Weibull survival model with a frailty effect. The results show that biological factors, notably multiple births, low birth weight, and birth order, have a greater influence on infant mortality, while socioeconomic, cultural, and health factors mainly explain the mortality of children aged 1 to 5 years. The authors also emphasize that introducing the frailty effect improves the accuracy of the estimates.

Furthermore, Mekonnen et al. (2013), in their study entitled "*An Analysis of the Trends, Differentials and Key Proximate Determinants of Infant and Under-Five Mortality in Ethiopia*", analyze the evolution and determinants of mortality among children under five in Ethiopia. To do so, they use data from the 2000, 2005, and 2011 DHS. The analysis relies on descriptive statistics complemented by multivariate regression models. The results reveal a gradual decline in child mortality over the study period. However, maternal education, place of residence, antenatal care visits, birth spacing, and household living standards remain major determinants of child survival. The authors therefore recommend strengthening health interventions that target rural populations in particular.

In addition, Abate et al. (2020), in their study entitled "*Proximate Determinants of Infant Mortality in Ethiopia*", examine the immediate factors associated with infant mortality in Ethiopia. The study draws on data from the 2016 Ethiopia Demographic and Health Survey. To analyze the risk of child death, the authors use the Kaplan-Meier estimator and a Cox proportional hazards model. The results indicate that the child's sex, multiple births, breastfeeding, birth interval, the mother's age, and the use of health services significantly influence infant mortality. The authors conclude that strengthening the coverage of maternal and child health care is an essential lever for reducing child mortality.

More recently, Ahinkorah et al. (2022), in their study titled 'Socio-economic and Proximate Determinants of Under-Five Mortality in Guinea,' analyzed the socio-economic and proximate factors affecting under-five mortality in Guinea. The authors used data from the 2018 Demographic and Health Survey in Guinea and estimated a multivariate logistic regression model to identify factors associated with child deaths. The results show that lack of postnatal care, low birth weight, and low household living standards significantly increase the risk of dying before age five. On the other hand, adequate spacing between births significantly reduces this risk, highlighting the importance of maternal health and family planning interventions.

In Senegal, Ndiaye et al. (2023), in their study entitled "*Les déterminants de la mortalité infantile au Sénégal: Une analyse économétrique*" [The determinants of infant mortality in Senegal: An econometric analysis], analyze the main factors explaining the mortality of children under five in Senegal. To do so, the authors use national time-series data from 1980 to 2015. To identify the factors associated with infant mortality, they estimate a linear regression model. The results show that the consumption of antimalarial drugs and improved access to safe drinking water sources, in both urban and rural areas, contribute significantly to reducing child mortality. The authors thus conclude that strengthening health interventions and improving water access infrastructure are essential levers for improving child survival in Senegal.

In conclusion, the empirical review shows that infant and under-five mortality is a multidimensional phenomenon influenced by a set of demographics, socioeconomic, health, and environmental factors. Despite the diversity of geographical contexts, databases, and methodological approaches, the studies converge on the importance of variables such as maternal education, maternal age, birth spacing, birth order, household living standards, use of health services, and residential conditions.

2. DATA SOURCE AND METHODOLOGY

2.1. Data source

The data used in this study come from Senegal's seventh Continuous Demographic and Health Survey (EDS-C 2023). Conducted as part of the international Demographic and Health Surveys (DHS) Program, the survey provides information on the demographic, health and socioeconomic conditions of the population. It was carried out by the National Agency of Statistics and Demography (ANSD, 2023), with technical assistance from ICF and support from various technical and financial partners. The survey covered the entire country and used a two-stage probability sampling design. This approach allows estimates to be produced at the national level, as well as for urban and rural areas and the different regions of Senegal.

The data collected cover, among other topics, fertility, mortality, maternal and child health, family planning, nutrition, childhood diseases, and the socioeconomic characteristics of households and individuals. They therefore constitute a relevant source of information for analyzing the determinants of infant and under-five mortality in Senegal.

For this research, the 2023 C-DHS data files were used to identify the demographic, socioeconomic, and health factors associated with under-five mortality.

2.1.1. Description of the dataset

The dataset used in this study comes from the 2023 Senegal C-DHS. It comprises 39,490 individuals described by 1,300 variables, covering a wide range of demographic, socioeconomic, and health information.

Dependent variable

The variable to be explained in this study is "*under-five mortality*". It is a binary variable that takes the value 1 if a child died before the age of 5 and 0 otherwise. This variable is used to model the probability of having a child who died before the age of 5.

Let Y_i denote the variable defining whether or not a child died before the age of 5. We then have :

$$Y_i = \begin{cases} 1 & si\ l'enfant\ est\ mort\ avant\ ses\ 5\ ans \\ 0 & sinon \end{cases}$$

Explanatory variables

The variables likely to explain under-five mortality were identified on the basis of the literature review. Table 1 presents the retained variables.

Table 1. Description of the variables used in the analysis

Variable (code)	Description	Categories
Under-five mortality (mort_5ans)	Indicates whether the child died before the age of 5.	Survived to age 5; Died before age 5
Mother's age (age_mere_classe)	Indicates the mother's age group.	Under 20 years; 20 years and older
Child's sex (sexe_enfant)	Indicates the child's sex.	Male; Female
Father's age (age_pere_classe)	Indicates the father's age group.	Under 25 years; 25-29 years; 30-34 years; 35-39 years; 40-44 years; 45-49 years; 50 years and older
Place of residence (mil_res)	Indicates the household's place of residence.	Urban; Rural
Ethnicity (ethnie)	Indicates the household's ethnic affiliation.	Pulaar; Serer; Mandinka; Soninke; Other
Birth interval (inter_nai)	Measures the interval between two successive births.	Less than 24 months; 24-35 months; 36 months or more
Husband's education level (niv_inst_mari)	Indicates the husband's education level.	None; Primary; Secondary; Higher
Mosquito net (moust)	Indicates whether the household uses a mosquito net.	No; Yes
Child's birth order (rang_enf)	Indicates the child's position among the mother's births.	1st child; 2nd child; 3rd child; 4th child; 5th child; 6th child; 7th child and above
Wealth class (classe_richesse)	Indicates the household's socioeconomic level based on the wealth index.	Poor; Middle; Rich

Mother's education level (v106)	Indicates the mother's highest level of education attained.	None; Primary; Secondary; Higher
Mother's economic activity (activite_mere)	Indicates whether the mother is employed.	No; Yes

2.2. Statistical methods

In this research, the objective is to explain under-five mortality. To do so, we have a binary variable with two categories: "1" and "0". It is therefore not appropriate to use a linear regression model, which is designed to model continuous quantitative variables. We therefore opted for a model specifically suited to the analysis of qualitative variables. Among the available models, the binary-response model proved to be the most relevant choice. Indeed, this model is suited to modeling binary qualitative variables. Its relevance also lies in the ease of interpretation it offers, notably through odds ratios (OR) and marginal effects.

Logistic regression is a statistical technique suited for studying binary dependent variables. Unlike ordinary linear regression, it lets you estimate the probability that an individual belongs to one of the two categories of the variable of interest, based on a set of explanatory variables.

Basic assumptions of the logistic model

Consider a sample of N individuals indexed by $i = 1, 2, \ldots, N$. For each individual i, we observe whether a certain event has occurred. We then define a binary variable y_i such that:

$$Y_i = \begin{cases} \mathbf{1} \ \ \textit{if the child died before turning } \mathbf{5} \\ \mathbf{0} \ \textit{Otherwise} \end{cases}$$

The expectation of y_i is given by:

$$\mathbf{E}(y_i) = \textit{Prob}(y_i = 1) \times 1 + \textit{Prob}(y_i = 0) \times 0 = \textit{Prob}(y_i = 1) = p_i$$

where p_i represents the probability that child i died before the age of 5.

Specification of the logit model

The logistic model has as its dependent variable the probability of occurrence of the event $y_i = 1$, conditional on the exogenous variables. We therefore consider the following model:

$$p_i = P(y_i = 1|X_i)$$

where X_i is the vector of characteristics for individual i.

The model is specified as follows:

$$\log\left(\frac{p_i}{1 - p_i}\right) = \beta_0 + X_i'\beta$$

The parameters β are estimated by the maximum likelihood method.

3. RESULTS

3.1. Bivariate analysis

At the national level, all variables are significantly associated with child mortality at the 1% level, except the mother's economic activity (Table 2). The distribution of each explanatory variable according to the children's survival status is presented in Table 3.

Table 2. Results of the chi-square tests of association with under-five mortality

Variable	Pearson χ^2	df	p-value	Significant association
Mother's age	30.125	1	< 0.001	Yes
Child's sex	22.581	1	< 0.001	Yes
Father's age	60.117	6	< 0.001	Yes
Birth interval	157.584	2	< 0.001	Yes
Ethnicity	59.808	4	< 0.001	Yes
Place of residence	44.826	1	< 0.001	Yes
Husband's education level	46.162	3	< 0.001	Yes
Mosquito net use	14.819	1	< 0.001	Yes
Mother's economic activity	0.023	1	0.881	No
Child's birth order	35.936	6	< 0.001	Yes
Wealth class	138.211	2	< 0.001	Yes
Mother's education level	100.775	3	< 0.001	Yes

Note: df = degrees of freedom. *Source:* Author's calculations based on the 2023 Senegal Continuous Demographic and Health Survey.

Table 3. Bivariate analysis of the explanatory variables and under-five mortality (column percentages)

Variable	Category	Died before age 5	Survived to age 5
Mother's age	Under 20 years	62.0%	56.1%
	20 years and older	38.0%	43.9%
Child's sex	Male	56.2%	51.1%
	Female	43.8%	48.9%
Father's age	Under 25 years	0.8%	0.8%
	25-29 years	1.8%	2.6%
	30-34 years	5.2%	7.4%
	35-39 years	8.7%	10.5%
	40-44 years	14.5%	16.3%
	45-49 years	16.0%	17.4%
	50 years and older	53.1%	45.0%
Birth interval	Less than 24 months	28.5%	17.9%
	24-35 months	22.1%	24.5%
	36 months or more	49.4%	57.6%
Ethnicity	Pulaar	30.6%	34.7%
	Serer	44.1%	39.6%
	Mandinka	10.6%	12.6%
	Soninke	12.4%	9.3%
	Other	2.2%	3.8%
Place of residence	Urban	29.4%	36.4%
	Rural	70.6%	63.6%
Husband's education level	None	84.5%	79.1%
	Primary	9.2%	10.6%
	Secondary	4.8%	7.3%
	Higher	1.6%	3.1%
Mosquito net use	No	23.9%	27.6%
	Yes	76.1%	72.4%
Mother's economic activity	No	58.5%	58.7%
	Yes	41.5%	41.4%
Child's birth order	1st child	31.1%	26.9%

Variable	Category	Died before age 5	Survived to age 5
	2nd child	20.7%	21.7%
	3rd child	14.8%	16.8%
	4th child	11.2%	12.6%
	5th child	7.4%	8.9%
	6th child	6.1%	5.9%
	7th child and above	8.7%	7.1%
Wealth class	Poor	66.6%	55.5%
	Middle	19.5%	20.7%
	Rich	13.9%	23.8%
Mother's education level	None	77.9%	68.4%
	Primary	15.1%	18.6%
	Secondary	6.5%	11.9%
	Higher	0.6%	1.1%

Source: Author's calculations based on the 2023 Senegal Continuous Demographic and Health Survey.

Mother's age

The distribution of under-five mortality by the mother's age shows a difference between the groups. Among children who died before the age of 5, 62.0% were born to mothers under 20 years of age, compared with 38.0% for mothers aged 20 and older. Among children who survived to age 5, these proportions are 56.1% and 43.9%, respectively. Under-five mortality thus appears to be more concentrated among children whose mother is under 20 years of age.

Child's sex

By the child's sex, boys account for 56.2% of children who died before age 5, compared with 43.8% for girls. Among children who survived to age 5, the proportion of boys is 51.1%, compared with 48.9% of girls. Under-five mortality thus appears more frequent among boys than among girls in the data studied.

Father's age

The distribution of deceased children by the father's age shows a particularly high concentration in the 50 and older category, which accounts for 53.1% of deaths before age 5, compared with 45.0% among surviving children. The 40-44 and 45-49 age groups account for 14.5% and 16.0% of deaths, respectively. Conversely, deaths are relatively less represented among children whose father belongs to the youngest age groups.

Birth interval

The birth interval also shows differences in the distribution of mortality. Among children who died before age 5, 28.5% were born after an interval of less than 24 months, whereas 22.1% correspond to an interval of 24-35 months and 49.4% to an interval of at least 36 months. Among surviving children, the proportion associated with an interval of less than 24 months is lower, at 17.9%. These results suggest that short birth intervals are more strongly represented among children who died before age 5.

Ethnicity

The breakdown by ethnicity shows that the Serer make up 44.1% of children who died before the age of five, followed by the Pulaar (30.6%), the Soninké (12.4%), the Mandingues (10.6%), and other ethnic groups (2.2%). Among children who survived to age five, the Serer also make up the largest proportion (39.6%), followed by the Pulaar (34.7%). Mortality patterns thus vary according to ethnic group.

Place of residence

Place of residence reveals a greater concentration of deaths in rural areas. Indeed, 70.6% of children who died before age 5 live in rural areas, compared with 29.4% in urban areas. Among children who survived to age 5, the proportion living in rural areas is 63.6%. Under-five mortality is thus more strongly represented among children living in rural areas.

Husband's education level

By the husband's education level, children who died before age 5 mostly come from households where the husband has no education, with a proportion of 84.5%. This proportion is 79.1% among children who survived to age 5. Deaths account for 9.2% at the primary level, 4.8% at the secondary level, and 1.6% at the higher level. Mortality is thus particularly concentrated in households where the husband has not attended school.

Use of mosquito nets

Regarding the use of mosquito nets, 76.1% of children who died before age 5 belong to households reporting the use of a mosquito net, compared with 23.9% in households not using one. Among children who survived to age 5, these proportions are 72.4% and 27.6%, respectively. Most deaths are thus observed in households using a mosquito net, which must be interpreted with caution. This distribution does not, on its own, allow a conclusion as to a protective or adverse effect of the mosquito net.

Mother's economic activity

The distribution by the mother's activity is practically identical between the two groups. Among children who died before age 5, 58.5% have a mother who does not work, compared with 41.5% whose mother works. These proportions are similar among surviving children, at 58.7% and 41.4%, respectively. Mortality thus shows a very similar distribution according to the mother's activity status.

Child's birth order

Regarding birth order, children who died before age 5 are mainly first-born children, who account for 31.1% of deaths, followed by second children with 20.7% and third children with 14.8%. Birth orders 4, 5, 6, and 7 or higher account for 11.2%, 7.4%, 6.1%, and 8.7% of deaths, respectively. Compared with surviving children, first-born children are proportionally more represented among deaths.

Wealth class

Wealth class shows a fairly clear difference. Among children who died before age 5, 66.6% belong to poor households, compared with 19.5% in middle-wealth households and 13.9% in rich households. Among children who survived to age 5, the proportion from poor households is lower, at 55.5%, whereas rich households account for 23.8%. Under-five mortality thus appears more concentrated among children from the poorest households.

Mother's education level

Finally, by the mother's education level, 77.9% of children who died before age 5 have a mother with no education, compared with 15.1% whose mother has a primary level, 6.5% a secondary level, and 0.6% a higher level. Among children who survived to age 5, the proportion associated with mothers with no education is 68.4%. Deaths are thus more concentrated among children whose mothers have received no education.

3.2. Determinants of under-five mortality

3.2.1. Validation of the model results

First, the overall significance of the model is assessed using the likelihood ratio test. The results indicate an associated p-value of 0.001. The null hypothesis that the explanatory variables have no joint effect on under-five mortality is therefore rejected at the 5% level. The logistic model is thus globally significant, which shows that the variables retained collectively contribute to explaining the probability of death before the age of five. However, McFadden's pseudo-R^2 of 0.0364 reveals relatively limited explanatory power. This result should be interpreted with caution, since the pseudo-R^2 of a logistic model does not have the same meaning as the R^2 of a linear regression.

Moreover, goodness of fit is assessed using the Hosmer-Lemeshow test, which yields a probability of 0.3891. As this is greater than 5%, the null hypothesis of agreement between the values observed and those predicted by the model cannot be rejected. The model thus shows a satisfactory fit to the data. In other words, the probabilities estimated by the model are sufficiently close to the proportions actually observed in the different risk groups.

Next, the discriminatory power of the model is assessed using the receiver operating characteristic (ROC) curve. The area under the curve (AUC) is 0.6548, which means that the model has a discrimination capacity superior to that of a model with no discriminatory

power, for which the AUC would be equal to 0.5. However, this value remains moderate. The model therefore makes it possible to distinguish children who died before the age of five from survivors, but this distinction remains imperfect.

Finally, the overall rate of correct classification reaches 94.27%. However, this result should not be interpreted in isolation. Indeed, the classification table shows that none of the 1,998 deaths are correctly classified, whereas all 32,886 survivors are correctly identified. The high overall classification rate is therefore mainly explained by the large proportion of surviving children in the sample. Thus, despite this seemingly high classification percentage, the model has a very limited ability to identify deaths. In this situation, the AUC of 0.6548 is a more relevant indicator of the model's discriminatory power than the overall classification rate alone.

3.2.2. Presentation and interpretation of the model results

The analysis of the results first shows that the mother's age is significantly associated with under-five mortality (Table 4). Compared with the reference category, children whose mother is aged 20 or older have 16.8% lower odds of dying before the age of 5, all else being equal. This difference is statistically significant at the 1% level. A higher maternal age thus seems to be associated with better chances of child survival.

Table 4. Results of the logistic regression model

Variable	Category	OR	95% CI	p-value
Mother's age	20 years and older	0.832	[0.755, 0.917]	<0.001***
Child's sex	Female	0.821	[0.749, 0.899]	<0.001***
Father's age	25-29 years	0.733	[0.397, 1.352]	0.319
	30-34 years	0.899	[0.522, 1.549]	0.702
	35-39 years	1.159	[0.682, 1.970]	0.585
	40-44 years	1.195	[0.708, 2.015]	0.505
	45-49 years	1.244	[0.737, 2.097]	0.413
	50 years and older	1.571	[0.939, 2.627]	0.085
Birth interval	24-35 months	0.582	[0.511, 0.662]	<0.001***
	36 months or more	0.408	[0.355, 0.467]	<0.001***
Ethnicity	Serer	1.118	[1.001, 1.250]	0.049*
	Mandinka	0.958	[0.814, 1.128]	0.608
	Soninke	1.427	[1.222, 1.666]	<0.001***
	Other	0.811	[0.590, 1.116]	0.199
Place of residence	Rural	1.003	[0.886, 1.135]	0.965
Husband's education level	Primary	0.985	[0.838, 1.159]	0.856
	Secondary	0.863	[0.686, 1.086]	0.209
	Higher	0.856	[0.588, 1.246]	0.417
Mosquito net	Yes	1.195	[1.074, 1.331]	0.001***
Mother's economic activity	Yes	1.109	[1.005, 1.223]	0.039*
Child's birth order	2nd child	0.491	[0.419, 0.575]	<0.001***
	3rd child	0.416	[0.350, 0.493]	<0.001***
	4th child	0.395	[0.328, 0.474]	<0.001***
	5th child	0.347	[0.282, 0.427]	<0.001***
	6th child	0.408	[0.327, 0.510]	<0.001***
	7th child and above	0.446	[0.365, 0.546]	<0.001***
Wealth class	Middle	0.830	[0.727, 0.947]	0.006***
	Rich	0.591	[0.499, 0.701]	<0.001***
Mother's education level	Primary	0.858	[0.748, 0.985]	0.029*
	Secondary	0.605	[0.491, 0.744]	<0.001***
	Higher	0.899	[0.477, 1.696]	0.743

Note: OR = odds ratio; CI = confidence interval. * $p < 0.05$; *** $p < 0.01$. *Source:* Author's calculations based on the 2023 Senegal Continuous Demographic and Health Survey.

Regarding the child's sex, the results indicate that girls have 17.9% lower odds of dying before age 5 than boys, all else being equal. This difference is statistically significant. The child's sex therefore appears to be a factor associated with under-five mortality, with a survival advantage in favor of girls.

By contrast, the father's age shows no statistically significant association with under-five mortality. The different age groups do not differ significantly from the reference category. Although children whose father is 50 or older show a tendency toward higher odds of dying, this difference is not large enough to be considered statistically significant at the 5% level. The father's age therefore does not seem to play a decisive role in mortality before age 5 in this model.

Birth spacing appears to be an important factor in under-five mortality. Compared with the reference group, children born 24 to 35 months after a previous birth have 41.8% lower odds of dying before the age of five. The reduction rises to 59.2% when the interval is 36 months or longer. Both associations are statistically significant. One possible explanation is that longer intervals give mothers more time to recover from pregnancy and may help them provide better care for their children.

The results also vary across ethnic groups. Compared with the reference category, the odds of under-five mortality are 11.8% higher among Serer children and 42.7% higher among Soninké children; both differences are statistically significant. However, the estimates for Mandingue children and those belonging to other ethnic groups do not show statistically significant differences from the reference group. These findings point to variations in child mortality across groups, although further analysis would be needed to determine whether socioeconomic circumstances, access to healthcare or other factors help explain these differences.

Regarding place of residence, no statistically significant difference is observed between children living in rural areas and those in the reference category. The odds of mortality are practically identical between the two groups. Thus, once the model accounts for other characteristics, place of residence does not appear to be significantly associated with under-five mortality.

Similarly, the husband's education level shows no statistically significant association with mortality before age 5. Although children whose mother's husband has a secondary or higher level of education show a tendency toward lower odds of dying, the differences observed are not statistically significant. It is therefore not possible to conclude, from these results, that the husband's education level has an independent effect on child survival.

The analysis also reveals a statistically significant association between the mosquito net variable and under-five mortality. Children in households that reported "yes" for this variable have 19.5% higher odds of dying before the age of five than those in the reference category. At first glance, this finding may seem unexpected, particularly if the variable measures mosquito net ownership or use. One possible explanation is that households at greater risk of malaria may be more likely to own or use mosquito nets. However, the available results do not establish why this association occurs. The finding should therefore be interpreted cautiously, as it does not imply that mosquito nets increase child mortality.

Regarding the mother's activity, children whose mother is engaged in an occupation have 10.9% higher odds of dying before age 5 than those in the reference category. This association is statistically significant at the 5% level. This result could be related to certain constraints that working mothers may face, notably in terms of availability for the care and supervision of the child. However, as before, this interpretation should remain cautious since it is an association observed in the model.

Birth order then appears as one of the factors most strongly associated with under-five mortality. Compared with the first-born child, second-born children have 50.9% lower odds of dying, while this reduction reaches 58.4% for the third child and 60.5% for the fourth. For children of fifth birth order, the decrease reaches 65.3%. It is 59.2% for the sixth child and 55.4% for those of seventh order or higher. All these differences are statistically significant. These results therefore show that, in this analysis, the first-born child has the highest odds of mortality relative to the other birth orders.

The household's wealth class is also an important factor. Compared with children from poor households, those from middle-wealth households have 17.0% lower odds of dying before age 5. This reduction is even greater for children living in rich households, who have 40.9% lower odds of dying. These results are statistically significant and highlight a socioeconomic gradient in mortality. In other words, an improvement in the household's economic conditions seems to be associated with better chances of child survival.

Finally, the mother's education level is significantly associated with mortality for some levels. Children whose mother has a primary level of education have 14.2% lower odds of dying than those in the reference category. This reduction reaches 39.5% when the mother has a secondary level. By contrast, no statistically significant difference is observed for the higher level. These results thus suggest that maternal education, particularly at the primary and secondary levels, is associated with a reduction in the odds of under-five mortality. This relationship may notably be explained by better knowledge of preventive practices, a greater capacity to use health services, and better care of the child.

Overall, the results highlight several factors linked to mortality in children under five. The most significant effects are notably related to the spacing between births, birth order, wealth class, and the mother's education level. On the other hand, the father's age, place of residence, and the husband's education level show no statistically significant association. These findings thus underline the importance of demographic and socio-economic characteristics in differences in child survival before the age of five.

3.3. Longitudinal comparison of the determinants of under-five mortality, 2005-2023

To assess how the determinants of under-five mortality in Senegal have evolved, the results obtained from the 2023 C-DHS data are compared with those of the earlier work of Ndiaye (2019), who analyzed the 2005, 2011, and 2017 DHS data using logistic regression models.

The longitudinal analysis of the results of the logistic regression models makes it possible to assess the stability or, conversely, the evolution of the factors associated with under-five mortality in Senegal between 2005 and 2023. The comparison reveals a certain permanence of several determinants, notably maternal characteristics, household living standards, the child's sex, and education level. However, the association of some factors evolves over the period, while others appear specifically in the 2023 model.

Maternal age is also associated with child survival across the different survey years. In 2005, 2011 and 2017, children born to mothers aged 19–34 generally had better survival outcomes than those in the reference category. This association was statistically significant, with survival odds ratios of 1.216 in 2011 and 1.143 in 2017. The relationship remained significant in 2023, although the age categories differed from those used in previous surveys. In that year, children whose mothers were aged 20 or older had 16.8% lower odds of dying before their fifth birthday than children in the reference category. Overall, the findings point to a relationship between maternal age and under-five mortality, while differences in age-group definitions should be taken into account when comparing results over time.

Household living standards appear as a structural factor in child survival. In 2005, children from middle- and high-income households had survival odds ratios of 1.184 and 1.817, respectively, compared to those living in poor households. These values were 1.277 and 1.495 in 2011, and then 1.151 and 1.366 in 2017.

In 2023, the association remains statistically significant. Children from middle-income households have 17.0% lower odds of dying compared to children from poor households. This reduction goes up to 40.9% for children living in wealthy households. So, a higher standard of living seems to offer some protection against death before the age of five, even though the size of this effect changes over the years.

The evolution of the place of residence is particularly interesting. In the earlier models, living in an urban area was significantly associated with better chances of survival. The survival odds ratio for urban children was 1.071 in 2005, 1.169 in 2011, and 1.208 in 2017. An association that even seemed to strengthen between 2005 and 2017 is thus observed. However, this relationship disappears in the 2023 model. Indeed, place of residence is no longer statistically significant, with an OR of 1.003 and a p-value of 0.965. This evolution suggests that the specific effect of the urban-rural divide has weakened in the most recent model, once the other individual, family, and socioeconomic characteristics are taken into account. This is thus one of the main transformations observed in the longitudinal comparison.

Maternal education is also a determinant that retains its importance over time. The earlier models show a positive association between education level and child survival. In 2011, for example, survival odds ratios reach 1.407 for the primary level and 1.967 for the secondary level, while the higher level shows a ratio of 2.215. In 2017, the corresponding ratios are 1.368 for the primary level and 1.834 for the secondary level, while the higher level shows a positive but non-significant association. In 2023, the mother's education remains a factor significantly associated with mortality, confirming the persistence of this dimension in the model. Maternal education thus appears as one of the most persistent determinants of child survival over the period studied.

Moreover, the mother's activity status also shows a significant association in the earlier models and in the 2023 model, but the interpretation of its evolution must remain cautious. In 2017, the mother's activity is associated with better survival, with an odds ratio of 0.839 in the model presented. In 2023, the result goes in the opposite direction. Children whose mother is engaged in an occupation have 10.9% higher odds of death, an association that is significant at the 5% level. This reversal in the direction of the association is therefore a notable development. It does not, however, allow us to conclude that there has been a causal change in the role of maternal activity, because the categories, contexts, and control variables may differ between models.

Finally, the 2023 model brings out with particular importance the reproductive factors, notably the birth interval and birth order. These variables cannot be considered as factors whose evolution is measured over 2005-2023, since they do not appear in the earlier models presented. However, their presence in the recent model provides additional insight into the mechanisms associated with

survival. The birth interval is strongly associated with mortality: relative to an interval of less than 24 months, intervals of 24-35 months and of 36 months or more are associated with 41.8% and 59.2% lower odds of death, respectively. Likewise, birth order appears strongly associated with mortality, with children of second or higher order having significantly lower odds of death than first-born children.

Comparing the 2005 and 2023 models shows that some factors linked to the mortality of children under five have stayed pretty stable over time. Household living standards, the mother's education and age, as well as the child's sex, are still related to child survival. These results suggest that, despite changes in the context studied, these factors continue to have a significant impact. By contrast, place of residence undergoes an important change, since it is significant in the earlier models but no longer in 2023. At the same time, the 2023 model brings out more strongly the factors related to reproductive dynamics, notably birth spacing and the child's birth order. The changes we're seeing don't actually mean that the usual causes of infant mortality have disappeared. It's more about how these factors connect and keep influencing a child's chances of survival over time. This longitudinal reading thus suggests that socioeconomic determinants remain important, while demographic and reproductive characteristics also take an important place in explaining under-five mortality in the most recent data.

4. DISCUSSION

The model results highlight the importance of several demographic, reproductive, and socioeconomic factors in under-five mortality. Overall, these results are in line with several studies presented in the empirical review, notably those of Hobcraft et al. (1985), Wang (2003), Mekonnen et al. (2013), Abate et al. (2020), and Ahinkorah et al. (2022). However, some divergences also appear, which may be explained by differences in context, study populations, and methods used.

First, the association observed between the mother's age and under-five mortality is consistent with the results of Hobcraft et al. (1985), who identify maternal age among the main demographic determinants of child survival. Similarly, Abate et al. (2020), using the 2016 Ethiopia Demographic and Health Survey, show that the mother's age significantly influences infant mortality. This convergence may be explained by the fact that early motherhood may be associated with greater biological vulnerability as well as limited experience in child care. Maternal age is thus an important demographic factor in explaining child survival.

The findings on the child's sex are consistent with those reported by Abate et al. (2020), who identified a significant association between sex and infant mortality in Ethiopia. The similarity between these results suggests that differences in survival between boys and girls are not specific to Senegal. One possible explanation is that boys may be more biologically vulnerable during early childhood, although this study does not directly test that hypothesis.

By contrast, the absence of a significant association between the father's age and mortality does not allow us to confirm an independent effect of this characteristic in our context. Moreover, this variable is not highlighted among the main determinants identified in the studies of Hobcraft et al. (1985), Mekonnen et al. (2013), or Abate et al. (2020). This absence of effect could be explained by the fact that the influence of the father's characteristics operates indirectly through the household's economic conditions or through the characteristics of the mother and of reproduction.

The finding regarding the intergenerational interval aligns with major studies on this issue. Hobcraft et al. (1985) had already shown that short birth intervals were associated with an increased risk of mortality. This relationship is also reported by Mekonnen et al. (2013) and Ahinkorah et al. (2022), who highlight the potentially protective effects of longer spacing between births.

Various mechanisms could help explain this connection: the mother's more complete recovery after pregnancy, more focused attention given to the child, and a fairer allocation of family resources. From this perspective, strengthening family planning and access to appropriate information could be an important lever for reducing child and youth mortality.

Regarding ethnicity, the differences observed between groups must be interpreted with caution. Indeed, the studies presented in the empirical review place more emphasis on socioeconomic, demographic, and health characteristics than on ethnic affiliation. The association observed in our study could therefore rather reflect differences in living conditions, health practices, access to care, or the geographic location of populations. The model does not, however, allow us to identify the mechanisms underlying these gaps precisely.

Likewise, the absence of a significant association for place of residence after adjustment is interesting in light of the results of Wang (2003) and Mekonnen et al. (2013), who highlight the existence of inequalities between urban and rural areas. This divergence may, however, be explained by the simultaneous control of other factors, notably household wealth, maternal education, and reproductive characteristics. Thus, part of the differences between areas of residence could be attributable to socioeconomic conditions rather than to the place of residence itself.

Regarding the husband's education level, the lack of a significant association contrasts with the importance given to education in several works of the review, notably Anand and Ravallion (1993), Hobcraft et al. (1985), and Mekonnen et al. (2013). However, these studies mainly highlight the role of general education or maternal education. In our analysis, the effect of education seems to be carried more by the mother, which could be explained by her more direct role in care, feeding, and the use of health services for the child.

Moreover, the association observed for the mosquito net must be interpreted with great caution. Contrary to what the result might suggest, it does not mean that mosquito nets increase mortality. One possible explanation is that the households most exposed to malaria are also likely to use more mosquito nets. This variable could thus reflect exposure to malaria risk rather than a causal effect of the mosquito net. This interpretation nevertheless requires further investigation, since the studies presented in the review, notably those of Wang (2003), rather highlight the importance of health interventions in reducing mortality.

Regarding the mother's activity, the result obtained must also be interpreted with caution. The empirical review does not allow a direct comparison with this variable, since the studies retained place more emphasis on demographic, economic, and health characteristics. However, the association observed could be explained by the time constraints that some working mothers may face in providing care and supervision for the child. This relationship may nevertheless depend on the type of activity performed and the childcare options available.

Birth order is also an important result. It is directly in line with the conclusions of Hobcraft et al. (1985), who identify birth order among the main demographic determinants of mortality. The particular situation of first-born children could notably be linked to the mother's limited experience in caring for a child and recognizing signs of illness. However, since birth order is strongly linked to maternal age and to the birth interval, its effect must be interpreted jointly with these reproductive factors.

The findings on household living standards are consistent with previous research on child survival. Anand and Ravallion (1993) examined the relationship between income per capita and infant mortality, while Wang (2003) and Ahinkorah et al. (2022) also highlighted the importance of household economic conditions. Families with greater financial resources are generally better able to provide adequate nutrition, seek medical care when needed and maintain healthier living and sanitation conditions. These advantages may contribute to better health outcomes for children and reduce their risk of dying before the age of five.

Regarding the mother's level of education, the results agree with those of Hobcraft et al. (1985), Anand and Ravallion (1993), and Mekonnen et al. (2013). Maternal education is often linked to lower child mortality, notably because it promotes better knowledge of nutritional, hygiene, and preventive practices, as well as more appropriate use of healthcare. It also helps moms spot early signs of illness and get medical care quickly. A mom's education level is a key factor in whether a child survives and a way to help lower under-five mortality.

Overall, the results obtained confirm several lessons from the empirical literature. On the one hand, reproductive factors, notably the mother's age, birth order, and above all the birth interval, play an important role in child survival. On the other hand, socioeconomic factors, in particular household wealth and maternal education, also appear decisive. By contrast, some variables such as place of residence, the father's age, or the husband's education show no independent effect after adjustment.

5. CONCLUSION

Under-five mortality remains an important public health issue, despite the progress made in Senegal over recent decades. The objective of this study was to identify the main factors associated with the mortality of children before the age of five, using data from the 2023 Senegal Continuous Demographic and Health Survey.

The results obtained confirm the multidimensional nature of under-five child mortality. It is linked both to demographic and reproductive factors, such as the mother's age, the child's sex, the birth interval, and birth order, as well as to socioeconomic factors related to the household and the mother. Household living standards and maternal education appear to be particularly important for child survival. Overall, these results align with the findings of empirical studies on the determinants of child mortality in sub-Saharan Africa.

The study also shows that some variables that may appear important at the descriptive level do not necessarily retain a significant association once the other factors are considered simultaneously. This is notably the case for place of residence, the father's age, and the husband's education level. This observation underscores the importance of a multivariable approach, which makes it possible to distinguish better the factors that have an independent association with mortality from those whose effect may be explained by other characteristics.

Overall, a lasting reduction in under-five mortality cannot be envisaged solely from the angle of health care supply. It also requires action on the conditions in which children are born and grow up, notably birth spacing, women's education, and household economic conditions. The results obtained thus make it possible to identify several avenues for action likely to contribute to improving child survival in Senegal.

In light of the results obtained, several recommendations can be made

First, strengthen family planning and birth spacing actions. The importance of the birth interval in the model underscores the need to strengthen information on and access to family planning services, particularly for women exposed to closely spaced pregnancies. It would also be relevant to improve counseling on the benefits of adequate birth spacing within maternal health services.

Second, continue efforts in favor of the education of girls and women. The significant role of maternal education shows the value of maintaining policies that improve girls' school enrollment and retention. Beyond the acquisition of general knowledge, education can foster better use of health services, better knowledge of prevention practices, and more appropriate care of children.

Third, strengthen interventions for economically disadvantaged households. The association observed between wealth class and mortality shows that economic conditions are an important determinant of child survival. Poverty reduction policies and policies to improve access to essential services should therefore focus on the most vulnerable households.

Fourth, strengthen actions for the prevention and management of childhood diseases. Interventions relating to malaria, vaccination, nutrition, hygiene, and prompt use of care must continue to be developed, with particular attention to the most exposed populations.

Lastly, strengthen the monitoring of mortality risk factors at the national level. Regular use of data from the Demographic and Health Surveys would make it possible to track changes in the determinants of mortality and to identify the most vulnerable population groups. Further analyses could also be carried out to understand certain specific results of this study better, notably the associations observed with mosquito net use, the mother's activity, and ethnic affiliation.

Thus, efforts to reduce under-five mortality should form part of an integrated approach combining health, family planning, education, and improvement of socioeconomic conditions. Such an approach would consolidate the progress already made and further reduce inequalities in child survival in Senegal.

Acknowledgement

The author would like to thank Senegalese National Institution of statistics and Démographis (ANSD) for providing access to the data from the 2005 to 2023 Senegal Continuous Demographic and Health Survey. The author also acknowledges the contributions of the institutions and individuals who supported this initiative.

Author Contributions

The author thanks the contributions of the institutions and individuals who supported this initiative.

Informed consent

Not applicable.

Conflicts of interests

The authors declare that they have no conflicts of interest, competing financial interests or personal relationships that could have influenced the work reported in this paper.

Ethical approval & declaration

Not applicable. This article does not contain any studies with animals performed by any of the authors.

Funding

This research did not receive any external funding like specific grant from funding agencies in the public, commercial, or nonprofit sectors.

Data and materials availability

All data generated and analysed during this study are presented within this manuscript. Additional information supporting the findings of this study will be made available by the corresponding author upon reasonable request.

REFERENCES

1. Abate MG, Angaw DA, Shaweno T. Proximate determinants of infant mortality in Ethiopia, 2016 Ethiopian Demographic and Health Survey: results from a survival analysis. Archives of Public Health 2020 ;78 :4. doi: https://doi.org/10.1186/s13690-019-0387-4.
2. ANSD (Agence Nationale de la Statistique et de la Démographie), ICF. Enquête Démographique et de Santé Continue 2023: rapport des indicateurs-clés. Dakar, Sénégal and Rockville, Maryland, USA: ANSD and ICF; 2023.
3. Ahinkorah BO, Budu E, Seidu AA, Agbaglo E, Adu C, Osei D, Banke-Thomas A, Yaya S. Socio-economic and proximate determinants of under-five mortality in Guinea. PLOS ONE 2022;17(5): e0267700. doi: https://doi.org/10.1371/journal.pone.0267700.
4. Anand S, Ravallion M. Human development in poor countries: on the role of private incomes and public services. Journal of Economic Perspectives 1993 ;7(1) :133-150. doi: https://doi.org/10.1257/jep.7.1.133.
5. Becker GS. A theory of the allocation of time. The Economic Journal 1965;75(299):493-517. doi: https://doi.org/10.2307/2228949.
6. Caldwell JC. Education as a factor in mortality decline: an examination of Nigerian data. Population Studies 1979;33(3):395-413. doi: https://doi.org/10.1080/00324728.1979.10412759.
7. Hobcraft J, McDonald JW, Rutstein SO. Demographic determinants of infant and early child mortality: a comparative analysis. Population Studies 1985;39(3):363-385. doi: https://doi.org/10.1080/0032472031000141576.
8. Mekonnen Y, Tensou B, Telake DS, Degefie T, Bekele A. Neonatal mortality in Ethiopia: trends and determinants. BMC Public Health 2013;13 :483. doi: https://doi.org/10.1186/1471-2458-13-483.
9. Mosley WH, Chen LC. An analytical framework for the study of child survival in developing countries. Population and Development Review 1984 ;10(Suppl) :25-45. doi: https://doi.org/10.2307/2807954.
10. Ndiaye O. Déterminants sociaux et économiques de la mortalité des enfants de moins de cinq ans en Afrique subsaharienne : cas du Sénégal. In: Actes de la conférence internationale Enjeux et perspectives économiques en Afrique francophone; 4-6 February 2019; Dakar, Sénégal. Montréal, Canada: Observatoire de la Francophonie Économique, Université de Montréal; 2019.
11. Ndiaye M, Diakhoumpa M, Diop M. Les déterminants de la mortalité infantile au Sénégal: Une analyse économétrique. Revue Française d'Economie et de Gestion 2023; 4(10): 181-202.
12. Omariba DWR, Beaujot R, Rajulton F. Determinants of Infant and Child Mortality in Kenya: An Analysis Controlling for Frailty Effects. Population Research and Policy Review 2007; 26(3): 299-321.
13. Wang L. Determinants of child mortality in LDCs: empirical findings from demographic and health surveys. Health Policy 2003;65(3):277-299. doi: https://doi.org/10.1016/S0168-8510(02)00213-8.
14. World Health Organization (WHO). Closing the gap in a generation: health equity through action on the social determinants of health. Final report of the Commission on Social Determinants of Health. Geneva, Switzerland: World Health Organization; 2008.