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Review Article

# Effect of the policy of free health care for children under five on child undernutrition and social inequalities in health care use in Senegal

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**Abstract:**

Access to care and child health remain public health concerns in developing countries; in particular in Senegal despite the free child care initiative. Therefore, this article examines the effect of free care on child undernutrition and social inequalities in health care utilization.

The data used are from the Continuous Demographic and Health Surveys (DHS-C). The trivariate model and the inequality index decomposition method proposed by Wagstaff et al [2003] are used respectively to analyze the effect of the free health care policy on undernutrition and social inequalities in health care utilization. The results underline that the free health care policy improves the nutritional status of children. In addition, it increases social inequalities in the use of health care in favor of the rich and contributes to horizontal inequalities to the tune of 7.56 %.

It is therefore necessary to review and monitor this policy within the health structures in order to correct its regressive nature. Moreover, a combination of policies of access to care and fight against undernutrition is essential for a better result in terms of child health.

**Keywords:** free health care policy; undernutrition; children under five; social inequalities in health care utilization and trivariate probit

## Introduction

Access to care and child undernutrition are now major concerns for many African countries [2,3] and Senegal, in particular. The low rate of child care utilization is a consequence attributed to financial barriers. This low utilization of care and the consequences it creates justify the need to intervene in the health sector through health policies. This is why, since 2005, the member states of the World Health Organization (WHO) have committed themselves to universal health coverage [WHO, 2005].

In this perspective, the Government of Senegal initiated in 2013, the policy of free health care for children under five. This policy aims to make health care accessible to all children aged 0 to 59 months, regardless of their social background, by making consultation fees, hospitalization fees and certain medicines free of charge. It aims to address the challenge of health care utilization considered as the fundamental factor of undernutrition Ruel [2013]. In addition, this policy aims to reduce social inequalities in health care utilization.

In the specific context of Senegal, where high levels of undernutrition, particularly stunting, coincide with low health care utilization seven years after the implementation of the free health care policy, it is necessary to question its impact. Indeed, the DHS-C report [2019] indicates that 18% of children under five years of age are stunted and that 46% of these children suffering from diarrhea could not yet access public health services. According to the report of the National Health and Social Development Plan [2019], stunting is responsible for one third of all deaths of children under five in Senegal. In addition, stunted children have a very high risk of suffering from infectious diseases and face deterioration in their physical and cognitive development. This has educational and economic consequences at the individual, family and community levels.

However, it is important to note that work evaluating the effect of these policies on morbidity is scarce and results are mixed [8]. In Senegal, to

our knowledge, the association between free health care and the nutritional status of children has not yet been sufficiently explored. Thus, despite all these problems of access to child health care, the persistence of malnutrition, especially chronic malnutrition in poor families, and the lack of studies evaluating the effect of free health care on morbidity in Senegal, answering this question becomes crucial: what is the effect of the policy of free health care on undernutrition and social inequalities in the use of child health care? Therefore, the general objective of this research is to evaluate the effect of the free health care policy on child health. More specifically, it aims to: i) identify the effect of the free health care policy on the nutritional status of children and ii) determine its impact on social inequalities in the use of health care.

In order to achieve these objectives, this work is structured around four sections. First, we have the section on the literature review followed by the methodology section; then, the section on the data and finally, the section on the results and discussions.

## 1. Review of the literature

### 1.1. Public policy and equity: theories

In the literature, state intervention in the health sector has been the subject of several controversies between utilitarians, libertarians, egalitarians, etc. Libertarian theory, for example, advocates ownership per se, where the individual is free to own a good and use it as he or she sees fit. Thus, the libertarian theory advocates property per se, the individual is free to own a good and to use it as he or she sees fit. This theory neglects the question of equity in health policies. In contrast, other theories advocate state intervention in the health system. However, their main point of contention is how to intervene.

First, for egalitarians all individuals are equal and should be treated without discrimination. Second, utilitarian theory seeks to ensure the maximum amount of goods for the maximum number of individuals, regardless of how the goods are distributed. Finally, Maximin theory [Rawls, 1974] argues for ensuring the maximum for those who have the minimum. However, the classical utilitarian model is the most widely used in health promotion projects Gilson et al [2000].

### 1.2. Effect of free health care policies on nutritional status and social inequalities

The effect of free health care policies on health care utilization has been widely discussed in the literature Ridde et al [2011]. Results globally show that they increase health care utilization [Johri et al. 2014; 12] and thus reduce child morbidity and mortality [13]. Indeed, the low rate of care utilization is a consequence attributed to the financial barrier [14, 15, 33]. Thus, the policy of free health care raises these financial barriers in the use of care. The work of Johri et al [2014] found that the free health care policy saved the lives of 14,000 to 19,000 children under the age of five in Burkina Faso.

In addition, it also contributes to improving equity in the use of care [17, 33]. However, these same authors claim that few works have explored the link between social inequalities in care utilization and free health care policies in developing countries. The same observation is made between the latter and nutritional status and the results found are mixed in both cases [8,19]. For example, Powell-Jackson et al [2014] found no significant association between user fee removal and the prevalence of severe and moderate anemia in Ghana.

## 2. Methodology

### 2.1. Effect of the free food policy on child undernutrition

#### 2.1.1. Analytical framework

In the literature, several models of household behavior have been used to analyze investments in human capital. In addition, the microeconomic analysis of the health of individuals is done from two angles: the production of health and the demand for health Strauss and Thomas [1995].

This work builds on the work of Kimani and Kioko [2016] for whom individuals optimize their future utility based on consumption, nutrition, and health status under traditional time and budget constraints. The production of health depends on inputs controlled by families (endogenous) and predetermined inputs (exogenous). Thus, the supply and demand functions for health result from solving the household utility maximization program.

The reduced form of the health demand or production functions are functions of exogenous variables only. The production approach is used in this research since we do not have market price data. Consider a household that seeks to maximize a utility function U under budget constraints:

$$\begin{matrix} Max\ U = U(H, l, X, X_h, X_c) \\ S/_C:\ pX = w(T - l) + y \end{matrix} \quad (1)$$

U is the utility that the household seeks to maximize; H, the child's health status, l is leisure, and $X, X_h, X_c$ represent consumption of goods and services, household and community characteristics, respectively.

The budget constraint is as follows: pX = w (T - l) + y where p is the vector of prices, w is the vector of wages of household members, T is the number of hours worked, y is all non-monetary income and I is health inputs including the consumption of goods and services that contribute positively and directly to household welfare and indirectly through H. The choice between the consumption of goods and services and the consumption of health inputs are made simultaneously. In the absence of detailed information and therefore of valid instruments, any estimate that does not pay attention to this simultaneity problem is potentially biased.

We therefore use the reduced form of this production function from the solution of the maximization program for the estimates.

$H_i = h(I(X_h, X_c), X_h, X_c, \varepsilon_i) = \tilde{h}(X_i, X_h, X_c, \varepsilon_i)$ (2) with $X_i$, child characteristics and $\varepsilon_i$a random error term associated with the child's nutritional status and unobserved characteristics.

#### 2.1.2. Empirical model

The multivariate probit model (MVP) allows for the analysis of multiple (simultaneous) choices made at the same time [Aurier and Mejía, 2014]. This model relaxes the constraining assumption made in the logit and binary probit models [Aurier, 1999]. These models have had extensions (multivariate models) to account for simultaneous choices that may be dependent. Thus, the variable observed in these models becomes a basket composed of several binary choices (yes/no; yes/no...).

In this research, our dependent variable is the child's nutritional status, which can be captured by stunting, wasting or underweight. Thus, the choice of the MVP is justified by the fact that the child can suffer from all three types of undernutrition simultaneously.

Let S, W, and U be the three binary random variables defined by:

$$S_i = \begin{cases} 1 \text{ if child i is stunted} \\ 0 \text{ otherwise} \end{cases} \quad (3)$$

$$W_i = \begin{cases} 1 \text{ if child i suffers from wasting} \\ 0 \text{ otherwise} \end{cases} \quad (4)$$

$$U_i = \begin{cases} 1 \text{ if child i is underweight} \\ 0 \text{ otherwise} \end{cases} \quad (5)$$

We can write the following system of equations:

$$\begin{cases} S^* = \beta_1 X_1 + \varepsilon_1 \\ W^* = \beta_2 X_2 + \varepsilon_2 \\ U^* = 3X_3 + \varepsilon_3 \end{cases} \quad (6)$$

The variables $S^*$, $W^*$ and $U^*$ are latent variables associated with the random variables S, W and U respectively. The $X_j$ (j=1,2,3) represent the vectors of the explanatory variables. The $\varepsilon_i$ are the error terms that are jointly distributed according to a normal distribution, such that:

$$\begin{pmatrix}\varepsilon_1\\ \varepsilon_2\\ \varepsilon_3\end{pmatrix} \rightarrow \mathrm{N}\left[\begin{pmatrix}0\\0\\0\end{pmatrix}, \begin{pmatrix}1 & \rho_{12} & \rho_{13}\\ \rho_{21} & 1 & \rho_{23}\\ \rho_{31} & \rho_{32} & 1\end{pmatrix}\right] (7)$$

The coefficients $\rho_{jk}$ (with $j \neq k$) reflect the correlations that may exist between the errors of the three equations. These coefficients are zero if there is independence between the variables to be explained in the three equations. In contrast, they are significantly different from zero if the variables are dependent on each other.

Some constraints on the identification of the model must be imposed in order to estimate all the parameters. The first restriction is to normalize the variances to 1, i.e.: $\sigma_1^2 = \sigma_2^2 = \sigma_3^2$. Due to the recursivity of the model, the residuals of the three latent equations are not independent, so the parameters of the model cannot be identified if the explanatory variables of the different equations are identical [Maddala, 1983]. The vectors $X_1$ , $X_2$ and $X_3$ are not exactly the same in each of the equations in this case.

### 2.2. Concentration index: calculation and decomposition

#### 2.2.1. Calculation of the concentration index

Social inequalities in health are the disparities observed in a society between individuals or groups of people in the absence of social justice, e.g., the premature death of some and the prolonged life of others is an irrefutable finding of inequality. In the literature, the Gini concentration index is one of the tools particularly used to measure inequality. But in this work, we calculate the concentration index based on the work of Mané [2013].

The concentration index is also between -1 and 1. A negative value of the concentration index means that it is pro-poor and vice versa. On the other hand, a zero value explains the absence of health inequality. It is proportional to the covariance between the health variable and the relative income rank, which is written as follows:

$$\mathrm{C} = \frac{2\times \mathrm{cov}(\mathrm{y_i}, \mathrm{R_i})}{\bar{\mathrm{y}}} \quad (8)$$

$\mathrm{y_i}$ represents the level of the health variable for individual i, $\bar{\mathrm{y}}$ is the average of $y_i$ and $R_i$, the relative rank $(\frac{\mathrm{r_i}}{\mathrm{n}})$ of the individual in the distribution of total consumption expenditures of the n individuals ranked from the lowest wealth indicator to the highest Mané [2013].

#### 2.2.2. Decomposition of inequalities in health care utilization

For the decomposition of inequities, we refer to the work of Wagstaff et al [2003]. In order to judge inequity in relation to the criterion of need, the concentration index will be decomposed into two parts. On the one hand, we will have the inequalities explained by the need variables and on the other hand, the inequalities explained by other variables (level of education, income, place of residence, etc.). This last component refers to the index of horizontal inequity in the distribution of care and is noted HI.

In their work, Wagstaff et al [2003] propose an additive function of health care consumption as follows

$$\mathrm{y_i} = \alpha + \sum_{\mathrm{k}=1}^{\mathrm{k}} \beta_{\mathrm{k_i}} \mathrm{x_{k,i}} + \varepsilon_{\mathrm{i}} \qquad \forall\, \mathrm{i} \in [1 \ldots . . \mathrm{n}] \ (9)$$

$\mathrm{x_k}$: the explanatory variables for health care consumption

$\alpha$ and $\beta$: parameters to be estimated

$\varepsilon_{\mathrm{i}}$: the error term

The authors based on Rao's (1969) theorem in the income inequality literature, propose the following concentration index formula:

$$\mathrm{C} = \sum_{\mathrm{k}=1}^{\mathrm{K}} \left(\frac{\beta_{\mathrm{k}} \bar{\mathrm{x}}_{\mathrm{k}}}{\bar{\mathrm{y}}}\right) \mathrm{C_k} + \frac{\mathrm{GC_E}}{\bar{\mathrm{y}}} \quad (10)$$

$\mathrm{C_k}$ is the concentration index of $x_k$ relative to income

$\mathrm{GC_E}$ is the generalized concentration index of $\varepsilon_i$ and calculated as follows:

$$\mathrm{GC_E} = \frac{2}{\mathrm{n}} \sum_{\mathrm{i}=1}^{\mathrm{n}} \varepsilon_{\mathrm{i}} \mathrm{R_i} \quad (11)$$

$\bar{\mathrm{x}}_{\mathrm{k}}$ is the average of $\mathrm{x_k}$ and $\bar{\mathrm{y}}$ is the average of $\mathrm{y_i}$.

Equation (10) is composed of the weighted sum of the concentration indices $\mathrm{C_k}$ of the k explanatory variables of the model (first component) on the one hand and the inequality in the consumption of care not explained by the $\mathrm{x_k}$ variables (part related to the error term) on the other. However, this equation does not yet capture the inequity. This is why it is necessary to use another decomposition of the concentration index.

Referring to the work of Huber [2008], the weighted sum of the concentration indices of the $\mathrm{x_k}$ variables in equation (10) is divided into two entities. One will be the need inequalities and the other will denote the inequities. Suppose our k variables are composed of a vector N of n need variables and a vector P of p different need variables, our concentration index can be rewritten as follows:

$$\mathrm{C} = \sum_{\mathrm{n}=1}^{\mathrm{N}} \frac{\beta_{\mathrm{n}} \bar{\mathrm{x}}_{\mathrm{n}}}{\bar{\mathrm{y}}} \mathrm{C_n} + \sum_{\mathrm{p}=1}^{\mathrm{P}} \frac{\beta_{\mathrm{p}} \bar{\mathrm{x}}_{\mathrm{k}}}{\bar{\mathrm{y}}} \mathrm{C_p} + \frac{\mathrm{GC_E}}{\bar{\mathrm{y}}} \quad (12)$$

$\beta_{\mathrm{n}}$ and $\beta_{\mathrm{p}}$ are the coefficient vectors associated with N and P, respectively.

According to Huber [2008], the first component of the concentration index is inequalities explained by needs and the last one is inequities. Moreover, there are three cases with respect to this index (HI):

HI is zero means that there is no inequality, the distribution of the variable is fair

HI is negative, inequalities exist and they are pro-poor.

HI is positive, the observed inequalities are pro-rich.

## 3. Data

The data used in this research are secondary data from the 2012 and 2019 DHS-C databases. These surveys are conducted by the Agence Nationale de la Statistique et de la Démographie (ANSD) in collaboration with the Ministère de la Santé et de l'Action Sociale (MSAS) and with the support of certain financial partners such as the World Bank. The information is collected from 4,175 and 4,538 nationally representative households in 2012 and 2019, respectively, in urban and rural areas, and in the four major eco-geographic regions of Senegal. The samples include 6,063 and 5,554 living children under the age of five for 2012 and 2019, respectively.

- ❖ Specification of variables

We have dependent variables and explanatory variables which are divided into a need variable, a supply variable and a socio-economic variable.

**a) Dependent variables**

In order to achieve our first objective, which is to identify the effect of the free food policy on the nutritional status of children, we have three dependent variables, namely the height-for-age index measuring stunting, the weight-for-height index evaluating wasting and the weight-for-age index capturing underweight. Thus, each index is expressed in terms of the number of units of standard deviation (SD) from age (respectively from height or weight), units of standard deviation (SD) from the median of the WHO international reference population [2006]. For each of them, an index value below -2 SD indicates that the child is chronically and/or acutely malnourished. If the value is less than -3 SD, chronic or acute malnutrition is in its severe form. These dependent variables are binary.

For the second objective on the effect of the free health care policy on inequalities in the use of health care, the dependent variable is constructed from the answers to the following questions: "Did (Name of the child) suffer from diarrhea and/or cough or fever during the last two weeks? Parents who answer yes must answer a second question; "Where did you go for advice or treatment?" and the last question is "Did (Child's name) take at least one childhood vaccine? The last question is "Did (Child's name) take at least one childhood vaccine?" The question has two meanings: 1 if the child used health facilities and/or took at least one vaccine, and 0 otherwise.

### b) Explanatory variables

The explanatory variables for the model studying the effect of the free lunch policy on nutritional status are divided into three categories:

- Need variables

The literature on decomposing inequalities into need and horizontal inequity factors broadly highlights health status, gender, and age [26]. For individual health status, its assessment is subject to several approaches in equity work. Biological or physical data taken by a health professional is preferable but the problem that arises at this level is the difficulty of collecting them [28]. For this reason, several studies [23, 28] have employed a self-reported measure of health (individuals' own judgment of their health status). However, this measure is likely to be influenced by individual preferences, social, economic, cultural context or individual characteristics.

To circumvent these difficulties with the data available in the DHS, this research will attempt to capture health status through anthropometric measures and the presence of disease symptoms (diarrhea, cough, and fever) in children. Regarding age, Grossman [1972] shows that health status decreases with age. Thus, older individuals consume more health care. Furthermore, the health of women and girls is influenced by biological differences related to sex and other social determinants. Women experience more morbidity and use more health care than men, especially for their reproductive health needs even though they have their higher life expectancy [30]. However, the variable will be subdivided into five classes by gender and age with a range of 11months.

-The supply variables

- The free care policy: this is the variable of interest in our work. Several works [12,31] have shown that it increases the use of care, on the one hand, and on the other, the result on social inequalities remains mixed.
- Other insurances include mutual health insurance, budget charging, private insurance, etc.

### - Socio-economic variables.

In the literature, the economic determinants of health care utilization and nutritional status are income, consultation costs [31]. In this work, income is captured by the household wealth index insofar as the DHS database does not contain variables related to the consumption of goods and services by households and their income. For price, we capture it with the question Do you have financial difficulties in accessing health facilities? This is a binary variable.

In addition, apart from economic variables, we also have sociodemographic variables that are taken into account in the analysis of the determinants of health care utilization or nutritional status in several empirical works [23,32]. In this work, the following variables are retained: mother's level of education, place of residence, ecological zone, distance from health facilities, partner's professional occupation, marital status, media exposure and age of the head of household.

## 4. Results and discussions

### 4.1. The free health care policy improves the nutritional status of children (table 1).

The free health care policy has a general tendency to improve the nutritional status of children (table1). Indeed, children who have benefited from this policy have a 2.22% lower chance of suffering from stunting than those who have not benefited from it. This result can be explained by poverty and the lack of health facilities in some localities. Thus, some parents find it difficult to access public facilities to treat their children despite the policy of free care. They are confronted with the cost of transportation to reach the health structures. This is why they are late in seeking care at the health facilities. They prefer to resort to traditional medicine with all the risks involved. These reasons can justify the fact that children who have benefited from the policy of free health care have less chance to suffer from stunting. Furthermore, this result found between the free health care policy and stunting is consistent with those of Illou et al [2015].

The health status of the child affects its nutritional status especially wasting. Indeed, wasting occurs during illness and/or when the child loses appetite. It is a short-term situation that can disappear very quickly as soon as the individual resumes good eating habits. For example, the results show that sick children (with diarrhea, fever and cough) are 3.74% more likely to suffer from wasting than their non-sick counterparts.

Financial independence influences a child's nutritional status. Compared to children from families with the financial capacity to care for themselves, children from poor families are 6, 4.03 and 5.78% more likely to suffer from stunting, wasting and underweight respectively. This result can be explained by the delay in seeking care in case of illness due to financial barriers related to transportation costs to health facilities and the purchase of medicines. As a result, non-use of medical treatment or inappropriate traditional treatment further deteriorates nutritional status. This result confirms the relationship found between the financial situation of the household and the use of health care. Indeed, the richer the household, the more sensitive it is to the health of its members and therefore makes more use of health care, thus improving the nutritional status of children through the use of health care and quality food.

There is also evidence in the literature [14, 17] that user fees are identified as the most significant barrier to accessing care. As such, they lead to reduced utilization of health services, delays in diagnosis, and limited access to appropriate treatment for mothers and their children. This contributes to increased morbidity and mortality among children and mothers. In addition, the results show that children who used facility-based care are more likely to be stunted and underweight than those who did not. The interpretation of this result is that parents generally only seek health care when the child is in a critical condition. This means that children who did not use health care have a better nutritional status than those who did.

Moreover, the prevalence of undernutrition increases with the age of the child and this for all its forms. Indeed, the older the child, the greater the probability of being undernourished. This can be explained on the one hand by the insufficiency or absence of food diversification from the sixth month. On the other hand, breast milk beyond six months no longer constitutes an antibody for the child and combined with the introduction of new foods, it no longer protects the child against pathologies and therefore increases the probability of being undernourished over time. In addition, the duration of breastfeeding increases with undernutrition in all its forms.

Furthermore, the results show that girls are less likely to suffer from undernutrition in all its forms. This result can only be justified by biological or cultural factors for which girls may often be better protected than boys due to poorly described social factors or physiological vulnerabilities. This result corroborates those of Thurstans et al [2020] and Bork et al [2017].

Birth weight also affects the nutritional status of the child. A normal birth weight reduces the likelihood of malnutrition for the child compared to a low or overweight birth weight that exposes the child to disease, thereby causing a deterioration in nutritional status over time. In addition, the results show that the age of the mother evolves in the opposite direction with the child's undernutrition. This result can be explained by the experience of caring for the young child with repetitive maternity compared to young mothers who are supposed to have better physical conditions to care for their children.

| Variables | Size over age | Weight over Size | Weight over age |
|---|---|---|---|
| **Free care policy** | | | |
| Beneficiary | -0.02215** | -0.0004 | -0.0073 |
| No beneficiary | R | R | R |
| **Health status of the child** | | | |
| Sick | -0.01134 | 0.0374** | 0.0028 |
| Not sick | R | R | R |
| **Financial problem to take care of oneself** | | | |
| Yes | 0.0600*** | 0.0403*** | 0.0578*** |
| No | R | R | R |
| **Occupation partner** | | | |
| Occupied partner | 0.0252 | -0.0035 | 0.0165 |
| Unoccupied partner | R | R | R |
| **Child age** | | | |
| **Âge** | 0,0021*** | 0,0014*** | 0,0022*** |
| **Child sex** | R | R | R |
| Girl | -0.03*** | -0.0283** | -0.0151 |
| Boy | R | R | R |
| **Birth weight** | | | |
| Normal | -0.1724*** | -0.1057*** | -0.1884*** |
| Abnormal | R | R | R |
| **Mother's age** | | | |
| Age | -0.0015* | -0.0014 | -0.0012 |
| **Breastfeeding duration** | | | |
| More than 2 years | 0.0243** | 0.0319** | 0.0353*** |
| Less than 2 years | R | R | R |
| **Use of care** | | | |
| Yes | 0.0891*** | -0.0145 | 0.0425*** |
| No | R | R | R |
| **Constant** | -0.690*** | -1.050*** | -0.757*** |
| **N** | 5554 | 5554 | 5554 |
| *** p < 0.01, ** p < 0.05, * p < 0.1<br><br>**Source:** Author from DHS-C 2012 and 2019 data | | | R= Reference |

**Table 1**: marginal effects of the trivariate model

### 4.2. The policy of free health care increases social inequalities in the use of health care in favor of the rich (tables 2 and 3).

Table 2 reveals that inequalities in health care utilization are globally concentrated towards the rich (0.018 and 0.052 for 2012 and 2019 respectively). In other words, in Senegal, children under the age of five from wealthy families make more use of health facilities. Furthermore, an increase in the inequality index is observed between the two periods. This shows that the policy has increased social inequalities in the use of care. This result is contradictory to the policy's objective of reducing inequalities in the use of care in public health facilities. This increase in overall inequalities is attributable to an increase in horizontal inequalities from 0.018 to 0.042. However, the overall index does not show the source of the inequalities observed. For this reason, we have decomposed these indices.

For inequality due to need factors, the value was 0.0005 in 2012. The need factors had a small contribution to inequalities in health care use between the poor and the rich even though it is pro-rich (positive sign). This reflects the fact that in 2012, children under five who were sick (diarrhea, cough, fever and stunting) from rich families used health facilities more than children from poor families with the same diseases. This result can be explained by financial barriers in the use of care. Moreover, several studies [13] have shown that financial barriers reduce the use of care. Indeed, less well-off families very often encounter difficulties in meeting medical costs. They resort instead to self-medication or traditional medicine and delay the use of care.

However, the inequalities due to the need's factors have increased in 2019, the needs factor index is still pro-rich with a higher value (0.0101) despite the abolition of the consultation ticket. This result can be explained by the increase in poverty and the increase in transport prices between 2012 and 2019. Indeed, in 2019 compared to 2012, the high cost of living (transport costs, price of medicines) is a major obstacle to the use of healthcare by poor families. The latter have low purchasing power and are riskier in terms of health because they struggle to satisfy their first need, which is to feed themselves. This means that most of them resort to self-medication or pharmacopoeia, despite the fact that the ticket and certain medicines are free.

| Index | 2 012 | 2 019 |
|---|---|---|
| Concentration Index | 0,0186 | 0,0520 |
| Inequality due to needs factors | 0,0006 | 0,0101 |
| Inequity Index | 0,0180 | 0,0419 |

**Source:** Author from DHS-C 2012 and 2019 data

**Table 2**: Inequalities in primary care utilization in health facilities in 2012 and 2019.

The decomposition of total inequalities (table 3) informs that gender and age influence inequalities in needs factors. Indeed, according to Grossman [1972], health status deteriorates with age and WHO [2018] showed that women experience more morbidity and make more use of health care. In 2012, the distribution of health care utilization is equal between girls and boys in health facilities. However, inequalities in need factors are pro-poor for girls and pro-rich for boys. In contrast, in 2019, inequalities in need factors are pro-rich for both girls and boys (0.0046 versus 0.0016). Girls use health care more than boys. This result is consistent with those of WHO [2018].

Furthermore, income contributes 0.0729 to inequities in health care utilization in 2019 versus 0.004 in 2012. This explains that in Senegal, all other things being equal, care is more accessible to the wealthy and the free health care policy has accentuated these gaps, which are always favorable to the wealthiest. Its contribution to horizontal inequities in the use of health care within health facilities is about 7.56%. This result can be explained by the fact that free health care coverage is not yet effective, especially among the least well-off. Indeed, according to the DHS-C [2019], the coverage rate is about 50% among children under five years old and also many sick children (about 58%) have not benefited from this free service in public facilities. The same source also reveals that the coverage rate of this policy is higher in the highest quintiles. This is explained by poor communication on the documents to be provided and the absence of health structures in some areas of the country. Thus, the long distances to public health facilities, combined with financial difficulties for transportation, reduce the likelihood that children from less affluent families will benefit from the policy. Indeed, these constraints cause them to forego the use of care in public facilities despite the fact that the service is free.

As for the other types of insurance, they reduce horizontal inequities in the use of care with a contribution of about 3%, even if the effect remains insignificant. This insignificance of the effect is due to the low coverage rate of children in these insurance categories. The results also indicate that the higher the mother's level of education, the more it reduces inequities in the use of health care. In general, educated mothers attach more importance to their child's health and therefore use modern care compared to uneducated women who mostly delay seeking care or resort to traditional medicine. In addition, educated mothers are more likely to find employment and therefore income to care for their child compared to a mother with no education.

| Variables | Average | | Elasticity | | Concentration index | | Contribution | | % of Contribution | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2012 | 2019 | 2012 | 2019 | 2012 | 2019 | 2012 | 2019 | 2012 | 2019 |
| Child health status | | | | | | | | | | |
| Sick | 0,1964 | 0,1922 | 0,0045 | 0,0977 | 0,0215 | 0,0619 | 0,0001 | 0,0061 | 0,0052 | 0,1161 |
| Growth delay | 0,1941 | 0,1950 | -0,0024 | 0,0101 | -0,1931 | -0,2148 | 0,0253 | -0,0022 | 0,0253 | -0,0416 |
| Child age and sex (referenceF4_5) | | | | | | | | | | |
| F0_1 | 0,1120 | 0,1112 | -0,0089 | 0,0684 | 0,0272 | -0,0066 | -0,0002 | -0,0004 | -0,0131 | -0,0086 |
| F1_2 | 0,1045 | 0,1038 | 0,0006 | 0,0693 | 0,0306 | 0,0551 | 0,0000 | 0,0038 | 0,0010 | 0,0734 |
| F2_3 | 0,0962 | 0,1032 | 0,0004 | 0,0647 | 0,0355 | 0,0262 | 0,0000 | 0,0017 | 0,0007 | 0,0325 |
| F3_4 | 0,0959 | 0,0941 | 0,0000 | 0,0178 | -0,0094 | -0,0294 | 0,0000 | -0,0005 | 0,0000 | -0,0100 |
| G0_1 | 0,1058 | 0,1145 | -0,0087 | 0,0701 | -0,0258 | 0,0146 | 0,0002 | 0,0010 | 0,0121 | 0,0196 |
| G1_2 | 0,1026 | 0,1018 | 0,0002 | 0,0609 | -0,0382 | -0,0075 | 0,0000 | -0,0005 | -0,0003 | -0,0088 |
| G2_3 | 0,1011 | 0,1011 | 0,0014 | 0,0625 | 0,0089 | 0,0376 | 0,0000 | 0,0023 | 0,0007 | 0,0451 |
| G3_4 | 0,1011 | 0,0932 | 0,0006 | 0,0153 | -0,0146 | -0,0287 | 0,0000 | -0,0004 | -0,0005 | -0,0085 |
| G4_5 | 0,0845 | 0,0874 | -0,0001 | 0,0114 | -0,0272 | -0,0747 | 0,0000 | -0,0009 | 0,0002 | -0,0164 |
| Free of charge policy | | | | | | | | | | |
| Beneficiary | | 0,4325 | | 0,0377 | | 0,1044 | | 0,0039 | | 0,0756 |
| Other types of insurance | | | | | | | | | | |
| Yes | | 0,9344 | | 0,0390 | | -0,0364 | | -0,0014 | | -0,0272 |
| Care structures Close by (reference away) | | | | | | | | | | |
| | | 0,3192 | | 0,0032 | | -0,3321 | | 0,0011 | | 0,0207 |
| Media exposure (reference no) | | | | | | | | | | |
| Yes | 0,8418 | 0,7967 | 0,0036 | -0,0216 | 0,0659 | 0,1139 | 0,0002 | -0,0025 | 0,0130 | -0,0473 |
| Wealth index (reference very poor) | | | | | | | | | | |
| Very_rich | 0,0986 | 0,0987 | 0,0026 | 0,0564 | 0,8046 | 0,7712 | 0,0021 | 0,0435 | 0,1147 | 0,8359 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Rich | 0,1540 | 0,1447 | 0,0046 | 0,0512 | 0,5508 | 0,5254 | 0,0025 | 0,0269 | 0,1355 | 0,5165 |
| Average | 0,2138 | 0,1878 | 0,0048 | 0,0327 | 0,1791 | 0,1923 | 0,0009 | 0,0063 | 0,0464 | 0,1210 |
| Poor | 0,2571 | 0,2652 | 0,0039 | 0,0145 | -0,2959 | -0,2618 | -0,0011 | -0,0038 | -0,0618 | -0,0728 |
| Mother's level of education (Higher) | | | | | | | | | | |
| None | 0,7046 | 0,6590 | -0,0134 | -0,1227 | -0,1459 | -0,1563 | 0,0020 | 0,0192 | 0,1055 | 0,3683 |
| Primary | 0,2021 | 0,1808 | -0,0007 | -0,0067 | 0,2300 | 0,1953 | -0,0002 | -0,0013 | -0,0082 | -0,0251 |
| Secondary (Reference for 2012) | | 0,1447 | | -0,0158 | | 0,3031 | | -0,0048 | | -0,0918 |
| Other | | 0,0004 | | -0,0004 | | 0,5651 | | -0,0002 | | -0,0042 |
| Regions (North reference) | | | | | | | | | | |
| Southern Region | 0,3039 | 0,3204 | -0,0035 | 0,0096 | -0,3681 | -0,4122 | 0,0013 | -0,0039 | 0,0697 | -0,0758 |
| Central Region | 0,3502 | 0,3466 | 0,0027 | 0,0216 | -0,0870 | -0,0876 | -0,0002 | -0,0019 | -0,0128 | -0,0363 |
| Western Region | 0,1353 | 0,1333 | 0,0068 | -0,0084 | 0,4016 | 0,4379 | 0,0027 | -0,0037 | 0,1478 | -0,0708 |
| Place of residence (rural reference) | | | | | | | | | | |
| Urban | 0,2989 | 0,2909 | -0,0019 | -0,0046 | 0,5363 | 0,5013 | -0,0010 | -0 ,0023 | -0,0546 | -0,0442 |
| Marital status (reference Unmarried) | | | | | | | | | | |
| Married | 0,9498 | 0,9553 | 0,0243 | -0,1120 | -0,0101 | -0,0109 | -0,0002 | 0,0012 | -0,0132 | 0,0235 |
| Head of household age | 51,3363 | 53,6194 | 0,0025 | 0,0076 | 0,0066 | 0,0189 | 0,0000 | 0,0001 | 0,0009 | 0,0028 |
| Partner occupation (reference not occupied) | | | | | | | | | | |
| Occupied partner | 0,9840 | 0,9330 | 0,0451 | 0,0318 | -0,0050 | -0,0108 | -0,0002 | -0,0003 | -0,0121 | -0,0066 |

**Source:** Author from DHS-C 2012 and 2019 data

**Table 3:** The decomposition of inequities in care utilization in 2012 and 2019.

## Conclusion

In this research, we have essentially tried to evaluate, on the one hand, the effect of the free health care policy on child undernutrition and, on the other hand, its effect on social inequalities in the use of health care among children under five in Senegal. DHS-C data from 2012 and 2019 were used to conduct this research.

Although Senegal has already made significant progress in reducing malnutrition and child mortality, rates are still very high compared to other countries and to WHO standards. It is therefore crucial to understand the socioeconomic impact of the free health care policy initiated since 2013. The empirical investigation we conducted, reveals some interesting results:

First, the free care policy improves the nutritional status of children. In addition, financial access to care, the mother's age, the duration of breastfeeding, the use of care, the child's age, sex and birth weight also affect the child's nutritional status.

Second, the free health care policy has further widened social inequalities in health care utilization in health facilities between 2012 and 2019 in favor of the rich. This result is contradictory to the policy's objective of reducing inequalities in the use of care in public health facilities.

Finally, the decomposition of the concentration indices shows that in both 2012 and 2019, the need factor indices participated in reducing horizontal inequities in care utilization even though they remained pro-rich with a larger value in 2019. On the other hand, variables other than need factors continue to exacerbate inequities in care utilization in health facilities.

Therefore, the economic policy implications of these results are:

First, increasing the coverage rate of the policy, especially among children from poor families, by popularizing the policy at the community level and by monitoring it in health facilities. Indeed, even if the policy improves the nutritional status of children, it also increases social inequalities in the use of care, which are pro-rich. In addition, the government needs to revisit this policy and combine it with policies or programs to combat undernutrition in order to have a better result in terms of child health.

Secondly, the construction of health structures in areas where they are almost non-existent becomes a priority for the State in order to facilitate access to health care for the population and to allow them to benefit easily from this policy. In addition, effective income redistribution policies must be put in place to reduce social inequalities in the use of health care, but also undernutrition and stunting in particular.

Lastly, the State must promote education and the retention of girls in school, because the results show that mothers' education contributes to the reduction of social inequalities in the use of health care and child malnutrition.

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