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Abstract

This study provides a comprehensive analysis of the implications of prenatal healthcare service utilization on under-five fever occurrence in Cameroon. The main objective is to examine how prenatal healthcare service utilization correlates with the occurrence of fever among children under-five in Cameroon. Methodologically, the study used data from the Cameroon Demographic and Health Surveys (DHS) for the years 2011 and 2018, respectively. A logit model was employed to analyse the results. The findings reveal that Prenatal Healthcare Service Utilization (PHSU) is strongly correlated with under-five fever occurrence in Cameroon. In terms of policy, the study suggests that policymakers must pay careful attention to the types of prenatal care services utilized, as this has a direct implication on under-five fever occurrence outcome in Cameroon.

Keywords: *Prenatal Healthcare, Under-five fever occurrence, Logit model, Cameroon.*

1.0 Introduction

As the international community seeks to achieve a better world with decent standard of living, health has become vital on the global development agenda in the recent years. The various programmes that development agencies and governments have exercised within a relative short period to handle the health challenges such as malnutrition, outbreaks of epidemics, child and maternal health and risky health behaviours, confirm this evidence. Counting from the Alma Ata declaration in 1978 at Kazakhstan, programmes such as Roll Back Malaria (RBM) partnership

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launched in 1998, the Global Fund to fight AIDS, Tuberculosis and Malaria (GFATM) set up in 2002 and the President's Malaria Initiative (PMI) launched in 2005 by the United States (US) have all been pursued in an attempt to improve health around the planet. Even the Millennium Development Goals (MDGs) have largely focused on improving health (Tambi, 2022). The considerable priority that has been given to health issues emanated from the immense economic benefits of good health and especially, the realization of the injurious consequence that ill health has on the poor and most vulnerable in the society due to loss of income and high healthcare costs. Children especially those under five years are the most handicapped individuals in our society and hence achieving better health for children must be a social responsibility.

In developing countries, many children younger than 5 years are exposed to various risks, including poor health, malnutrition, poverty, and unstimulating home environments, which prejudicially affect their cognitive, motor, and socio-emotional development. Education plays a very important role in determining the socioeconomic status, occupation and lifestyle which in turn greatly influences the income, housing and other material resources (Zhang et al., 2017). According to Kickbusch (2012), an important proportion of the poorest mothers have problem with basic literacy and it was estimated that each additional year of schooling increase a women's income by 10 to 20 percent which in turn has a direct impact on the child's health. Therefore, maternal education was found to play an important role in improving the child survival and health in developing countries (Barros, A. et al., 2020). This can be attributed to the fact that educated mothers have a better knowledge about health care, nutrition and may provide a healthy sanitary habits and safer environment for their children (Wulifan et al., 2022).

From the various existing literatures on child issues, child health can be defined as the extent to which children are able or enabled to develop and realize their potential, satisfy their needs and develop the capacities that allow them to interact successfully with the biological, physical and social environment. Khare (2021) predicted that maternal education improves the use of maternal health care that has the greatest impact on child health especially among the children of age group 0-2 years. Improving female education is important for reducing childhood mortality rate. This is the reason for emphasizing on the education of girl child. Studies have shown that the use of basic health facilities that relate to childhood survival has a direct relationship with mothers' education. Hence, the implementation of public health interventions is crucial in seeking child survival for developing countries.

Despite all these health programmes, the nation is still in search of solutions to the myriad of health problems especially those facing children and women. In fact, the health system still suffers quantitative and qualitative shortage of human resources, despite recruitment efforts in recent years; lack of technical and managerial expertise and unethical behaviour among personnel; information deficiencies, that would otherwise facilitate improvement in the management of health services, a weak legal framework for the effective regulation of pharmaceuticals, which is essential to ensure the availability of quality medical product (including vaccines); lack of funds and low absorption of available funds. Conscious of the numerous weaknesses of the supply component of the country health system which depends on government and development agencies, it is vital to scrutinize some individual social factors which consist of the child health demand component and their contribution on the child health outcomes.

A casual glance of the PHSU statistics and under-five mortality rate across the globe and in Cameroon provides some support for the positive correlation between improved PHSU and good child health. In 2014, the world female population being enrolled in primary education stood at

90.33% against 85.87 for Cameroon (UNICEF, 2018). For secondary education, 62.53% world female population was enrolled against 42.03% for Cameroon. The under-five mortality rate for the world and Cameroon in 2015 were 43 and 88 per 1000 live births respectively (UN, 2017). The under-five mortality rate in Cameroon decreased from 144 per 1000 live births in 2004 to 88 per 1000 live births in 2015. Similarly, as the educational attainment of mothers improved from 2004 to 2011 and from 2011 to 2018, increase in the PHSU was observed and the percentage of children who suffered from fever, diarrhoea and ARI declined over the period. The proportion of female adults in Cameroon who have never attended formal education declined from 22.4% in 2004 to 20% in 2011. Under the same period, while the percentage of children who suffered from ARI declined from 11% in 2004 to 5% in 2011, the percentage of children who suffered from fever and diarrhoea instead increased from 23.7% and 16.1% respectively in 2004 to 26% and 21% in 2011 (DHS- 2011).

In recent times, Cameroon has made some gains in improving the health conditions among children. However, the failure in achieving the health objectives of the MDGs denotes the evidence of which the nation is far from solving these health problems. Besides, the conditions of child health in Cameroon are worse as compared to the average conditions around the globe. The incidence of under-five mortality in the country at 2009 was 69 per 1000 live births whilst the global average value was 60 per 1000 live births that year (Tambi, 2022). Furthermore, about 28.6 percent of children below five years in Cameroon are estimated to be stunted whilst 20.3 percent of these children are under weight (CDHS, 2011). Diseases, mainly diarrhoea and Acute Respiratory Infection (ARI) are afflicting pain, suffering and death on Cameroonian children on daily. According to the Cameroon Demographic and Health Survey (CDHS) conducted in 2018, twelve percent of children under-five years suffered episodes of diarrhoea whilst one percent of the children suffered from ARI.

Contributing to the achievement of the Sustainable Development Goal 3 (SDG 3) target require a deep investigation on all the factors that can influence child health, mostly those that have been neglected by previous studies toward the achievement of the MDG 4. For instance, an investigation of the literature into cross-sectoral factors that affect health gave a little interest to PHSU and focused on health insurance, education, access to water and sanitation, and human resources capacity (WHO, 2011). Studies that have investigated the child health-maternal healthcare services utilization relationship are scanty and have focused mainly on the indicators of malnutrition (height for age, weight for age) to capture the child health. The present study analyses another side of the relationship between PHSU and child health in Cameroon. The research examines the correlation between prenatal healthcare utilization on child morbidity, placing particular emphasis on fever occurrence in children under-five to capture overall morbidity levels. In fact, Fever can be one of the main symptoms of many diseases, including malaria and measles, which cause many deaths in Africa. From the above statement, this study seeks to provide answers to the research questions on how prenatal healthcare service utilization correlates children's morbidity's in acting on the use of prenatal health care in Cameroon. The objectives consist to: (1) analyze the relationship between the frequency of antenatal care services utilization and the likelihood of under-five child fever occurrence in Cameroon, (2) determine the link between the skilled birth assistance and under-five child fever outcomes in Cameroon, and to appraise the contributions of other socio-economic factors on the under-five child fever occurrence in Cameroon.

2.0 Review of Literature

Considering Child Characteristics, many child factors resulting from parental choice or not have significant effects on the health of the child. Studies have shown that biological factors such as gender and age are associated with nutritional status (Hadi, 2003; Pongou, 2013). It is generally argued that girls have a stronger immunity system in early ages, resulting in relatively better health status as compared to boys. However, Panpanich et al. (2000) found that being a female child is associated with health issues, motivating further research on the relationship between gender and health. In developing countries, the role of child age in determining health status is also well documented (Pongou, 2013). As children age, demand for quality supplementation and contact with the external environment increases; generally resulting in lower nutritional status in older children. In many studies however, the effect of age remains significant even after controlling for household and environmental factors, suggesting that some biological unobservable might work against children's health as they grow older.

Birth weight is another determinant of child health status in developing countries (Mustafa et al., 2003; McCrary et al., 2006). Low birth weight children have low health endowment, making them more vulnerable to infectious diseases and malnutrition in the short and the long run. Similar to birth weight, birth spacing, which is related to parental choice, might influence child health status. Shorter birth spacing results in many younger children in the household, which might decrease the quantity and quality of parental investment per child. This might therefore result in lower health and nutritional status, as demonstrated in some studies (Figueiredo et al., 2018; Bartley, 2004). The cost of child rearing implies that as the number of children increases, fewer resources are left to be invested in higher rank children (Tambi, 2022), implying a negative relationship between birth order and child nutritional status as found in the Philippines (Belay, 1997)

Another potential determinant of child health status mainly documented in the medical literature is duration of breastfeeding. However, the results for its effects are mixed. Breastfeeding after 12 months has been linked to improved survival rates and anthropometric status in many settings (Meh, et al., 2019; Okonji et al., 2023). Alderman et al. (2004) found that breastfeeding mitigates the effects of poor social conditions on growth for children who have breastfed for longer than 6 months after birth. However, longer periods of breastfeeding have also been found to be related to higher mortality and substandard anthropometric (Martin-Vivaldi, 2009). Along the same line, improper weaning was found to be a significant risk factor for malnutrition for children less than five years of age (Pongou, 2013).

Associations between maternal characteristics such as education, marital status, employment status, weight and height, and parity on one hand and child health on the other hand are documented in several studies (Madise, 2003); Koblinsky et al., 2016). Higher levels of maternal education are associated with better knowledge of nutritious foods and proper nutrition. Education is also associated with positive utilization of health care services, and better hygiene practices. Consequently, education is expected to have positive impact on child health, as demonstrated in several studies (Pongou, 2013).

While maternal education has been consistently found to have positive impact on child health, a study conducted in Nigeria was unable to find any positive effect of mothers who earn cash from their work on childhood malnutrition (Shikuku et al., 2020). Other maternal demographic factors such as age and marital status have been found to be significantly associated with severe child morbidity (Wulifan, et al., 2022). Older mothers have richer experience of child care, and children

born to married mothers benefit from care from both parents, which may improve their health status. Consistent with this theory, mother's age at birth has been found to be associated with malnutrition in studies conducted in Brazil and Ghana (Yi et al., 2011; Zhang et al., 2018). Also, children born to married mothers were found to fare better than their counterparts born to unmarried mothers in Cameroon (Pongou, 2013).

Household characteristics ranging from household size (Khare, 2021; Janz et al., 1984), number of children under 5 years of age, economic status, and utilization of health care (Jolly et al., 2000; Pongou, 2013) has been identified as predictors of childhood health status. However, the effect of household size might not be obvious. Khare (2021) found that Mexican children from larger households tended to be shorter and consumed food of poorer quality. However, in a context where presence of adults in the same household is likely to increase total income and other inputs to child health, a larger number of adults would result in better health status (Pongou, 2013).

Obasola et al. (2018) argue that a mother's consumption of tetanus vaccination increases survival chances of the child after birth, which motivates the mother to further invest in antenatal care. If inputs that complement antenatal care in improving child health are not available, mothers have little incentive to invest in antenatal care. Examples of these inputs include tetanus vaccination of the mother during pregnancy, sanitary obstetric care, and child immunizations. This complementarity hypothesis is best investigated using panel data on mothers as in Obasola et al (2018). They maintained the hypothesis that tetanus vaccination and antenatal care are complementary in the production of child health but is not tested due to data limitation. The present research work differs from that of Obasola et al (2018) in many respects. child fever is the measure of infant health rather than the probability of an infant being at a particular birth weight that is employed by Dow et al. Framework that nests child health production into a utility maximizing behaviour of the mother is used, and this nesting permits explanation of a wide range of consumption patterns observed in health care and related markets.

In Cameroon, it is evident that the rural population is more distressed than the urban population, thus low birth weight children require additional outpatient care and hospitalization during their childhood (Tambi, 2022). Because of lack of medical centres in the rural community, most mothers spent their time in hospitals trying to take care of their children, hence fuelling poverty and deteriorating living standards (Lambon-Quayefio et al., 2014). Awiti (2014) cited a number of authors that contributed in child health determinant research in Cameroon. For instance, higher antenatal care visits increase birth weight according to Eller et al. (2006). An increase in the quality of prenatal care increases birth weight (Mwabu, 2009). Delay in seeking prenatal care increases the risk of low birth weight and early initiation of prenatal care leads to a reduction to low birth weight (Wehby et al., 2009). Inadequate use of prenatal care is associated with higher risk of low birth weight (Fagbamigbe et al., 2016). Prenatal care visits lost early in the pregnancy negatively impact birth outcomes (Fiori, 2022) and low birth weight rates are higher among women who receive inadequate prenatal health care than those who receive adequate and intensive prenatal care (Khare, 2021).

3.0 Methodology

Based on the Grossman (1972) health demand theory, Brunello's model posits that the stock of health capital enters the utility function as a consumption good because better health increases utility. In other words, households obtain utility from better health (H) of children, consumption goods (C) and risky health behaviours (B) of parents. Thus, utility is denoted as $U(C, H, B)$ and

it is concave in its arguments. The marginal utility of health is characterised by diminishing marginal utility and the marginal utility of consumption (UC) and marginal utility of risky health behaviours (UB) vary with health. The utility of the household is depicted as:

$$U = U(C, H, B) \quad (1)$$

In addition to healthy children generating utility for the household, children's health is also a human capital. It determines the amount of time and resource that the household can devote to other markets. In an event a child falls sick, the household will have to devote its scarce time and resources to care for the child. The health of the child depreciates over time, and this requires the household to invest in the child's health using health inputs such as medical care, diet, and vaccination. The relationship between the health inputs and health outcome of the child is shown by the production function of child health. As illustrated by Grossman in his model, whereas medical inputs (T), diet, exercise and other health behaviours affects health, education (E) acts as a catalyst that positively influence the stock of individual health (H). In the case of child health, the health stock of the child can be improved with the use of medication, proper nutrition, use of health equipment and other behavioural characteristics of parents whereas the education of the parent increases the efficiency of health production. For instance, educated parents will be able to properly administer medicine to children than less-educated parents. Lleras-Muney (2005) and Currie and Moretti (2003) all provide evidence that education affects health. In addition to generating good child health using medical inputs (T) and education (E), the health stock of children (H) also depends on the behaviour of their parents (B) as well as unobservable traits of the household (such as genetic features, environment, and occupation of key members of the household) which is denoted by μ .

This relationship between health stock of children, medical input, behaviour of their parents and the other unobservable factors is expressed by the relation:

$$H = F(T, E, B, \mu) \quad (2)$$

From the above relationship a linear specification of the health production function of children can be expressed as:

$$H = \alpha T + \beta E - \theta B + \gamma \mu \quad (3)$$

Rationally, households seek to increase their utility from consumption, subject to their child health production function and to their budget constraint. The budget constraint of individuals in this case is given as: $P_T T + P_C C + B = R(E, Z)$ (4)

where R is income of the household, which depends on education and a vector of observable controls z, P_T and P_C are the vector of prices for medical input (T) and consumption goods (C) as well as P_B the price of risky health behaviour (B) which is normalized to 1. If an internal solution exists, the necessary conditions for a maximum are:

$$U_C - \lambda P_T = 0 \quad \text{or} \quad U_C = \lambda P_T \quad (5)$$

$$U_B - \theta U_H - \lambda P_C = 0 \quad \text{or} \quad U_B - \theta U_H = \lambda P_C \quad (6)$$

Where λ is the Lagrange multiplier. The concavity of the utility function implies $U_{HH} < 0$. Since the marginal utility of consumption increase with improved health conditions of the child and the marginal utility of risky behaviours of the parent rises with higher health of the child, $U_{CH} > 0$ and $U_{BH} > 0$. By totally differentiating (4) and (5) and using (1) we find that higher education reduces health damaging behaviours of parents if the following condition holds:

$$|U_{HE}| > \beta \left[\left(\frac{|U_{BE}|}{\alpha} - \frac{|U_{CH}|}{P_2} \right) + |U_{BH}| \right] \quad (7)$$

Households with better education usually earn higher income per a given period and have higher expectations for the future than less-educated households. As such, the higher-educated households' value of time is higher and hence, they are expected to suffer a greater loss of satisfaction if they have to take time off to take care of a sick child. Conversely, they should derive a higher utility from better health stock of a child. This is because the resources and the time that they can conserve from parenting a healthy child give them a higher utility. Due to this, it is logical to assume that the marginal utility of good child health increases with an increase in the behaviour of parents (B). In other words, $U_{BH} > 0$

The optimal consumption plan for the household in implicit form is given by:

$$C = C(E, P_T, P_B, \mu, Z) \quad (8)$$

$$B = B(E, P_T, P_B, \mu, Z) \quad (9)$$

Using (4) in (2) and in the utility function yields the "reduced form" health equation for the household: $H = H(E, P_T, P_B, \mu, Z)$ (10)

and the indirect utility function $V = V(E, P_T, P_B, \mu, Z)$. The marginal effect of education on health in (3) is the "behaviour gradient". Assuming that the cost of the use of health facilities $\tau(B, W)$, where W is a vector of cost of the use of health facilities shifters, is convex in the years of education, optimal use of health facilities is given by:

$$V_E(B, P_T, P_B, \mu, Z) = \tau_E(B, W). \quad (11)$$

It consists of obtaining the probability distribution from the samples of data (DHS 2011 and DHS 2018) by calculating the relative frequency of occurrence of each event. Thus, the data sets (DHS 2011 and DHS 2018) will be translated into valuable and usable information. From the above discussions, the health of a child depends on a number of socio-economic factors as well as the health behaviours of the parents. The relationship between the health stock of the child and behaviours of the mother as well as education is estimated using the regression model:

$$H_i = a + \alpha PHSU_i + \beta_i X_i + \theta_i B_i + \varepsilon_i \quad (12)$$

Where H_i is a measure of child i 's health, $PHSU_i$ is the use of health facilities by child i 's mother, X_i is a vector of the socio-economic characteristics that includes the educational level of child i 's mother, B_i is a vector of health behaviours of child i 's mother, a is a constant term and ε_i is the error term (Tambi, 2022). In specific terms, child health captured in our research by fever occurrence will be estimated as:

$$Fv = a + \alpha PHSU_i + \beta_1 B_i + \beta_2 R_i + \dots + \varepsilon_i \quad (13)$$

Where the health outcome of children is measured independently as fever (Fv). Each of these health outcomes is estimated as depending on mother's health care utilization, mother's health behaviours and household socio-economic characteristics which are:

B_i : Mother's health behaviours, R_i : The income/wealth of the household, ε_i : The error term and $\alpha, \beta_1, \beta_2, \dots, \beta_n$ are parameters which measures the relative effect of the explanatory variables on each of the individual fever occurrence of children.

Estimation technique

Studies where the unknown variable or the regression is qualitative and dichotomous or binary variable, the binary models of Linear Probability Model (LPM), logit or probit are employed. The LPM which allows for the use of Ordinary Least Square to estimate the parameters is plagued with many challenges. It is characterized by heteroscedasticity, non-normality of the disturbance term, low R^2 and non-fulfilment of $0 \leq R_i/X_i \leq 1$ restriction of binary models. Though these challenges can be surmounted with a number of remedies, the LPM assumes that the marginal or incremental effect of the explanatory variables remain constant throughout (Gujarati, 2004). This makes the LPM an unattractive binary model of estimation, though it is the simplest one. The logit and probit models overcome the problems that the LPM poses. When using micro level data, the standard OLS estimation is not feasible for both the logit and probit. The maximum likelihood method is used to estimate the parameters.

To assess the association between the health outcomes among children (under-five child fever occurrence) and the use of health facilities by their mothers-PHSU, the study like many other health economics studies that employ micro level data, uses the logit model. The logistic regression predicts the probability of an event occurring (Green, 2003). This statistical model provides a good description of the relationship between the probability of a response which has two outcomes and the variable or variables that influence(s) this outcome. The logit (natural logs) regression expresses the odds of the unknown binomial variable as linearly dependent on the explanatory variable and this linear relationship is derived from the Logistic Cumulative Density Function (LCDF). Given that the probability density function $f(x)$ of the logit distribution is:

$$f(x) = \frac{e^{-x}}{(1 + e^{-x})^2} \quad -\infty < x < +\infty \quad (14)$$

Whilst the cumulative density function $F(x)$ of logit distribution is a sigmoid ‘‘S-shaped’’ curve defined by two parameters: the location parameter μ and the scale parameter $s > 0$. The formula is given by: $F(x) = \frac{1}{1 + e^{-(x-\mu)/s}}$ (15)

To study under-five fever occurrence in Cameroon, we use a logit model with keys variables such as antenatal care frequency, skilled birth assistance, and under-five child fever occurrence. Let us considered:

- Binary Dependent variable Y_i (1 if the child has fever in the last two weeks, 0 otherwise).
- Core independent variables: number of Antenatal Care (ANC_i) visits during pregnancy, and binary indicator for Skill Birth Attendance (SBA_i) (1= yes, 0= no).
- Control variables (x_i): mother’s education, place of residence, household wealth index, etc.

The probability $P_i = P(Y_i = 1/ANC_i, SBA_i, x_i)$ is model using the logistic cumulative distribution function: $P_i = \frac{e^{\beta_0 + \beta_1 ANC_i + \beta_2 SBA_i + \sum \gamma_k x_{ki}}}{1 + e^{\beta_0 + \beta_1 ANC_i + \beta_2 SBA_i + \sum \gamma_k x_{ki}}}$ (16)

Taking the natural logarithm of the odds ratio ($\frac{P_i}{1 - P_i}$), the linear estimating equation is:

$$\text{Ln} \left(\frac{P_i}{1 - P_i} \right) = e^{\beta_0 + \beta_1 ANC_i + \beta_2 SBA_i + \sum \gamma_k x_{ki}} \quad (17)$$

- β_0 is the log-odds of a child having a fever when all explanatory variables are zero.
- β_1 is the change in the log-odds of under-five fever associated with one-unit increase in antenatal care visits.

- β_2 is the difference in the log-odds of fever for births attended by skill health personnel compared to unassisted or traditional births.
- γ_k is the effect of each control variable (x_{ki}) on the log-odds of fever occurrence.
- ε_i is the logistic error term.

The model is adopted to provide a good description of the relationship between the occurrence or otherwise of fever outcome among children and the level of their mother health care use as well as all the other factors that influence child health. Applying the model to address the objectives of the study, P_i represents the child health outcomes of fever; β_0 is the intercept; β_1, β_2 and γ_k are the coefficients of the explanatory variables whilst ANC_i, SBA_i , and x_i are the independent variables.

For each child health measure, the study focuses on only two possible outcomes – whether each outcome occurred or not. For instance, the Cameroonian DHS finds out from households whether they have ever experience adequate antenatal or not in the preceding five years. Also mothers are asked if their children ever experienced fever or not. In these binary possibilities of the unknown, the logit offers an appropriate model for estimation. The presence of each of the stated child health outcomes is assigned the value 1, whilst the absence of the health outcome is given a value of zero. The effect of PHSU on each child health outcome is investigated by using the marginal effect. In the logit model, coefficients of explanatory variables measure the change in log-odds due to a unit change in the independent variable rather than the marginal effect. However, the effect of the explanatory variables can be measured in relative terms using the marginal effect of the logit relation. These estimates will predict the effect of prenatal healthcare services utilization on each child health outcome.

Based on our observations and literature review, prenatal healthcare utilization unidirectional relates child health outcomes; an inverse causal relationship is absent since child's existence occurs strictly post-utilization. By applying the complex stratified cluster design of the Cameroon Demographic and Health Survey (CDHS), our analysis already yields valid, precise and representative estimates. Consequently, any additional complex regression technique is redundant, as the proper use of the survey weights and design-based methodology fully accounts for the unidirectional relationship. Detailed information can be found in the official CDHS documentation.

Data setting

An examination of the relative relation between PHSU and under-five child fever in Cameroon requires a nationwide data that covers several economic, social and geographical variables. The 2011 and 2018 CDHS which are the most recent nationwide health survey designed to provide data for monitoring the population and health situation in Cameroon, provides good source of data for the estimation. The survey gathered information on child and maternal health, nutritional status of women and children, health behaviours, fertility preferences and other national health measures. It provides an update for other demographic and health survey carried out in 1991, 1998 and 2004.

A nationally representative sample of 13,527 women age 15-49 in all selected households and 6,978 men age 15-64 in half of the selected households were interviewed. This represents a response rate of 98% of women and 98% of men. They provided information on the health and nutritional status of their children. The sample design for the 2018 CDHS provides estimates at the national level, for urban and rural areas, and for 12 study domains. The 2011 CDHS and 2018

CDHS were aimed at national representative samples of about 11 732 children (0-59 months) and 9 733 children (0-59 months) respectively.

This section commenced by taking a brief glance at the estimation techniques employed for empirical studies of PHSU and health relationship. Considering the data set available and the scope of this study, the binary model, specifically the logistic regression model is selected for its relative advantages. The section subsequently discussed the theoretical model that anchors the research. Though Brunello's model of health production function is based on the classic Grossman model, it provides a detailed relationship between education and health whilst it is devoid of complexities. The model is adopted and modified to suit the investigation into the relationship between PHCU and selected health outcomes of children in Cameroon. The explanatory variables that affect child health and how they are expected to influence child health are also discussed. We ended the section by the description of the data that will be used for the empirical estimations for the discussion of the results in the next section.

4.0 Results and Discussion

This section presents the descriptive statistics and examines the nexus between prenatal healthcare services utilization and under-five fever occurrence in Cameroon.

4.1 Descriptive statistics

Descriptive statistics from 2011 CDHS

Data from table 1 indicate that 28% of mothers reported a recent episode of child fever in the two weeks preceding the 2011 CDHS, compared to 72.0% reporting no such morbidity. Analysis of categorical covariate shows maternal education attainment distributed as follow: 25.0% had no formal education, 42.0 % attained primary education, and only 3.0% achieved higher education, reflecting an educational gap. Regarding residential distribution, 60% of the surveyed women resided in rural areas, while 40.0% inhabited urban settings.

Socioeconomic status proxied by household wealth quintiles, reveals a concentration in low-income brackets: the 21.0% poorest, 23.0% poorer, and the 22.0% middle wealth index categories comprise the majority of the sample. Conversely, the 19.0% richer and 15.0% richest quintiles exhibit lower representation, demonstrating the disproportional vulnerability of low income households-a factor with potential adverse implication for health capital accumulation. Utilization of Prenatal Healthcare Services (UPHS) was high, with 92.0% reporting ANC uptake and 64.0% experiencing facility-based or assisted deliveries versus 36.0% in unassisted or inadequate conditions.

Maternal age distribution shows that women aged 20-34 years constitute the modal group (70.0%), followed by those aged 35-49 years (21.0%), while adolescents aged 15-19 years account for 9.0 %. Parity distribution indicates singleton live births represent 23.0%, followed by parity two (19.0%), parity three (16.0%), and parity four (13.0%), with higher order births (> 4 children) each contributing under 10.0%. child sex ratio is balanced at roughly 50.0% male and 50.0% female.

Marital status is predominantly married (69.0%) with cohabiting partners (19.0%) and single mothers (10.0%), while widows and divorcees represent 1.0% each. Religious affiliation is led by Catholics (34.0%), Protestants (33.0%), and Muslims (24.0%), with animists and others Christian denominations at 2.0% each. Geographically, the Far North (15.0%) and the North (13.0%) regions exhibit the highest sample concentrations, with remaining regions averaging 10.0% each. Finally,

labour force participation indicates 69.0% were currently employed compared to 31.0% unemployed.

Table 1: Descriptive statistics from 2011 CDHS

Variables	Mean	Standard deviation	Minimum	Maximum
Fever occurrence (1= Yes, 0 otherwise)	0.28	0.45	0	1
Independent variables				
Antenatal visits (1= Yes, 0 otherwise)	0.92	0.27	0	1
Skilled Birth Attendance (1= Yes)	0.64	0.48	0	1
Mother's Age:				
15-19	0.09	0.28	0	1
20-34	0.70	0.46	0	1
35-49	0.21	0.41	0	1
Birth order:				
1	0.23	0.42	0	1
2	0.19	0.40	0	1
3	0.16	0.36	0	1
4	0.13	0.33	0	1
5	0.09	0.30	0	1
6+	0.20	0.40	0	1
Gender of the child				
Male	0.50	0.50	0	1
Female	0.50	0.50	0	1
Marital Status:				
Single	0.10	0.31	0	1
Married	0.69	0.46	0	1
Concubine	0.19	0.39	0	1
Widowed	0.01	0.12	0	1
Divorced	0.01	0.09	0	1
Religion:				
Catholic	0.34	0.48	0	1
protestant	0.33	0.47	0	1
Moslem	0.24	0.43	0	1
Animist	0.03	0.16	0	1
Others Christian	0.06	0.24	0	1
Region:				
Adamawa	0.09	0.29	0	1
Centre	0.09	0.28	0	1
Douala	0.07	0.25	0	1
East	0.07	0.26	0	1
Far North	0.07	0.26	0	1
Littoral	0.15	0.36	0	1
North	0.05	0.22	0	1
North west	0.13	0.34	0	1
South	0.08	0.28	0	1
South west	0.08	0.28	0	1
West	0.06	0.23	0	1
Yaounde	0.06	0.23	0	1
	0.09	0.29	0	1
	0.06	0.24	0	1
Place of Residence:				
Urban	0.40	0.49	0	1
Rural	0.60	0.49	0	1
Mother's Education:				

No education	0.25	0.43	0	1
Primary	0.42	0.50	0	1
Secondary	0.30	0.46	0	1
Higher	0.03	0.17	0	1
Wealth Index:				
Poorest	0.21	0.41	0	1
Poorer	0.23	0.42	0	1
Middle	0.22	0.41	0	1
Richer	0.19	0.39	0	1
Richest	0.15	0.36	0	1
Work status:				
Employed	0.69	0.46	0	1
Unemployed	0.31	0.46	0	1

Source: Author's Construct from CDHS, 2011

Descriptive statistics from 2018 CDHS

The summary statistics from the 2018 CDHS are presented in table 2. The descriptive analysis reveals an 84.0 % prevalence of non-occurrence versus 16.0% incidence of fever among children under-five. This indicates a favourable improvement in preventive health measures against childhood morbidity during the inter-survey period (2011-2018), potentially driven by increased utilization of skilled birth attendants. Regarding maternal education attainment, 23.0% of women had no formal education, 33.0% attained primary education, and 39.0% completed secondary education in 2018. Higher education participation increased from 3.0% in 2011 to 5.0% in 2018, though it remains low relative to male counterparts. Spatially, 56.0% of women resided in rural areas and 44.0% in urban areas. Wealth quintiles show the poorest, poorer and middle categories representing 21.0%, 23.0%, and 24.0% respectively, while the richer and richest categories comprise 19.0% and 15.0%. ANC utilization remained stable at 92.0% across both surveys rounds, with 8.0% reporting to no ANC. Furthermore, 69.0% deliveries were professionally assisted, compared to 31.0% without institutional assistance.

Maternal age distribution indicates that women aged 15 to 19 years represent 9.0% of the sample, cohorts aged 20 to 34 years comprise 69.0%, and those aged 35 to 49 years' account for 22.0%. Birth order patterns show parity-one mother constituting 23.0%, follow by parity two, three, four, and five at 19.0%, 16.0%, 13.0%, and 9.0% respectively, while parities of six and above represents 20.0%. child gender distribution is almost balanced at 49% male and 51.0% female. Marital status is dominated by married women (59%), with widows and divorcees representing 2.0% and 3.0%, and informal unions (cohabitation) accounting for 22.0%. Affiliated religions include Catholicism (35.0%), Protestantism (27.0%), Moslem (26.0%), Animism (4.0%), and other Christian denominations (8.0%). Regional representation is concentrated in the North-West (13.0%), South-West (13.0%), Far North (12.0%), North (10.0%), and Centre (10.0%) regions, with all remaining regions under 10.0% each. Labour force participation indicates that 68.0% of mothers are employed and 32.0% are unemployed.

Table 2: Descriptive statistics from 2018 CDHS

Variables	Mean	Standard deviation	Minimum	Maximum
Dependant variables				
Fever occurrence				
Yes	0.16	0.37	0	1
No	0.84	0.37	0	1
Independent variables				
ANC				
Antenatal visits	0.92	0.28	0	1
No Antenatal visits	0.08	0.28	0	1
Safe delivery				
Medical institution delivery	0.69	0.46	0	1
No medical institution delivery	0.31	0.46	0	1
Mother's Age:				
15-19	0.09	0.28	0	1
20-34	0.69	0.46	0	1
35-49	0.22	0.42	0	1
Birth order:				
1	0.23	0.42	0	1
2	0.19	0.39	0	1
3	0.16	0.36	0	.1
4	0.13	0.33	0	1
5	0.09	0.30	0	1
6+	0.20	0.40	0	1
Gender of the child				
Male	0.49	0.50	0	1
female	0.51	0.50	0	1
Marital Status:				
Single	0.16	0.37	0	1
Married	0.59	0.49	0	1
Concubine	0.22	0.42	0	1
Widowed	0.02	0.13	0	1
Divorced	0.01	0.10	0	1
Religion:				
Catholic	0.35	0.48	0	1
protestant	0.27	0.44	0	1
Moslem	0.26	0.44	0	1
Animist	0.04	0.18	0	1
Others Christian	0.08	0.28	0	1
Region:				
Adamawa	0.08	0.26	0	1
Centre	0.10	0.29	0	1
Douala	0.02	0.13	0	1
East	0.07	0.26	0	1
Far North	0.12	0.32	0	1
Littoral	0.07	0.23	0	1
North	0.10	0.30	0	1
North west	0.13	0.34	0	1
South	0.06	0.23	0	1
South west	0.13	0.33	0	1
West	0.05	0.22	0	1
Yaounde	0.07	0.30	0	1

Place of Residence:				
Urban	0.44	0.50	0	1
Rural	0.56	0.50	0	1
Mother's Education:				
No education	0.23	0.42	0	1
Primary	0.33	0.47	0	1
Secondary	0.39	0.49	0	1
Higher	0.05	0.22	0	1
Wealth Index:				
Poorest	0.21	0.39	0	1
Poorer	0.23	0.42	0	1
Middle	0.24	0.43	0	1
Richer	0.19	0.40	0	1
Richest	0.15	0.35	0	1
Work status:				
Employed	0.68	0.47	0	1
Unemployed	0.32	0.47	0	1

Source: Author's Construct from CDHS, 2018

Overall, the 2018 statistics, confirm a significant drop in childhood fever incidence, underpinned by enhanced ANC and skill delivery inputs. Following this descriptive profile, econometric models and statistics tests are applied to analyse the determinants of fever occurrence among under-five children.

4.2 Implications of the use of prenatal healthcare services utilization on the under-five fever occurrence in Cameroon

Prenatal healthcare utilization and under- five child fever occurrence nexus

To estimate the effect of prenatal healthcare utilization on the occurrence of fever among children below five years, child fever occurrence is regressed on ANC, skill delivery, and socioeconomic covariates. Table 3 displays the estimated marginal effects of ANC, Skilled Birth Attendance (SBA) on fever occurrence, evaluated across the 2011 and 2018 CDHS datasets. The logit specification is statistically robust, with a chi-square p-value significant at 1% level.

Table 3: Estimates Prenatal health care utilization and child fever occurrence nexus

Variable	2011	2018
Antenatal visits (base- No adequate anc)		
Adequate ANC	-0.02356** (0.0103)	-0.0417** (0.0168)
Safe delivery (base-No save delivery)		
Safe delivery	-0.100941* (0.0583)	-0.324944* (0.1923)
Mother age (base- 15-19)		
20-34	0.00259 (0.0227)	-0.0263 (0.0197)
35-49	-0.005 (0.0266)69	-0.0140 (0.0272)
Region (base- Adamawa)		
Centre region	0.183*** (0.0297)	0.0773*** (0.0297)
Douala	0.0218 (0.0272)	-0.0511* (0.0269)
Other regions	0.0473* (0.0335)	-0.0264 (0.0300)
Place of residence (base-urban)		
Rural	-0.00259 (0.0208)	-0.00222 (0.0138)
Mother Education (base- No Education)		
Primary education	-0.0482*** (0.0113)	-0.0412** (0.0162)
Secondary education	-0.0722** (0.0312)	-0.0315* (0.0173)
Higher education	-0.05977*** (0.0221)	-0.0993*** (0.0298)
Wealth of the household (bas- poorest)		
Poorer	-0.0578** (0.0275)	0.00980 (0.0194)
Middle	-0.0549* (0.0329)	-0.02061* (0.0124)
Marital status (base-single)		
Married	-0.2258*** (0.0329)	-0.3815*** (0.1221)
Single (widow, divorced)	0.0183 (0.0208)	-0.0115 (0.0149)
Bird order (base-1)		
3 children	-0.0481*** (0.0179)	-0.00344 (0.0135)
4 children	-0.0474** (0.0206)	0.0147 (0.0166)
5 children	-0.0514** (0.0204)	0.0404* (0.0218)
Child gender (base-male)		
Female	-0.0246** (0.0102)	0.000628 (0.00970)
Religious affiliation (base- catholic)		
Moslem	0.0738*** (0.0221)	0.0409** (0.0184)
Animist	-0.0959*** (0.0352)	0.000149 (0.0268)

Work status (employed)		
Unemployed	-0.0299**	0.00976
	(0.0128)	(0.0113)
Observations	10,734	9,085

Standard errors in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Source: Author's Construct from CDHS, 2011 and 2018

Empirical estimates indicate that ANC utilization significantly reduces the risk of childhood fever. As reported in table 3, the marginal effects of maternal ANC utilization on fever incidence are - 0.024 (2011) and -0.042 (2018), implying that children of ANC utilization mothers exhibit a 2.4 percentage point and 4.2 percentage point lower probability of experiencing fever compared to the reference group. Similarly, relative to unassisted deliveries, professionally assisted deliveries reduce the probability of childhood fever by 10 percentage point in 2011 and 32 percentage point in 2018. These empirical findings align with human capital theory and health production theories, wherein maternal utilization professional obstetric care proxies for higher parental health knowledge and efficiency in household health production functions, yielding superior preventative health investments for offspring.

Regional disparities, maternal education, and healthcare utilization are significantly related to the prevalence of fever among children under-five in Cameroon, demonstrating that maternal availability, ANC, and skilled birth attendance substantially mitigate paediatric morbidity risks. Regional variations significantly accounted for differential fever incidence among children under-five. Base on the data from the 2011 CDHS, children residing in the Centre, East, Far North, Littoral, North, South West, West regions, and Yaounde exhibited a significantly higher probability of fever occurrence relative to the reference Adamawa region, whereas children in Douala showed no statistically significant differential risk. From the 2018 CDHS, children born in Douala demonstrated a significant lower probability of fever incidence compared to the Adamawa region. Maternal formal education- spanning primary, secondary, and higher education- consistently reduce the probability of childhood fever relative to no mother education. In 2011, the marginal effects of primary, secondary, and higher education on fever incidence were -0.048, - 0.072, and -0.059, respectively indicating approximately 5%, 7%, and 6% in the probability of fever occurrence. In 2018, these respective marginal effects were -0.041, 0.032, 0.099, reflecting a 4 percentage point increase in the protective contribution of higher maternal education. These findings align with human capital and health production theories positing that maternal education enhances health literacy and preventive healthcare investments, consistent with empirical evidence from Shikoya and Senbajo (2008). Furthermore, female children exhibited a 2.5 percentage point lower risk of fever occurrence compared to male children.

Socioeconomic status and household characteristics also exerted differential effects from epidemiological outcomes. Children of mothers from poorer and middle wealth quintiles exhibited a significantly reduced risk of fever relative to those from the poorest household in 2011 (with marginal reduction of 6 and 5 percentage points, respectively), a trend largely preserved in 2018 aside from the poorer category. Additional covariates, besides maternal marital status (married versus single), birth order (≥ 3 compared to single child), and female child gender, were associated with a reduce probability of fever occurrence. Regarding the religious from moslem and animist household in 2011 showed a 7.4 percentage point higher and 9.6 percentage point lower probability of fever incidence, respectively, compared to Catholic households; by 2018, only

Moslem household residency retained a significant positive differential risk (approximately 4 percentage points). Work status revealed that children of unemployed mothers experienced a lower probability of fever incidence (by approximately 3 percentage points) relative to those of employed mothers. This counterintuitive dynamic is attributable to greater maternal time allocation flexibility among unemployed women facilitating compliance with ANC schedules and supervisory health monitoring, whereas formal labour market constraints often impede timely emergency care-seeking and prenatal attendance.

5.0 Conclusion

This study evaluates the effect of prenatal healthcare utilization- specifically ANC and skilled delivery attendance-on the incidence of fever among children under-five in Cameroon. Utilizing data from the 2011 and 2018 CDHS cycles within a logistic regression framework controlling for maternal age, regional fixed effects, urban-rural residence, education, household wealth index, marital status, birth order, child gender, religion, and work status of the mother, the empirical estimates indicate robust relationships.

Maternal age and place of residence exhibited no statistically significant relationship with fever occurrence, whereas remaining covariates demonstrated notable effects. Effective ANC utilization and skilled birth attendance substantially reduced the relative risk of childhood fever. In 2011, ANC utilization reduce fever incidence by 2.4 percentage points, while professional delivery assistance reduced fever incidence by up to 10 percentage points relative to unassisted cohorts. This protective effect amplified in 2018, where ANC utilization reduce fever risk by 4.2 percentage points and SBA increased the probability of remaining fever free by 32.5 percentage point.

These findings underscore the necessity of targeted public health interventions: government policy should expand prenatal healthcare sensitization across urban and rural zones, optimize rural ANC infrastructures, and harmonize or subsidize institutional delivery fees to reduce financial barriers across heterogeneous socioeconomic backgrounds.

REFERENCES

- Alderman, H. and Behrman, J. R. (2004). Estimated economic benefits of reducing low birth weight in low income countries. *HPM discussion paper*. Washington DC: The World Bank.
- Awiti J.O. (2014). A Multilevel Analysis of Prenatal Care and Birth Weight in Kenya. *Health Economics Review* 4(1)
- Barros, A. J. D, Wehrmeister, F.C, Ferreira, L.Z, et al., (2020). Are the poorest poor being left behind? Estimating Global Inequalities in Reproductive, Maternal, Newborn and Child Health. *BMJ Global Health*. 2020;5: e002229.Pp 1-9.
- Bartley, M. (2004). Health Inequality: An Introduction to Theories, Concepts and Methods. Cambridge: Polity Press. of maternal and child health services in Metro Cebu, the Philippines. *Health Transition Review* 3(1):77-89.
- Belay, T. (1997). Correlates of antenatal care attendance among women in Yirgalem town and surrounding peasant associations, Southern Ethiopia (thesis).

- Currie, J. and Moretti E. (2003). Mother's education and the intergenerational transmission of human capital: evidence from college openings, *Quarterly Journal of Economics*, 118:1495- 1592.
- Eller, A.G., Branch, D.W. & Byrne, J.L. (2006). Stillbirth at Term. *Obstetrics and Gynecology*, 108(2), 442-447.
- Fagbamigbe, A. F. and Idemudia, E. S. (2016). Wealth and antenatal care utilization in Nigeria: Policy implications, *Health Care for Women International* Retrieved from <http://www.tandfonline.com/action/journalInformation?journalCode=uhcw20>.
- Figueiredo, K. M. S., Gonçalves, G. A. A., Batista, H. M. T., Akerman, M., Pinheiro, W. R., & Nascimento, V. B. (2018). Actions of primary health care professionals to reduce maternal mortality in the Brazilian Northeast. *International Journal for Equity in Health* 2018 17:1, 17(1), 1–8.
- Fiori, K. P., Lauria, M. E., Singer, A.W., Jones, H. E., Belli, H. M., Aylward, P. T., et al. (2022). An Integrated Primary Care Initiative for Child Health in Northern Togo.
- Green, W.H. (2003). *Econometric Analysis*, Pearson Education, Upper Saddle River, NJ.
- Grossman, M. (1972b). *The Demand for health: A theoretical and empirical investigation*, Columbia University Press for the National Bureau of Economic Research, New York.
- Gujarati, D. N. (2004). *Basic Econometrics*, 4th ed McGraw-Hill. See Chapter 15, The Linear Probability Model.
- Hadi, A. (2003). Management of acute respiratory infections by community health volunteers: experience of Bangladesh Rural Advancement Committee, *Bulletin of World Health Organization* 81:183-189.
- Janz, N. K., & Becker, M. H. (1984). The health belief model: A decade later. *Health Education & Behaviour*, 11, 1–47.
- Jolly, M., Sebire, N., Harris, J., Robinson, S. and Regan, L. (2000). The Risks Associated with Pregnancy in Women 35 Years or Older. *Health Reproduction* 15(11): 2433-2437.
- Khare, S. (2021). Impact of women's education on decision making regarding their children affairs. *J. Sci. Res.* 65, 144–149.
- Kickbusch, I. (2012). 21st century determinants of health and wellbeing: a new challenge for health promotion. *Global Health Promotion*, 19(3), 5-7.
- Koblinsky, M. D., Moyer, C. A. P., Calvert, C. P., Campbell, J. M. P. H, Campbell, O. M. R. P., Feigl, A. B. P. (2016). Quality maternity care for every woman, everywhere: a call to action. *The Lancet* (British edition)
- Lambon-Quayefio, M. P. and Owoo, N. S. (2014). Examining the Influence of Antenatal Care Visits and Skilled Delivery on Neonatal Deaths in Ghana. *Applied Health Economics and Health Policy* 12(5):511- 22.
- Lleras-Muney, A. (2005). The Relationship between Education and Adult Mortality in the United States. *Review of Economic Studies*, 72(189-221)
- Madise, N. J. (2003). Infant Mortality in Zambia: Socio-economic and demographic Correlates. *Social biology* 50: 148-166.

- Martin-Vivaldi, M. *et al.* (2009). Antimicrobial chemicals in hoopoe preen secretions are produced by symbiotic bacteria. *Proc. R. Soc. B-Biol. Sci.* 277: 123–130.
- McCrary, J. and Royer, H. (2006). The Effect of Female Education on Fertility and Infant Health: Evidence from School Entry Policies Using Exact Date of Birth. *National Bureau of Economic Research Working Paper No.* 12329.
- Meh, C., Thind, A., Ryan, B., & Terry, A. (2019). Levels and determinants of maternal mortality in Northern and Southern Nigeria. *BMC Pregnancy & Childbirth.* 19, 417 (2019). <https://doi.org/10.1186/s12884-019-2471-8>.
- Mustafa, H. (2003). Socioeconomic Determinants of Infant Mortality in Kenya: Analysis of Kenya DHS 2003, *Journal of Humanities and Social Science*, 2: 1934-722.
- Mwabu, G. (2009). The Production of Child Health in Kenya: a structural model of birthweight. *Journal of African Economies* 18 (2): 212 – 260.
- Obasola, O. I., & Mabawonku, I. M., (2018). Mothers’ perception of maternal and child health information disseminated via different modes of ICT in Nigeria. *Health Information & Libraries Journal*, 35(4), 309-318.
- Okonji, O.C., Nzoputam, C. I., Ekholuenetale, M., Okonji, E. F., Wegbom, A. I., Edet, C. K. (2023). Differentials in Maternal Mortality Pattern in Sub-Saharan Africa Countries: Evidence from Demographic and Health Survey Data. *Women* 2023, 3 175–188. <https://doi.org/10.3390/women3010014>
- Panpanich, R. and P. Garner (2000). “Growth monitoring in children.” *Cochrane Database System Rev* (2): CD001443.
- Pongou, R. (2013). Why is Infant Mortality Higher in Boys than in Girls? A New Hypothesis Based on Preconception Environment and Evidence from a Large Sample of Twins. *Demography* 50: 421–444.
- Shikoya, I. O., & Senbanjo, I. O. (2008). Mother education to be a strong and enduring determinant of the incidence of diarrhea among children below 12. *Journal Tropical paediatrics/ Nigeria Medical Journal*, 54(2), 112-118.
- Shikuku, D. *et al*, (2020). “Early indirect impact of COVID-19 pandemic on utilization and outcomes of reproductive, maternal, newborn, child, and adolescent health services in Kenya,” *medRxiv* (2020) Preprint.
- Tambi, D. M. (2022). Health Status of Under-Five-Children and Tetanus Toxoid. *Journal of Global Economics*, Vol. 10(5); pp 3-10
- United Nations inter-agency Group for child Mortality Estimation (UN IGME). (2017). Levels & Trends in child mortality: repport 2017.
- UNICEF (2018). Child Mortality Statistics. UNICEF. Retrieved 4 April 2018.
- Wehby, G. L., Murray, J. C., Castilla, E. E. (2009). Quantile Effects of Prenatal Care Utilization on Birth Weight in Argentina. *Health Economics* 18(11): 1307–1321.
- World Health Organisation. (2011). The world health report 2003: shaping the future. World Health Organisation.

- Wulifan, J. K., Dordah, A. D., & Sumankuuro, J. (2022). Nomadic pastoralists' experience accessing reproductive and maternal healthcare services in low and middle-income countries: A contextual scoping review. In *Pastoralism*. <https://doi.org/10.1186/s13570-022-00261-5>.
- World Health Organization (2009). *Diarrhoea: Why children are still dying and what can be done*. Retrieved from <http://en.wikipedia.org/wiki/Diarrhea>.
- Yi, B., Umuhoza, S. M. and Ataguba, J. E. (2011). Inequalities in health and health risk factors in the Southern African Development Community: Evidence from World Health Surveys, *International Journal for Equity in Health*, 17(1), 1-12.
- Zhang, W., Woodcock, S., Anis, A. H., (2017). Valuing Productivity Loss due to Absenteeism Firm-Level Evidence from a Canadian Linked Employer-Employee Survey. *Health Economics Review* 7 (3)