Inequalities in children's survival in Cameroon: the influence of the mother's socioeconomic status

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Abstract

Few researches on determining factors of children mortality took into account the potential contribution of the mother's status influence. Moreover, most of previous studies focused exclusively on the mother's educational level and her economic activity. These approaches did not consider the multidimensional nature of the mother's status. In this paper, we construct a combined indicator of this variable using eight other variables to analyse its influence on children survival in Cameroon. The Kaplan-Meier survival estimates and the discrete-time logistic regression highlight a statistically significant and positive relationship between the chances of survival of children and the mother's status. Overall, a high status of the mother, a preceding birth interval greater than 24 months and a delivery within 20-34 years contribute to increase the chances of survival of children, all things being equal. Therefore, the improvement of children survival passes through the enhancement of mothers' and fathers' educational level, the empowerment of mothers and fathers, the implementation of programs of family planning so as to encourage births spacing within couples and the reinforcement of programs of poverty alleviation. All these measures should focus more on Muslims communities, living in rural areas of the northern part of the country.

Key words: Mother's status, Children's survival, Discrete-time survival analysis, Kaplan-Meier survival estimates, Health, Cameroon.

Introduction

Despite programs implemented by public authorities to improve the health situation of children in Cameroon, the infant mortality rate remains high. According to the National Institute of Statistic (2012), about one child out of eight dies in Cameroon before reaching the age of five. This finding shows that these programs alone are not sufficient to improve the health status of children. They require the participation of all members of the community, particularly women, since women's active participation in health programs is of paramount importance to ensure their effectiveness (Rakotondrabe 2004). Thus, researches aimed at improving knowledge on the determinants of children's health are placing more and more importance to the characteristics of the mother and her status in particular. Indeed, researchers' interest seems more and more focused on the relationship between the status of mothers and children mortality. This interest may be justified by the preponderant and even crucial role played by mothers in the health of their children. Rakotondrabe (2004) reinforced this point of view by highlighting that variations in children mortality depend on the status of mothers. In addition, (Boehmer & Williamson 1996), point out that there is an inverse relationship between the status of mothers and infant mortality rate. As a matter of fact, mothers' status, their autonomy, their social class and their education significantly influence the children's survival as well as others demographic phenomena (Das Gupta 1990; Dormor 1994). In addition, studies show that the intermediate determinants of children mortality are related to economic, social and cultural characteristics of women that influence their health behaviours towards their children (Rakotondrabe 2004).

However, despite the importance of women status in the explanation of children's health, earlier studies did not fully take into account all the dimensions of this variable. These studies only measured the women status by their economic activity and their educational level. Such approaches did not consider the multidimensional nature of this variable (Rwenge 2007). The first approach taking into account the multidimensional nature of women status is based on the theory of the seven roles of women highlighted by (Oppong 1986). According to this author, women can have seven roles in all social groups: roles related to their status as mothers, workers, spouses, caretakers, family members and members of the community. This approach has the advantage of considering relevant indicators of the status of women not taken into account in previous studies. However, while the theory of the seven roles seems relevant for a better view of the influence of mother's status on children survival, the fact remains that this theory has some limitations. As a matter of fact, some important indicators

of the socioeconomic status of mothers, especially those related to the husband or partner are not considered in this theory. Studies show that the economic activity of the husband and its educational level are part of the mother's status and are of great importance as far as children survival is concerned (Rakotondrabe 2004). Therefore, an approach including indicators related to mothers as well as those related to their husbands or partners is needful to have a better understanding of the influence of this variable on the survival of children. The purpose of this paper is to highlight the influence of the mother's socioeconomic status on the risk of death of children under five, as well as some intermediate factors which are likely to determine children survival in Cameroon. More specifically, we aim to contribute to a better understanding of differentials in risk of death among children according to their mothers' status.

1. Background

Before we present some theoretical approaches of the relationship between woman's status and the survival of children, let us take a look at some of the definitions of woman's status. The status of woman is a difficult concept to grasp. According to Mason (1986), this concept is often confused with that of gender inequalities, which presents a distorted image of social reality since men are treated as the point of reference and women like others who deviate from this reference. For this author, the status of women should refer to differences in power, prestige and resources between women rather than to gender inequality. Several terms including the emancipation of women, women's empowerment, gender equality and access to resources were used in the literature to define the woman's status (Kishor & Neitzl 1997). Despite the multidimensional nature of the woman's status, this concept can be examined through different factors. Socioeconomic, social and demographic characteristics are most used to describe the situation of women in the society (Mahmoudian 2005).

The economic power of women is the most powerful predictor of the overall status of women (Blumberg 1984). According to Blumberg (2005), woman's economic power is defined as woman's control over income and other key economic resources such as land and animals. In fact, the improvement of women's economic power is almost like a magic potion that boosts gender equality and economic development of nations (Blumberg 2005). Furthermore, this power depends on the process of economic development of a country that has a profound impact on the economic status of women (Boehmer & Williamson 1996). As a result, there is a reciprocal relationship between the economic status of women and the level of economic development of a country.

From a social perspective, the status can be defined as the position occupied by an individual in the society. This position is determined by the function exercised by the individual in the community. Moreover, this position depends on the role to which each individual is constrained in the social system. According to Bazzi-Veil (2000), the woman's status refers to the woman's condition, the woman's situation in relation to society, the fact of being a woman. For this author, the social status recognized to the woman is that of wife and mother, any traditional or domestic education of a girl is oriented towards this goal. This traditional and fragmented view of the social status of woman seems to give preeminence to her role as wife and mother. The study carried out by Assogba (1990) in the Gulf of Benin adds to this narrow view of the status of woman a demographic variable that plays an important role in her status: her age. According to this author, the age of the woman, her capacity to procreate, her social class of belonging, her economic activity are attributes that contribute to valorize or not her position in the society. Furthermore, Rakotondrabe (2004), defines the woman's status as a polysemic concept that refers to a social position that provide her with some kind of prestige in the society and which conditions her access to resources, her faculty to control those resources and the use of a power or a possibility to partake in decision making within the household. In this paper, we define the woman's status as a social position in which the woman is more empowered, more likely to control economic resources and have a greater power in decision making.

Several explanatory approaches have been used in the literature to highlight the relationship between children survival and mother's status. Some lay emphasis on socioeconomic variables, while others focus on sociocultural and/or demographic variables. On the one hand, according to advocates of economic approach, the health status of children is largely dependent on the economic status of mothers and their households (Rakotondrabe 2004). This approach is based on the assumption that the child survival is largely determined by social and economic resources of the family (Mosley & Chen 1984). Among the variables used in this approach, we have: the economic activity of the mother and/or the economic activity of the father. Empirical studies on the relationship between the mother's economic activity and the survival of children highlight divergent points of view. For some authors, the level of child mortality among parents who are not working is higher than the one observed among working parents (Dackam 1990; Akoto 1994; Rakotondrabe 2004). In addition, the influence of parents' economic activity on children survival depends on the sector of activity. Indeed, children of executives and senior technicians are generally less likely to die than those whose

parents work in agriculture (Akoto 1994). Unlike this finding, a study conducted in India by Sivakami (1997), reveals that the risk of death of children born from a mother who works is higher than the one of children whose mother is inactive. Furthermore, studies show that a favourable socioeconomic status of the household positively influences children survival (Joshi 1994; Banza 1999).

On the other hand, the sociocultural approach is based on the educational level of the mother, her religion, her ethnicity, her participation in decision making within the household and the educational level of the father to explain children mortality trends (Das Gupta 1990; Dackam 1990; Hobcraft 1993; Joshi 1994). The educational level of the mother is an essential component of her status which has a determining effect on the survival of children (Rakotondrabe 2004). Most of the empirical studies highlight a negative relationship between the educational level of the mother and the risk of children (Dackam 1990; Akoto 1994; Ouedraogo 1994). The educational level of the father also plays a crucial role on children mortality. As a matter of fact, studies emphasise a positive and statistically significant relationship between the educational level of the father and the survival of children (Joshi 1994; Zourkaléini 1997; Banza 1998). The ethnicity of the mother, as an indicator of her culture, plays a key role in children mortality (Akoto 1994; Rakotondrabe 2004). Indeed, according to Akoto (1994), cultural traditions, norms and practices affect children mortality through the behaviours, the attitudes and beliefs they induce to individuals. Thus, the cultural practices inherent to different ethnic groups largely determine the survival of children. However, these practices cannot overshadow the role of contextual and bio demographic factors which seems to play an undeniable role in children survival.

As a matter of fact, studies show that children mortality varies according to the place of residence (Akoto 1994; Rakotondrabe 2004; Adébiyi 2011). Children mortality is higher in rural areas than urban ones (Akoto 1994). In fact, children living in rural areas of Cameroon are 16% more likely to die before their fifth birthday than those living in urban areas (Adébiyi 2011). This trend could be explained by the fact that children living in urban areas have potential health benefits due to a greater accessibility to health services and the presence of numerous socioeconomic infrastructures (Adébiyi 2011). The same point of view is shared by Zourkaléini (1997), when he claims that living in an under-equipped and/or unhealthy environment can increase the risk of death of children. According to this author, the significant variations in the children mortality could be explained by the place of residence, which directly affects the chances of survival of children.

Furthermore, trends in children mortality might be explained by the bio demographic approach which uses the biological and demographic characteristics of children and mothers. Indeed, for physiological reasons, boys and girls are not born with the same chances of survival. Nature seems to favor girls by exposing them to lower mortality. In general, excess male mortality is higher during the neonatal period and is maintained throughout childhood, whereas, there is excess female mortality during the interval 12-24 months. However, there are no significant differences in mortality in the post-neonatal period and within 24-59 months (Zourkaleini 1997). Among biological factors that may affect children survival, the birth weight plays a very important role. According to Barbieri (1991), the birth weight is an excellent indicator of the physiological potential of children. According to this author, for each cause of death, infant mortality is significantly higher for children weighing less than 2.5 kilograms at birth. Moreover, many studies also point out the negative relationship between children survival and birth order. As a matter of fact, the risk of children mortality is generally higher among children of high birth order (Banza 1998; Barbieri 1991). Also, the study of Banza (1998) reveals that children of high birth order (6 and more) are less likely to survive than their counterparts with a birth order within 2 to 5. Nevertheless, the firstborns seem to have a greater risk of death than others when their mother is too young at their delivery. On the other hand, they seem to be favoured in terms of survival because, they may benefit from a better maternal health care compared to the others (Rakotondrabe 2004). In addition, a high birth order usually corresponds to an advanced age of the mother (35 years and more) and to a relatively short interval between births (less than 24 months) which are likely to increase the risk of death of children (Zourkaléini 1997; Banza 1998; Lachaud 2002). However, the risk of death of children differs depending on whether they are twins or not. According to Zourkaléini (1997), the mortality of multiple births remains significantly higher than that of single births at all ages of childhood. In fact, cultural as well as biological factors play a significant role in the excess mortality of twins (Barbieri 1991; Zourkaléini 1997; Banza, 1999).

In this paper, we use an approach that tries as much as possible to take into account all the approaches involved in the studies related to children survival and mother's status. It takes into account socioeconomic, sociocultural and bio demographic variables to explain the relationship between the mother's status and the survival of children, without pretending to be exhaustive. To this end, we have built a combined indicator for the mother's status using some variables found in the literature.

2. Data and Method

The data used for this study is the Demographic and Health Survey (DHS) of Cameroon carried out by the National Institute of Statistics in 2011. The dataset used is made up of informations concerning children born within the last five years preceding the survey. The population of our study is made up of children under five, born from mothers in couple. They are 10381 and 916 of them are dead before the age of five. Generally, despite problems of omission of events, inaccuracy of informations and errors on ages and dates, data collected during DHS are relevant and of good quality for studies related to children mortality (Tabutin 2006; Pullum 2006).

2.1. Dependent variable

The dependent variable of our study is the risk of death of children aged 0-59 months, measured by the duration of survival (in months) of children. This duration is defined as the interval time between a child's birth and its death or censoring. It is either observed, either censored by the date of the survey. A dummy variable c_i indicates whether there is a censoring or not. It is equal to 0 if the child $i's$ survival duration is censored and 1 otherwise. The event indicator y_{ij} indicates whether a death occurred for an individual i in a time period j. It takes the value 0, if the child i did not die in period j and 1 if he died in period j.

2.2. Independent variable

The main independent variable is the mother's socioeconomic status. In the rest of the document, it is simply referred to as mother's status. It is a multidimensional concept which can be implemented using different approaches. Within the framework of this paper, its construction takes into account variables that emerge from the literature review and the ones that are considered in its definition. However, we should acknowledge as (Akaldie 1997) that there is not a unique indicator which could summarize all the dimensions of the mother's status. In this paper, it is a combined indicator constructed via the Principal Component Analysis (PCA) using eight variables: the mother's educational level, the father's educational level, the mother's sector of economic activity, the father's sector of economic activity, the mother's age, her participation in decision making within the household, her religion and her parity. It comprises three categories: *"Poor status"*, "*Medium status"* and "*High status"*. The table below shows the characteristics of mothers according to their status.

Table 1: Characteristics of mothers according to their status

Variables/categories	Mother's status		
	High status	Medium status	Poor status
Mother's educational level			
No level	0.3%	15.2%	76.5%
Primary	24.5%	70.8%	22.7%
Secondary and above	75.2%	14.0%	0.8%
Husband's educational level			
No level	0.3%	8.6%	64.2%
Primary	13.4%	57.6%	33.6%
Secondary and above	86.3%	33.8%	2.2%
Mother's sector of activity			
Inactive	26.7%	19.6%	31.3%
Modern sector	42.2%	20.7%	14.3%
Traditional sector	31.0%	59.8%	54.4%
Father's sector of activity			
Inactive	2.6%	1.2%	0.5%
Modern sector	52.2%	18.2%	13.3%
Traditional sector	45.2%	80.6%	86.1%
Mother's religion			
Christian	95.2%	73.1%	24.2%
Muslim	3.2%	20.4%	60.7%
Animists and others	1.7%	6.5%	15.1%
Parity			
1	16.6%	9.2%	6.4%
2-5	73.9%	66.2%	47.8%
6 and more	9.5%	24.6%	45.7%
Participation in decision making			
Yes	56.0%	30.7%	15.0%
No	44.0%	69.3%	85.0%
Mother's age			
15-24 years	30.4%	34.0%	27.8%
25-34 years	54.9%	50.4%	44.3%
35 years and more	14.7%	15.6%	27.9%

This table highlights differences in terms of characteristics from one status to another. As far as educational level is concerned, most of high-status mothers (75.2%) as well as their husbands or partners (86.3%) have attained at least a secondary level. While, medium and poor-status mothers, as well as their husbands or partners mostly have a primary and no educational level respectively. In addition, high-status mothers and their husbands or partners are mostly found in the modern sector of economy, whereas others mostly exercise in the

traditional sector. Moreover, most of high-status and medium-status mothers are Christians (95.2% and 73.1% respectively) whereas most of poor-status mothers are Muslims (60.7%). This last set of mothers mostly has a relatively high parity compared to high-status mothers. Furthermore, most of poor-status mothers do not take part in decision making within their couple (85%).

2.3. Others variables

Taking into account the availability of variables in our dataset, we have considered three groups of factors to measure the effect of mother's status on the risk of death of children. These groups comprise: the socioeconomic and cultural factors as well as the bio demographic ones. Among the socioeconomic and cultural factors we take into account: the region of residence, the place of residence, the ethnic group of the mother and the standard of living of the household. Among the demographic factors we consider: the mother's age at delivery, the preceding birth interval, the child's age, its gender, its birth order, its birth weight and the type of birth.

2.4. Methods

In this paper, we use survival analysis to determine the effect of the mother's status on the duration of survival of children under five. This method is suitable for the study of events that occurred in the course of the time and studies related to censored data (Courgeau & Lelièvre 2003 ; Singer & Willet 2003 ; Cleves & al. 2004).

Descriptive analysis is performed using the Kaplan-Meier survival curve. This graph estimates the survival probability of children in the course of time (Singer & Willet 2003). In other words, it indicates the proportion of surviving children that have not yet experienced the event of interest. To compare the survival distributions, the logrank test and the Wilcoxon test are performed to check whether differences in the proportion of surviving children according to mother's status are statistically significant (Hill & al. 1996).

Multivariate analysis are performed via the discrete-time logistic regression model. This approach enables to explore the relationship between time or other covariates and hazards, it facilitates examination of the shape of hazard function. It is also possible to postulate and fit smooth, reasonable models of baseline hazard and incorporate time-varying covariates as well as interactions between time and predictors (Allison 1982; Singer & Willet 1993; Steele & Washbrook 2013). Prior to analysis, the person-oriented dataset has been converted into a

person-period dataset in which each individual has multiple records, one per time period of observation. The model is characterized by the following relationship:

$$logit\left(\frac{h_{it}}{1-h_{it}}\right) = \alpha D_{it} + \beta X_{it}$$

Where h_{it} is the conditional probability that the ith child die during a time period t given that the event has not yet occured, $D_{it} = (D_{1it}, D_{2it, \ldots}, D_{Jit})$ is a vector of dummy variables indexing time period t with coefficients $\alpha = (\alpha_1, \alpha_2, \ldots, \alpha_J)$ representing the baseline hazard function, $X_{it} = (X_{1it}, X_{2it, \ldots}, X_{kit})$ is a vector of constant or time-varying covariates with regression coefficients $\beta = (\beta_1, \beta_2, \ldots, \beta_k)$. J refers to the last time period observed for any individual. In our model, the time analysis has been divided into intervals representing time periods as follows: 0-11 months, 12-23 months and 24-59 months. The risk of death is assumed to be constant within each interval making our model a *piecewise contant* one (Allison 1982; Singer & Willet 1993; Steele & Washbrook 2013).

Multivariate analysis is carried out using Stata 12 statistical software which is appropriate for survival analysis.

3. Results

The Kaplan-Meier survival curve (Figure 1), highlights a differential in terms of duration of survival according to mother's status. In every month, the profile for high-status mothers is higher relative to its location for medium and poor-status mothers. That is, in every month, children from poor-status mothers are at greater risk of death than their counterparts from medium and high-status mothers. In other words, the proportion of surviving children from high-status mothers remains superior at all age (0-59 months) to the one of their homologues from medium and poor-status mothers. This result highlights a difference in level of risk between each category of the mother's status. This difference is significant at 1% level (Log-rank test=86.11; p-value=0.0000 and Wilcoxon test=67.88; p-value=0.0000). As a matter of fact, at 59 months, roughly 93% of children from high-status mothers are still surviving, whereas, this percentage is estimated at 90% and 84 % for children from medium and poor-status mothers respectively.
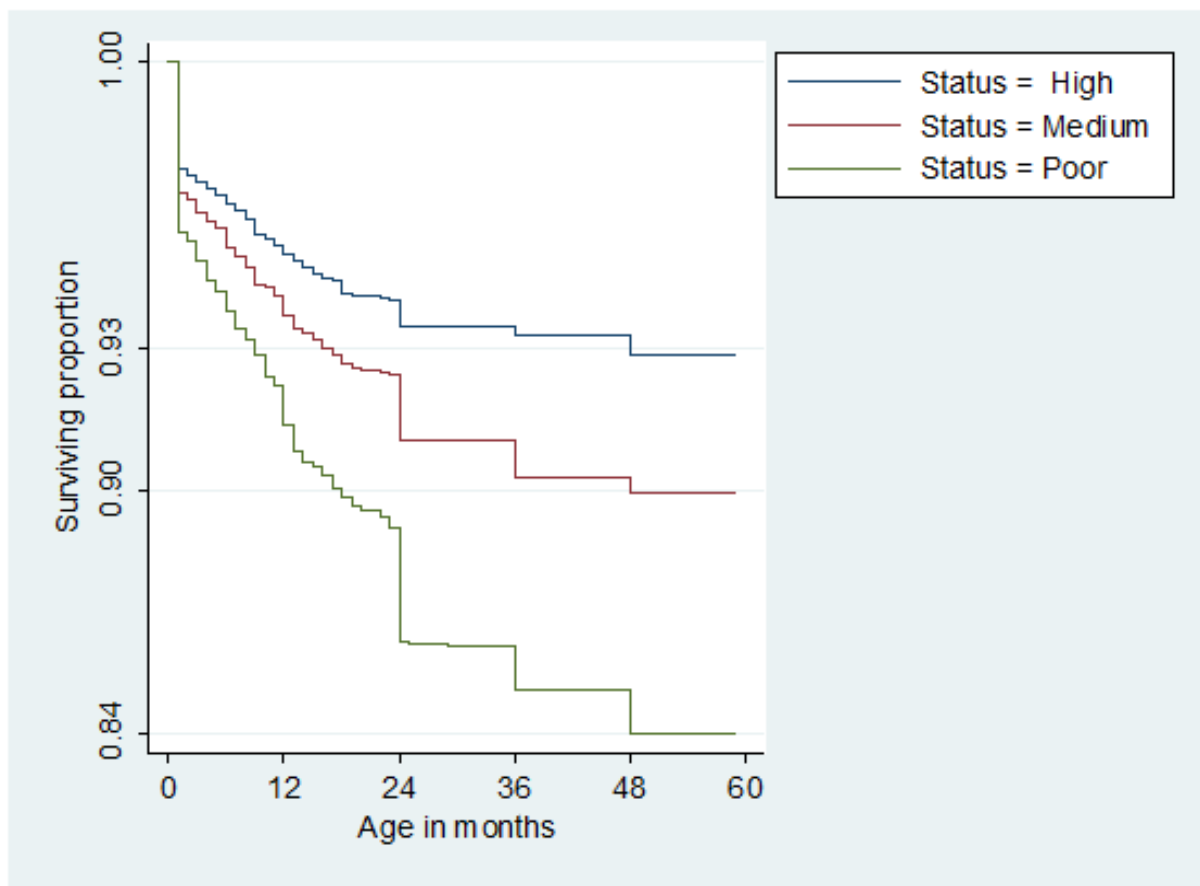
Figure 1: Kaplan-Meier survival estimates according to mother's status

Whatever the mother's status, the risk of death is highest in the first month and declines over time. After the first month, the periods during which a child is most likely to die are: 12, 24, 36 and 48 months. Except the rapid drop observed during the first month, the survival curve is characterized by a steady and rapid decline before the age of 24 months and a slow drop after that age, regardless the mother's status. Overall, the risk of death is relatively low for children from high-status mothers compared to their counterparts from medium or poor-status mothers. This advantage is due to contextual, socioeconomic conditions and reproductive behaviours characterizing high-status mothers. Table 2 below shows the distribution of the sample by independent variables according to mother's status.

Table 2: Distribution of births by independent variables according to mother's status

Variables/categories	p-value[a]	Mother's status		
		High status	Medium status	Poor status
Region of residence	0.000			
Adamaoua/North/Far-North		11.3%	38.6%	83.7%
Centre/South/East		37.8%	20.7%	4.5%
Littoral/West		36.4%	21.6%	8.8%
North-West /South-West		14.5%	19.1%	3.1%
Place of residence	0.000			
Urban		69.7%	33.6%	17.9%
Rural		30.3%	66.4%	82.1%
Ethnic group	0.000			
Semites/Hamates/Sudanese		12.5%	40.2%	84.3%
Betis and other Bantus		34.1%	16.5%	2.0%
Bamileke		47.4%	35.8%	10.1%
Pygmies/Foreigner		5.9%	7.5%	3.6%
Standard of living	0.000			
Poor		14.5%	49.7%	75.7%
Medium		17.9%	25.4%	15.7%
High		67.6%	24.9%	8.7%
Mother's age at delivery	0.000			
12-19 years		12.4%	15.8%	16.5%
20-34 years		78.0%	74.1%	63.6%
35 years and more		9.6%	10.1%	19.9%
Birth interval	0.000			
Less than 24 months		18.6%	19.9%	25.1%
24-36 months		37.0%	42.7%	40.9%
37 months and more		44.3%	37.4%	34.0%
Weight at birth	0.000			
Less than de 2.5 kg		6.8%	4.6%	1.7%
2.5-3.96 kg		63.7%	40.2%	14.7%
4 kg and more		29.4%	55.3%	83.6%
Birth's order	0.000			
Rank 1		26.5%	17.8%	12.8%
Rank 2 to 5		66.1%	62.5%	47.8%
Rank 6 and more		7.4%	19.7%	39.3%
Sex of the child	0.878			
Male		49.3%	49.0%	48.7%
Female		50.7%	51.0%	51.3%
Type of birth	0.010			
Single		95.5%	95.1%	96.6%
Multiple		4.5%	4.9%	3.4%
Child's age	0.063			
0-11 months		21.8%	20.4%	20.7%
12-23 months		21.1%	21.1%	19.0%
24-59 months		57.1%	58.5%	60.2%

Note: (a) Based on the Chi-square test.

As illustrated in the table above, except the child's gender and its age, the association between the mother's status and all the other variables is statistically significant. Children from high-status mothers are favoured by the living environment, the standard of living of the household and the reproductive behaviours of their mothers. As a matter of fact, high-status mothers are mostly located in urban areas (69.7%) while their counterparts with poor status are mostly found in rural areas (82.1%). In addition, poor-status mothers are almost all located in the northern part (Adamaoua, North and Far-North regions) of the country (83.7%). Furthermore, high-status mothers are mostly found in richest households (67.6%) whereas poor-status mothers are found in majority in poorest ones (75.7%). As far as mother's behaviour is concerned, poor-status mothers are more likely to give birth at younger and older ages compared to the others. Indeed, the proportion of poor-status mothers giving birth at less than 20 years and more than 35 years ages is 4.1% and 10.3% respectively greater than the one of high-status mothers. Moreover, high-status mothers are more likely to have children with higher birth interval than others. In addition, poor-status mothers seem to have a high parity compared to their counterparts with high status. As a matter of fact, children with high birth order (6 and more) are 5.3 times more in this group of mothers than the ones from high-status mothers (39.3% against 7.4%).

Although bivariate analysis provides strong evidence supporting the sense of the relationship between mother's status and the risk of death of children, we need to be concerned with the real effect of explanatory variables on the risk of death of children before the age of five. Multivariate analysis highlights gross and net effects of each of these variables on the risk of death of children under five. To this end, Table 3 and Table 4 have been constructed.

Table 3: Gross effect of independent variables on the risk of death of children 0-59 months

Variables/categories	Odds ratio	p-value
Mother's status		
High status	0.450	0.000
Medium status	0.645	0.000
Poor status	1.000	Ref[a]
Child's age		
0-11 months	2.33	0.000
12-23 months	1.591	0.000
24-59 months	1.000	Ref
Mother's age at delivery		
12-19 years	1.201	0.037

20-34 years	1.000	Ref
35 years and more	1.053	0.614
Birth interval		
Less than 24 months	1.781	0.000
24-36 months	1.000	Ref
37 months and more	0.812	0.015
Weight at birth		
Less than de 2.5 kg	1.171	0.276
2.5-3.96 kg	0.564	0.000
4 kg and more	1.000	Ref
Birth order		
Rank 1	0.938	0.481
Rank 2 to 5	1.000	Ref
Rank 6 and more	1.288	0.002
Sex of the child		
Male	1.071	0.307
Female	1.000	Ref
Type of birth		
Single	1.000	Ref
Multiple	2.867	0.000
Region of residence		
Adamaoua/North/ Far North	1.000	Ref
Centre/South/East	0.559	0.000
Littoral/West	0.474	0.000
North-West /South-West	0.556	0.000
Place of residence		
Urban	0.657	0.000
Rural	1.000	Ref
Ethnic Group		
Semites/Hamates/Sudanese	1.000	Ref
Betis and other Bantus	0.705	0.000
Bamileke	0.421	0.000
Pygmies/Foreigner	0.719	0.013
Standard of living		
Poor	1.000	Ref
Medium	0.678	0.000
High	0.540	0.000
Time period		
First period	4.258	0.000
Second period	1.511	0.000
Third period	1.000	Ref

Note: (a) indicates the reference category.

The table above shows that socioeconomic, cultural and bio demographic variables have a significant gross effect on the risk of death of children under five in Cameroon. As a matter of fact, except the gender of the child, results highlight a statistically significant effect at 5%

level between the risk of death of children and other variables. Compared to children from poor-status mothers, those from high and medium-status mothers have 55% and 35% more chances of survival respectively. The mother's age at delivery and the birth interval are also factors differentiating children in terms of survival. A low mother's age at delivery (less than 20 years) and a high age (35 years onwards) are associated to a risk of death of 20% and 5.3% higher than an age at delivery within 20-34 years. Compared to children born after a birth interval within 24-36 months, those born after a birth interval less than 24 months and those born after an interval of 37 months and more have a risk of death roughly 78% higher and 19% inferior. That is, the more the birth interval increases, the more the chances of survival of children are high. Other bio demographic variables such the child's weight at birth, the birth order and the type of birth have a statistically significant effect on the risk of death of children. We also notice differential risks of death according to the context of residence. Children residing in the northern part of the country are more likely to die before the age of five than their counterparts from other regions. Those residing in urban areas have 34% more chances of survival than their homologues form rural areas. The standard of living of the household is also a factor of differential risks of death of children under five. Children from households with high standard of living have 46% more chances of survival than their counterparts from poor ones. Last but not the least, the time period plays an undeniable role on the risk of death of children. Indeed, the risk of death of children is 4.26 and 1.5 times greater during the first and the second period of life respectively than the third one. Overall, these results highlight the various factors found in the literature likely to influence the risk of death of children under five in Cameroon. The purpose of this paper is to assess the effect of mother's status on the risk of death of children under five in presence of others variables. To this end, the table 4 has been constructed to emphasize the main effect of the various variables on the risk of death of children. First and foremost, let's check the proportional-odds assumption.
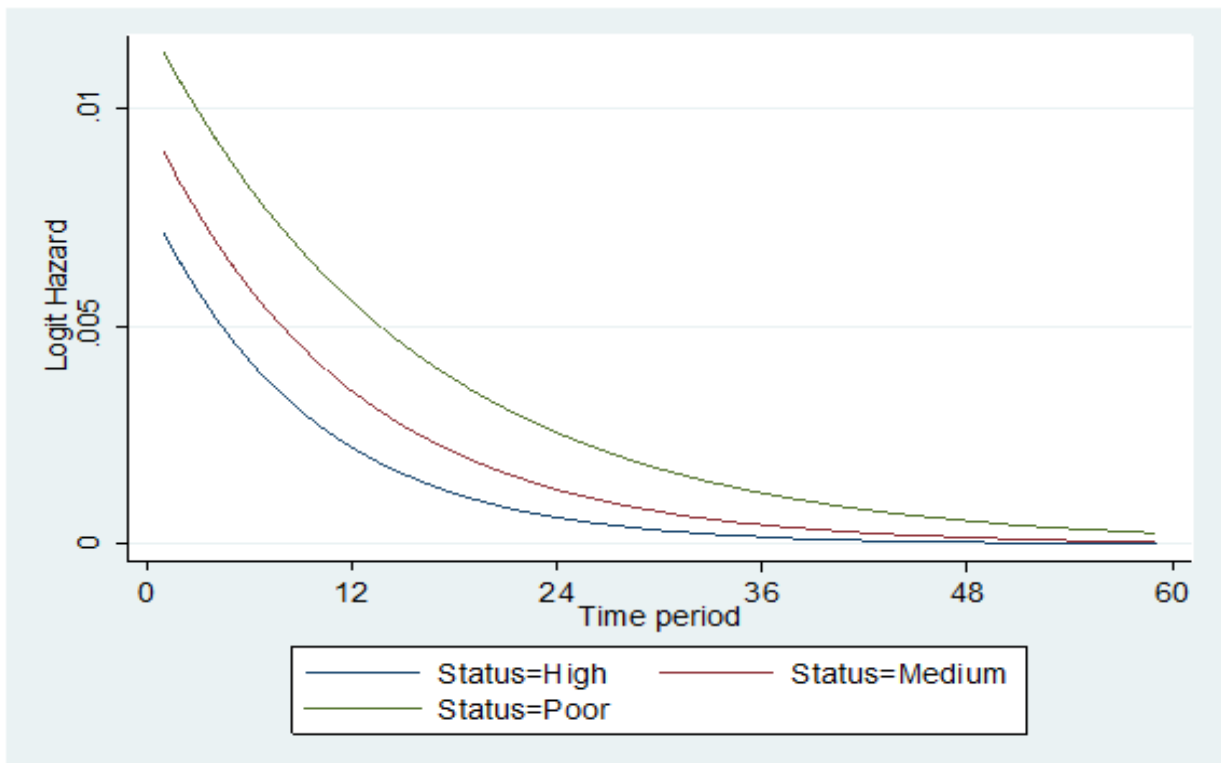
Figure 2: Fitted logit-hazard functions describing the risk of death of children by month according to mother's status
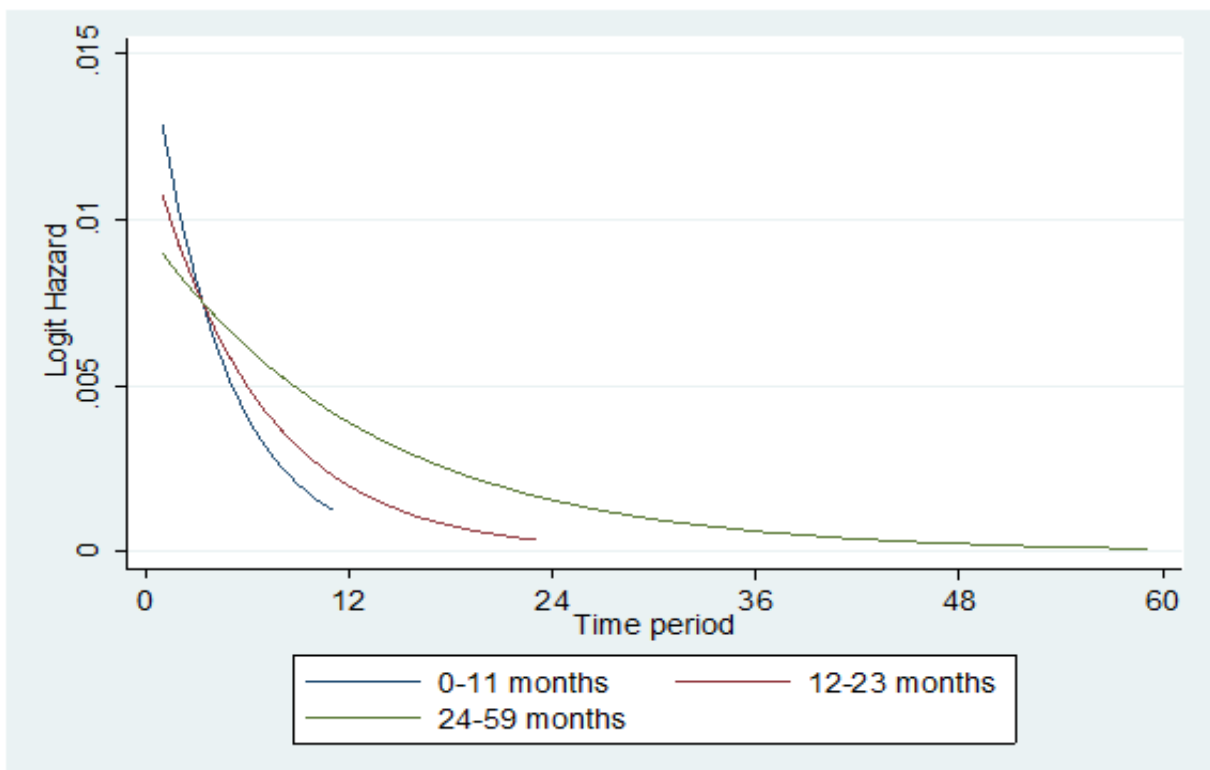

Figure 3: Fitted logit-hazard functions describing the risk of death of children by month according to child's age
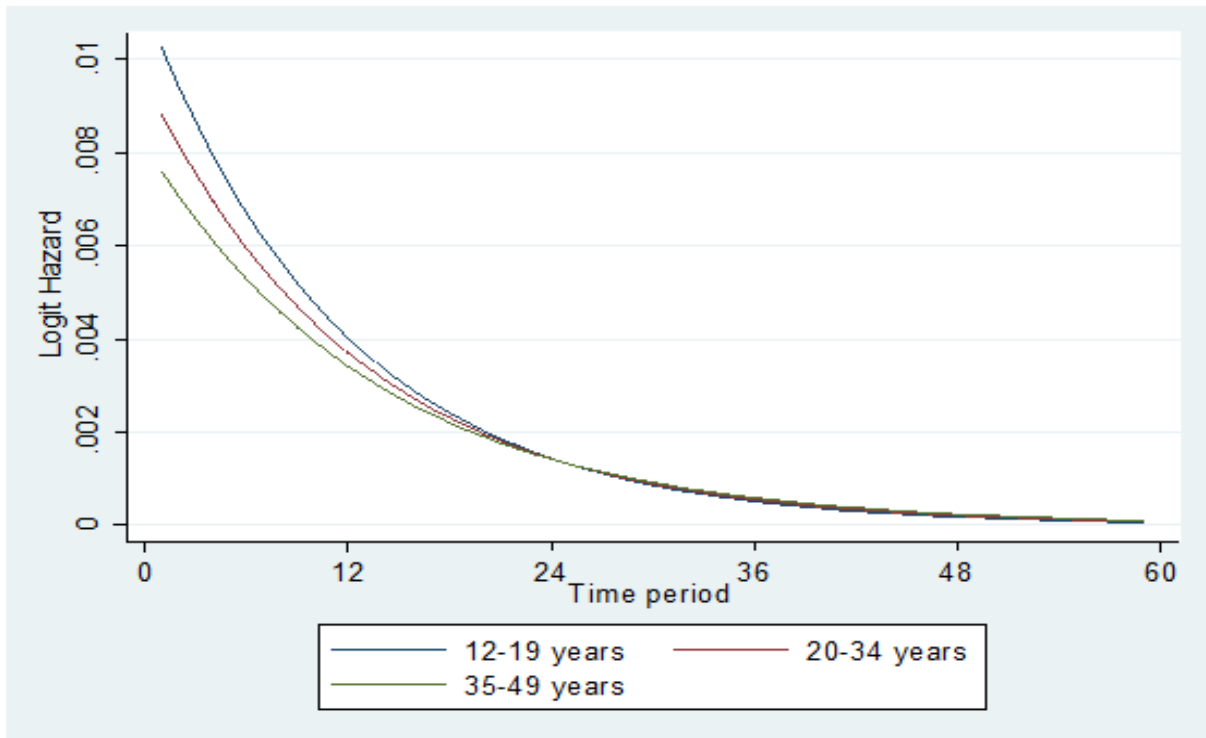
Figure 4: Fitted logit-hazard functions describing the risk of death of children by month according to mother's age at delivery

The proportional-odds assumption is met for a given variable when the logit-hazard functions representing categories of this variable are approximately parallels, with each pair having a constant vertical separation, if they are not, it is violated (Singer & Willet 1993). In other words, the fitted logit-hazard functions corresponding to different categories of a variable should have the same shape in case the proportional-odds assumption is met. Thus, regarding the shape the of hazard functions in Figure 2, Figure 3 and Figure 4 we conclude that the proportional-odds assumption is met for the mother's status and is violated for the child's age and mother's age at delivery. Consequently, interactions between time and these two latter variables are incorporated as predictors in our model along with the relevant main effects (Singer & Willet 1993; 1995). Note that, this procedure has been carried out for all our predictors. Except the child's age and the mother's age at delivery, the proportional-odds assumption is met for the other variables.

Table 4: Main effect of independent variables on the risk of death of children 0-59 months

Variables/categories	Model M1		Model M2		Model M3	
	Odds ratio	p-value	Odds ratio	p-value	Odds ratio	p-value
Mother's status						
High status	0.450***	0.000	0.503***	0.000	0.585***	0.000
Medium status	0.646***	0.000	0.676***	0.000	0.760***	0.004
Poor status	1.000	Ref	1.000	Ref	1.000	Ref
Child's age						
0-11 months	4.544***	0.000	4.749***	0.000	4.757***	0.000
12-23 months	1.692***	0.001	1.654***	0.002	1.668***	0.002
24-59 months	1.000	Ref	1.000	Ref	1.000	Ref
Mother's age at delivery						
12-19 years			1.818***	0.000	1.734***	0.000
20-34 years			1.000	Ref	1.000	Ref
35 years and more			1.217ns	0.240	1.247ns	0.188
Birth interval						
Less than 24 months			1.708***	0.000	1.695***	0.000
24-36 months			1.000	Ref	1.000	Ref
37 months and more			0.803**	0.029	0.817**	0.046
Weight at birth						
Less than de 2.5 kg			1.159ns	0.364	1.299ns	0.116
2.5-3.96 kg			0.751***	0.001	0.911ns	0.341
4 kg and more			1.000	Ref	1.000	Ref
Birth's order						
Rank 1			1.215ns	0.109	1.241*	0.078
Rank 2 to 5			1.000	Ref	1.000	Ref
Rank 6 and more			1.131ns	0.228	1.091ns	0.395
Sex of the child						
Male			1.059ns	0.429	1.06ns	0.423
Female			1.000	Ref	1.000	Ref
Type of birth						
Single			1.000	Ref	1.000	Ref
Multiple			3.156***	0.000	3.27***	0.000
Region of residence						
Adamaoua/North/Far-North					1.000	Ref
Centre/South/East					0.704**	0.036
Littoral/West					0.873ns	0.490
North-West/South-West					0.773ns	0.222
Place of residence						
Urban					0.98ns	0.872
Rural					1.000	Ref
Ethnic Group						
Semites/Hamates/Sudanese					1.000	Ref
Betis and other Bantus					1.398*	0.062
Bamileke					0.69*	0.057
Pygmies/Foreigner					1.005ns	0.977

	Model 1		Model 2		Model 3	
Standard of living						
Poor					1.000	Ref
Medium					0.803*	0.060
High					0.824ns	0.192
Age at delivery×Time[a]						
Agb1			0.958***	0.000	0.958***	0.000
Agb2			1.000	Ref	1.000	Ref
Agb3			0.975**	0.018	0.975**	0.018
Child's age×Time[b]						
Age1	0.637***	0.000	0.651***	0.000	0.650***	0.000
Age2	0.930***	0.000	0.934***	0.001	0.934***	0.001
Age3	1.000	Ref	1.000	Ref	1.000	Ref
Time period						
First period	3.987***	0.000	3.098***	0.000	3.083***	0.000
Second period	1.561***	0.000	1.377**	0.012	1.366**	0.014
Third period	1.000	Ref	1.000	Ref	1.000	Ref
Log likelihood	-5328.6857		-4932.1456		-4891.8168	
Pseudo R2	0.0424		0.0599		0.0649	
LR Chi-square	471.44***		628.87***		678.90***	
Area under ROC curve	0.7037		0.7311		0.7412	
BIC	10769.53		10125.83		10157.11	

ns : non significant; *p <0.1; **p <0.05; ***p <0.01

Notes: (a) Interactions between the time indicator and the child's age are formed by cross-products of time indicator and each corresponding covariates. (b) Interactions between the time indicator and the mother's age at delivery are formed by cross-products of time indicator and each corresponding covariates. Model 1=Mother's status + Child's age + Child's age×Time + Time periods, Model 2= Model 1 + Bio demographic variables + Age at delivery×Time, Model 3=Model 2 + Socioeconomic and cultural variables.

The table above shows that the effect the mother's status on the risk of death of children is significant at 1% level whatever the model. As a matter of fact, children born from high-status mothers have roughly 41% more chances of survival than their homologues born from poor-status mothers, while, being born from a medium-status mother is associated to a chance of survival of about 24% greater than the one of a child born from a poor-status mother, all things being equal. Thus, the mother's status has a direct effect on the chances of survival of children. It discriminates children in terms of survival whatever the socioeconomic and cultural constraints. That is, the chances of survival of children increase as the mother's status improves. However, this advantage decreases in presence of other factors. This finding shows that the effect of the mother's status on the risk of death of children is influenced by some intermediate factors. Among these factors we have contextual, socioeconomic and bio demographic factors. The advantage of children from high-status mothers decreases from

55% to 50% after the control of bio demographic variables and from 50% to 41% after controlling socio economic and contextual variables. In the meantime, the advantage of children from medium-status mothers drops by 3% and 8% after the control of bio demographic and socioeconomic variables respectively. Among bio demographic variables, we have the child's age which has a statistically significant effect on the risk of death of children. As a matter of fact, children aged 0-11 months and those aged 12-23 months are 4.76 times and 1.7 times respectively more likely to die before their fifth birthday than children aged 24 months and more. However, the odds ratio of interactions between the time indicator and the child's age indicate that, over time, this differential reverses. That is, as time elapses, the risk of death increases. Moreover, the mother's age at delivery exerts a statistically significant effect on the risk of death of children at 1% level. Indeed, younger age delivery (less than 20 years) and older age at delivery (35 years and more) are associated to a risk of death about 73% and 25% greater than an age at delivery within 20-34 years, all things being equal. Nevertheless, interactions with time show that, the effect of the mother's age at delivery on the risk of death of children significantly decreases over time, especially for younger ages. Beside this variable, the birth interval directly affects the survival of children and its effect is significant at 5% level. In fact, children born after an interval of less than 24 months are 70% more likely to die than those born after an interval within 24 and 36 months whereas, children born after a longer time interval (37 months and more) are 19% more likely to survive than their counterparts born after an interval within 24 and 36 months. Ceteris paribus, being born after an interval of more than 24 months contributes to increase the chances of survival of the children. Another important factor influencing the risk of death of children is the type of birth. It has a statistically significant influence on the risk of death of children at 1% level. Indeed, all things being equal, twins have roughly 2.3 times more risk to die before their fifth birthday than singletons. Furthermore, the region of residence has a statistically significant effect on the risk of death of children. As a matter of fact, children residing in the northern part of the country are less likely to survive till their fifth birthday than their homologues from other regions, all things being equal. More precisely, all things being equal, children from the Centre, South and East regions have approximately 30% lesser risk of death than those from the northern part of the country.

4. Discussion

Our results show that, all things being equal, the risk of death of children declines significantly as the mother's status improves. This relationship between the mother's status

and children survival is consistent with the findings of many authors (Boehmer & Williamson 1996; Rakotondrabe 2004). Indeed, Rakotondrabe (2004) pointed out that the risk of death of children declines significantly as the mother's public status improves. Differentials in children survival by mother's status are due to different characteristics of mothers in the various categories of status. In fact, it should be emphasized that there is a considerable gap between high-status and low-status mothers in terms of characteristics. Indeed, most of high-status mothers have a high level of education as well as their husbands/partners. They mostly work in the modern sector of economy as well as their husbands/partners and are mostly Christians. Almost all of them have a high standard of living and a high birth spacing. Most of them participate in decision making within their household and their fertility is relatively low. All their characteristics seem to be associated with a high chance of children survival. On the other hand, low-status mothers generally have characteristics associated with a high risk of children mortality such as illiteracy, low educational level of their husbands/partners, agricultural activity, low standard of living, low participation in decision making, relatively low birth spacing and high parity.

Beside the mother's status, the child's age has a statistically significant effect on the risk of death of children all things being equal. During earlier periods, we notice the disadvantage in terms of survival for children under two compared to those aged more than two years. However, this disadvantage reverses over time. The fact that the child's age is an important factor in its survival in childhood is corroborated by numerous studies (Zourkaléini 1997; Rakotondrabe 2004). The disadvantage of children under two in earlier periods is due to physiological conditions and high vulnerability of new-borns, especially in their first month of life. On the other hand, the vulnerability of the child increases with age, there is a general problem of inadequate nutritional practices by mothers during weaning which may lead to the development of infectious diseases and malnutrition among children (Rakotondrabe 2004).

Furthermore, our results suggest that younger age (less than 20 years) and advanced age (35 years and more) are associated to a greater risk of death of children. This finding is consistent with that of our predecessors (Banza 1999; Rakotondrabe 2004). The effect of this variable may be explained by the fact that, younger mothers have not yet reached biological maturity, their reproductive system is not yet prepared for childbearing (Barbieri 1991). Whereas, the high risk of death of children from older mothers who generally have a high parity is due to physiological difficulties associated with many maternal pregnancies, as well as the low quality of care they benefit (Zourkaléini 1997).

Moreover, the effect of the type of birth on children survival is statistically significant. Twins are more likely to die before their fifth birthday than singletons, all things being equal. This effect of twinning on the survival of children goes in the expected direction. This effect has been highlighted by several authors (Zourkaléini 1997; Banza 1999). While biological and cultural factors play an important role in the high mortality of twins, socio-economic conditions are not unrelated to this situation. Indeed, though the effect of socio-economic conditions on the high mortality of twins is negligible compared to genetic and biological factors, their effect may increase with the child's age (Zourkaléini 1997). In Cameroon, twins are rather pampered in different ethnic groups. In the Bamileke communities in particular, they are a symbol of wealth and prestige. All this suggests that, their high mortality is due to adverse socio-economic conditions, especially poverty.

Our results also highlight a statistically significant net effect of the birth interval on the risk of death of children. Indeed, a birth interval of more than 24 months helps to significantly reduce the risk of death of children. This finding is consistent with that of many authors (Banza 1999; Lachaud 2002; Rakotondrabe 2004). Thus, the reproductive interval seems to play a key role in the explanation of children mortality. The effect of this variable is explained by the fact that short intervals, in particular less than two years, reduce the recovery of physiological capacities of mothers, which increases the risk of children mortality (Lachaud 2002).

Furthermore, our results reveal that the region of residence is a differentiating factor of children survival. More specifically, children living in the northern part are those who are least likely to survive before their fifth birthday. This trend could be explained by unequal distribution of health infrastructures and the diversity of economic and cultural contexts in different regions of the country. As a matter of fact, the region can be a reflection of the economic and cultural context in which women and children live. The prevailing climate, the availability of social infrastructures, food resources, the predominant activities, the cultural model conveyed and many other elements differ from one region to another (Rakotondrabe 2004). In Cameroon, the unequal distribution of health infrastructures, sociocultural burdens and economic characteristics are factors that may explain the differences in mortality between regions. Overall, the risk of death of children in Cameroon is directly influenced by the mother's status, whose effect diminishes in presence of socioeconomic and bio demographic factors, which play an intermediate role. These results corroborate those of previous researches (Boehmer & Williamson 1996; Zourkaléini 1997; Banza 1999; Rakotondrabe 2004).

Conclusion

The purpose of this paper was to highlight inequalities in terms of survival, between children under five in Cameroon according to their mothers' status. At the descriptive level, the Kaplan-Meier survival estimates emphasizes statistically significant differences between each category of mother's status as far as children survival is concerned, as well as the speed of occurrence of deaths. Multivariate analysis performed using the discrete-time survival analysis highlights large differentials in terms of children survival between categories of mother's status. Indeed, this variable exerts a significant influence at 1% level on the risk of death of children. Children from high-status and medium-status mothers have approximately 41% and 24% more chances of survival respectively than their counterparts from poor-status mothers, all things being equal. The advantage of children from high-status mothers is due to socioeconomic, cultural and bio demographic characteristics of their mothers, which seem to increase their chances of survival. Thus, the reduction of children mortality requires an improvement of mothers' living conditions at economic, social and cultural levels. This finding suggests that the mother's status plays a major role in the explanation of differentials in children mortality. Our results also reveal intermediate factors determining the risk of death of children. It show that, the child's age, the mother's age at delivery, the region of residence and the type of birth are also determining factors of the risk of death of children under five. Thus, the reduction of the risk of death of children passes through the promotion of mothers' and fathers' education, the empowerment of mothers and fathers, the promotion of family planning so as to encourage birth spacing within couples and the reinforcement of programs of poverty alleviation. All these measure should focus more on the Muslims communities, living in the rural areas of the northern part of the country. In sum, although all the variables playing a key role in children mortality have not been taken into account within the framework of this study, our results reveal the great influence of the mother's status on children survival. Therefore, considering the role of this variable in subsequent studies can lead to a complete and a better understanding of factors determining the risk of death of children.

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