

# The Effect of Fertility on Women's Health and the Determinants of Fertility in Cameroon

Kinga Bertila Mayin<sup>1, 2, 3</sup>, Dobdinga Cletus Fonchamnyo<sup>3</sup>, Fuein Vera Kum<sup>3</sup>,  
Eyvonne Ngequih Tumasang<sup>1, 2, 4</sup>

<sup>1</sup>Department of Health Economics and Policy Management, Catholic University of Cameroon (CATUC), Bamenda, Cameroon

<sup>2</sup>Health Economics Association of Cameroon (HEAC), Bamenda, Cameroon

<sup>3</sup>Department of Economics, Faculty of Economics and Management Sciences, The University of Bamenda, Bamenda, Cameroon

<sup>4</sup>Department of Nurse and Midwifery, The University of Bamenda, Bamenda, Cameroon

## Email address:

[bertsking@yahoo.com](mailto:bertsking@yahoo.com) (K. B. Mayin), [dfonchamnyo@yahoo.com](mailto:dfonchamnyo@yahoo.com) (D. C. Fonchamnyo), [fkvera@gmail.com](mailto:fkvera@gmail.com) (F. V. Kum),  
[ntumasang@yahoo.com](mailto:ntumasang@yahoo.com) (E. N. Tumasang)

## To cite this article:

Kinga Bertila Mayin, Dobdinga Cletus Fonchamnyo, Fuein Vera Kum, Eyvonne Ngequih Tumasang. The Effect of Fertility on Women's Health and the Determinants of Fertility in Cameroon. *International Journal of Health Economics and Policy*. Vol. 7, No. 2, 2022, pp. 36-45. doi: 10.11648/j.hep.20220702.14

Received: March 28, 2022; Accepted: April 19, 2022; Published: May 10, 2022

---

**Abstract:** The World Fact Book ranked Cameroon at the 20<sup>th</sup> position with a fertility rate of 4.66 in 2020. UNSD Database (2020) gives the fertility rate of Cameroon as 5.4, 5.2 and 5.0 for 2005, 2010 and 2019 respectively. In the rank for the most obese countries, Cameroon was the 135<sup>th</sup> with an average BMI of 11.4 in 2016. In 2019, 11.4% of Cameroonians were obese with an average BMI of 24.4%. These figures show that years with higher fertility rates had lower levels of life expectancy and BMI. This is a possible indication of a direct link between fertility and health. This work was aimed at investigating the determinants of fertility and the effect of fertility on women's health (BMI) in Cameroon. The expo-facto research design and pooled data from the 1991, 1998, 2004, 2011 and 2018 Cameroon DHS data sets were used. The total sample size stood at 50,131. The Instrumental Variable Probit Model, 2SLS Regression were used to analyze the data. Fertility had a positive and statistically significant effect on health. The use of contraceptives, knowledge on ovulation, age at first sex, age at first cohabitation, women's employment, education, husband's education, wealth level, religion and lifetime sex partners all had negative and statistically significant influence on women's fertility. Age and region of origin had a positive and statistically significant influence on women's fertility. Women's educational level, husband's education, skipping meals and religion all had positive and statistically significant influence women's health. Age, husband's occupation, lifetime sex partners, women's employment, use of modern contraceptives, husband's age, age at first birth, respondent's occupation had a negative and statistically significantly influence on women's health. The study recommended birth spacing for 2 years minimum to give the woman's body time to lose weight naturally.

**Keywords:** Fertility, Health, BMI, Women, Determinants, Cameroon

---

## 1. Introduction

The World Fact Book ranked Cameroon at the 20<sup>th</sup> position with a fertility rate of 4.66 in 2020. UNSD Database puts the fertility rate of Cameroon at 5.4, 5.2 and 5.0 for 2005, 2010 and 2019, respectively [33]. As far as health is concerned, the life expectancy rate for Cameroonian women stood at 53.1 (2005), 55 (2010) and 57 (2019). The percentage of healthcare expenditure as a

percentage of GDP for Cameroon stood at 4.1 (2005), 4.6 (2010) and 4.7 (2019). In the rank for the most obese countries, Cameroon was the 135<sup>th</sup> with an average BMI of 11.4 in 2016. In 2019, 11.4% of Cameroonians were obese with an average BMI of 24.4% [33]. These figures show that years with higher fertility rates had lower levels of female employment, life expectancy, and BMI. This is a

possible indication of a direct link between fertility, health, and female employment.

Esteban et al. also confirmed that maternity, pregnancy, childbirth, and the period after childbirth impose a substantial burden on women's health and time [11]. Researchers estimated that in 1920, women could lose on average 2.31 years per pregnancy due to disabilities associated with maternal conditions. Even more importantly, Goldin and Katz show that increasing women's control over their reproductive choices contributes to altering their career and marriage choices by eliminating the risk of pregnancy and encouraging career investment [13].

Women do the bulk of household chores and musculoskeletal disorders (MSDs) may be a reflection of the accumulation of difference in exposures at work and at home [2]. This is of course a biological burden uniquely borne by women. Moreover, maternity is not only a burden in terms of time. It is also risky, and often imposes on women a substantial burden in terms of health. Improved maternal health alleviates the adverse effects of pregnancy and childbirth on women's ability to work, and is hence a key driver of female labour force participation [5]. This study therefore seeks to investigate the relationship between fertility and women's health in Cameroon.

## 2. Concept and Literature Review

According to Norman and Clark cited in the US health engine, obesity is associated with a general decline in fertility with a significant relationship existing between excess body fat and problems with reproduction [24]. To Norman and Clark, fertility problems arising from obesity in women include: Irregular menstrual cycles; problems with ovulation; increased androgen levels; polycystic ovarian syndrome (PCOS); increased risk of miscarriage and decreased success rates with assisted reproductive technologies (ART). These associations between obesity and reduced fertility are particularly significant when fat is deposited around the abdominal area [24].

Payne worked on the impact of a reduced fertility rate on women's health [25]. They found out that total fertility rate decline varies considerably by geographic location and socio-demographic subgroup. Further, the associations between family size and selected determinants of health were different for women and men. Schultz reviewed the effects of fertility change on the health and welfare of children in Kenyan household survey data by analyzing the consequences of twins [28]. The effect of avoiding unanticipated fertility appeared to have a larger beneficial effect on the body mass index or health status of children in the family than would be expected due to vary in fertility, which is accounted for, by parent's education and

household land. Tsafack and Zamo-Akono also reported the empirical relationship between fertility and health on female labour market outcomes. In their study, they investigated how fertility and health affect each other and how they interrelate with female labour force participation [32]. One of the key UN Millennium Development Goals objectives was to achieve universal access to reproductive health and family planning services. Allowing families to plan the number and timing of their children reduces infant mortality rates and improves the health of both women and their families [29].

Stoebenau et al. summarized works addressing whether and to what extent have fertility declines experienced in lower and middle-income countries in the last forty years benefitted women in those countries? They argued that fertility decline should be expected to benefit women's lives through two demographic processes: increased lifespan and increased time spent outside of childbearing; as well as accompanying socio-cultural processes, namely: shifts in the value placed on large families and therefore on controlling women's reproduction [31]. Nathan found a connection between low women's health ratings and fertility, but others have not. Furthermore, it is not always possible to separate fertility from health. Women in better health tend to have more children than those with chronic health problems [23]. A study led by Sorokowski et al. found that both BMI and age separately correlated with the number of children that the women had [30]. However, even when age and BMI were normalized, the researchers observed a subtle, but direct linear relationship between waist-hip ratio and number of children. According to a report from the office of women's health WHO weight, whether too high or too low, can affect your ability to get pregnant [34]. Being overweight or underweight can also cause problems during your pregnancy. Reaching a healthy weight can help you get pregnant and improve your chances of a healthy pregnancy and baby.

## 3. Methodology

This study uses the cross-sectional (expo-facto or causal or explanatory) research design. This work uses secondary data. The secondary data was gotten from all available Demographic Health Survey (DHS) data for Cameroon. The available data sets for DHS Cameroon are: DHSVII (2018), DHSVI (2011), DHSIV (2004), DHSIII (1998) and DHS II (1991) [6-10].

Modeling Fertility on Health Relationship (IV Probit and IV Regression):

This work is out to investigate the relationship between fertility and women's health in Cameroon. The model is specified as:

$$H = \lambda_0 + \lambda_1 Fe + \lambda_2 D + \lambda_3 WE + \lambda_4 A + \lambda_5 W + \lambda_6 Ed + \lambda_7 CU + \lambda_8 HA + \lambda_9 AFB + \lambda_{10} HED + \lambda_{11} Rel + \lambda_{12} KOv + \lambda_{13} LTSP + \mu \quad (1)$$

**Table 1.** Description and measurement of Variables on the fertility and health equation.

Variable	Meaning	Description	Expected sign
H	BMI	BMI and categorical as BMI>30 obese and BMI<30 not obese	-/+
Fe	Fertility	Number of child born alive over lifetime	-
D	Diet	Skip meals yes-1; No=0	+/-
WE	women's employment	Working (1) and not working (0)	-/+
A	Age	Age in years	-/+
IN	Income	Wealth index	
HED	Husband's education	Level	
CU	Contraceptive use	Use of modern contraceptives or not	
HA	Husband's age	Years	
AFB	Age at first birth	In years	
HEd	Husband's education	In level	
Rel	Religion	Protestant, Other Christians, Muslims Animist and Catholics	
KOv	Knowledge on ovulation	Yes 1. No 0	
LTSP	Life time sex partners	Number	
$\mu$	Error term		

To assess the relationship between fertility and health, whose respond variables (fertility and health) are continuous in nature, use is made of the two-stage least square 2SLS regression and the IV probit model. To run the IV probit model, the dependent variable health captured by BMI was categorized into two groups. BMI $\geq$ 30=obese and BMI< 30 non-obese. Zijian and Dylan specified that a popular instrumental variable approach for such a model is the two-step procedure [35]. Differences between 2SLS and ML are small and favour 2SLS in small samples ( $N \leq 100$ ) [20].

## 4. Results and Discussion

This work set out to investigate the effect of fertility and other factors on women's health, the researcher uses three different models to see the results of the different models when particular variables are dropped and when dependent variable is continuous or dummy. All three models have the main variable of interest (fertility). However, in some models some variables were omitted to see if the results are different using different instruments.

The results of all three models presented on Table 2 give fertility a positive coefficient. Model one (IV Probit 1) and model II (IV Regression) give a positive and statistically significant coefficient of 0.4127508 and 0.0002356, respectively. The results of model 3 (IV probit 2) is also positive (0.1258248) but statistically insignificant. Since the results of up to two of the models are significant and that of all three models are positive, we conclude that as women's fertility increased, her health worsened (increase BMI). Model one shows that increase in fertility by one child increases the BMI by 0.4 unit. That is, if the fertility rate was to increase by 100%, the woman's BMI will increase by 41.3%.

This result is in line with literature Tsafack and Zamo-Akono, that reported positive empirical relationship between fertility and health [32]. BMI though, has major risk factors like age and family history (Kinga *et al.*), is an equation of energy intake (food) minus energy spent (activity level). When the energy intake surpasses energy spent, it results in weight gain [18]. On the other hand, if energy intake is less than energy spent, it results in weight loss. Thus BMI used as

an indicator of health in this study. Fertility thus favors increase in energy intake and fall in activity level. This is due to the fact that, after each birth the woman usually has a long period of sedentary lifestyle (as she stays at home in line with the Cameroonian culture and has more hands around her to help with her routine activities). In addition to this, in Cameroon, many women's weight increase when they start having children due to the pregnancy hormones (progesterone) that increases a woman's appetite and help her body to convert more food as fat and store in the body resulting to a drastic weight gain during pregnancy. The body naturally converts this stored fat to food for the baby after he/she is born.

However, in Cameroon, when a woman gives birth, she is being given extra feeding with the intention of providing for the extra nutrients needed to feed the baby, whom the body already took care of storing during pregnancy. This extra feeding of nursing mothers also emanates from the adherence to the tradition that forces nursing mothers to eat from every basket that comes to her house. It is believed that, if a visitor leaves the woman's house without her eating the food, the woman does not like or trusts her and is surely going to throw away the food as soon as he/she is gone. Thus for the woman to prove her love and appreciation for the visitor, she eats from every basket she is presented with.

In some regions like the West, there are special meals (fufu corn, Nkwi and vegetables) prepared for nursing mothers. The pregnant woman is expected to plant Nkwi and buy its spices as part of preparations towards giving birth. After birth, every visiting woman brings corn flour and vegetables. This woman prepares food which the nursing mother is expected to eat a large quantity and this too when the food is still hot. Immediately after eating, if she has a new visitor, the new visitors immediately starts her own cooking expecting this woman to still eat immediately its ready. This woman is expected to eat food cooked by as many as the visitors she has in a day. Most times the daily calories intake of these women end up going far above what she and the baby need. The extra calories is thus converted into fat and stored to the body, making the woman to gain weight. This thus justifies the significant and positive link between fertility and health (captured by BMI) in Cameroon.

**Table 2.** The Effect of Fertility on Health in Cameroon.

Variables Dependent variable (BMI)		IVProbit1 (BMI≥30 obese and BMI< 30 non obese) (Standard Error)	2SLS (BMI continues) (Standard Error)	IV Probit2 (BMI≥30 obese and BMI< 30 non obese) (Standard Error)
Fertility		0.4127508*** (0.0600881)	0.0002356*** (0.0000383)	0.1258248 (0.0971154)
Skip meals			-0.4900623** (0.2469453)	
Women employment			-0.3463266 (0.2978281)	0.0152787 (0.1926509)
Age		0.133401 *** (0.0148257)	0.396739 (0.1489573)	0.1873657** (0.0794077)
Wealth	Poorer	0.9168638*** (0.2419692)	0.9640108** (0.4032128)	1.32386 (.2541774)
	Middle	1.596578*** (0.2622699)	1.849582*** (0.4402785)	0.325702 (0.2706875)
	Richer	0.582178*** (0.2905363)	0.500794*** (0.4963493)	0.165742 (0.3054688)
	Richest	0.541777*** (0.3345744)	0.271586*** (0.5728098)	0.415235 (0.3462619)
	Base group (Poorest)			
Education	Primary	0.671576*** (0.2124373)	0.8625136** (0.4229272)	0.268989*** (0.2629643)
	Secondary	0.933627*** (0.2457548)	0.7297407 (0.4796599)	0.29754*** (0.2947357)
	Tertiary	2.592836*** (0.4728983)	1.191515 (0.7926695)	0.385367*** (0.47707)
	Base group (No education)			
Contraceptive use			0.5992543** (0.2601218)	
Husband's age		0.000403 (0.0104627)	-0.0808337 (0.2117234)	0.0291714*** (0.0101227)
Age first birth		0.0078053*** (0.0221606)		
Husband 's education	Primary		0.0614925 ** (0.4466207)	0.6286419** (0.2874165)
	Secondary		0.3320248** (0.4786733)	0.6662814** (0.3060277)
	Tertiary		0.3673911** (0.6314305)	0.8505657** (0.3786559)
	Base group (No education)			
Religions	Protestant		-0.1532844 (0.29901)	
	Other Christians		-1.1357813 (0.453032)	
	Muslims		-.9270075** (0.3674365)	
	Animists		-1.906242** (0.9435973)	
	None		0.326251* (1.193316)	
Base group (Catholic)				
Knowledge on ovulation			0.0345894 (0.0923366)	
Life time sex partner		0.0668668 (0.0278049)	0.0004859 (0.0396058)	
Constant		12.92315* (0.888949)		15.30031*** (0.1372467)
Number of observations		3,323	13341	4940
Prob> F		0.0000	0.0000	0.0000
R-squared Adj R-squared	0.2569			
	0.2522			

Standard errors in parentheses \*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

Source: Computed by authors using Stata 16.

Results of Model 2 (2SLS), the only model that includes the variable skipping meals shows that skipping meals negatively (-0.4900623) and statistically influenced health. This finding is in line with the theory of Bennett as in Fisher which states that people get fat because of what and how they eat [12]. Our results thus show that, those who skip meals are less liable to high BMI and thus to poor health. It could also mean individuals with high BMI are more likely to skip meals. This is the situation in our environment where individuals become conscious of what, where and how they eat immediately they start getting uncomfortable with their weight. Most individuals, who feel they are overweight, resort to skipping meals, living on particular diet or eating smaller portions of food. This is most common amongst the rich and educated individuals [18]. Most poor and uneducated individuals have no control over what they eat even when they have very high BMI. They see high BMI as a sign of good living, wealth and peace of mind. To them, the more drinks and food you take, the more you feel you are living a fulfilled life. Maslow hierarchy of need theory justifies this as poor individuals on the level one of the

pyramids are at the level of fulfilling their basic needs of food, water, housing etc. [19]. They give more importance to food and it is completely out of question to skip meals. However, as the individual becomes educated and wealthy, their priority shifts from food to other things like the need to socialize, self-esteem and self-actualization.

The 2SLS model also shows that women's employment affects BMI negatively (-0.4900623) thus health positively. Though this result is statistically insignificant, the sign is in line with literature Ingrid who all found a negative relationship between women's employment and BMI and a positive relationship between women's employment and their health [14]. Judith and LaRosa also justifies this results [15] and Rena et al. [27]. Employment simply increases the woman's activity level thus increasing the energy spent. If the woman does not increase her energy intake, this will lead to fall in BMI and thus better health.

The woman's age (0.1334007) positively and statistically significantly affects the BMI. That is, as the woman aged, her BMI increased meaning her health worsened. Baum and Ruhm justifies this by showing that health changes with age

for a cohort moving through early adulthood [3]. As a woman ages, her activity levels fall making her more liable to high BMI assuming she maintains her energy intake (feeding) level. In addition, the change in hormones as women get to menopause (which has been proven by literature to lead to weight increase) also justifies the positive effect of age on BMI. As a woman ages, her metabolism slows down thus using very small energy. The excess energy is thus converted to fat and stored in the body thus increasing BMI.

Being in the poorer, middle, richer and richest group significantly increased BMI. Those in the poorer groups had higher chances of having high BMI compare to those in the richest groups. Quinel linked poorer wealth index to higher BMI and thus poor health [26]. As explained above, poorer people at the base of the Maslow hierarchy of need place more importance to food thus increases in energy intake. If this is not counteracted by a corresponding increase in physical activities, these women in the poorest class are bound to have higher BMI compared to women in richer class who have more focus on self-esteem thus having a proper size and health becomes a major priority to them.

Use of contraceptives has a positive coefficient (0.5992543) and statistical significant effect on BMI. Women who used contraceptives had higher weights thus contraceptives worsened their health. In line with the speculations of Cameroonian women, the use of contraceptive leads to increase BMI. Most women who resorted to traditional contraceptive methods, like lactation, withdrawal, calendar methods and the consumption of local products like salt, honey etc. have indicated that amongst other reasons that make them fear using modern contraceptive methods is increase in BMI. This result thus confirms their fear on increase in BMI from the use of modern contraceptives. Most contraceptives simply increase the progesterone of the woman to prevent her body from ovulating. The increase progesterone makes the woman to feel pregnant with increase appetite and cravings. This in turn increases her food intake thus BMI.

The results further show a positive and significant effect of education on health. Higher levels of education are associated with lower health (higher BMI). This result is in line with the findings of Nagata *et al.* who showed that health was positively associated with years of schooling, income and literacy [22]. Unlike amongst uneducated women, it is common to hear educated women say they do not eat this or that because it is not healthy. Most educated women are more informed about the health ills of obesity and thus selective with food (healthy eating) making sure every calorie they eat is worth it. In parties for example, the plate size and content of different women can tell you about their educational level. Educated women mostly seek to eat a lot of fruits and vegetables while uneducated women fill their plates with starch and meat. This increase in the starch intake goes a long way to increase the BMI of uneducated women compared to the educated ones. In addition, most educated women are conscious of the need for physical exercise and most times

are in gyms and outdoor sport. This thus justifies the fact that education improves health in terms of BMI.

Husband's age show a positive and statistically significant effect on body mass index. This implies that, as her husband's ages, her BMI increases and the health gets worst. In Cameroon, it is believed that a woman should always be younger than the husband. Couples where the women are actually older or simply look older are always a topic of discussion for the family and quarter members. Most Cameroonians feel something is wrong when a woman is older than the husband. This makes most women married to young men attempt to look younger than their husbands. Most of these women married to young men, are on a constant check out for their weights. They do not wish to grow fatter so as not to look older than their husbands do. They jokingly say, "I need to control my weight not to look like my husband's auntie". This is however not the case with women whose husbands are say 10 years older. There is a natural gap between them and no matter how fast the woman gets she always looks younger than the man. Thus, these set of women are less conscious about weight control. This justifies the results that increase in husband's age can lead to an increase in women's BMI and worsen their health.

Age at first birth for all three models show a positive and statistically significant effect on body mass index. This implies that as the age at first birth increases, the BMI increases and the health deteriorates. Women who have children later in life most often have shorter intervals for having children leading to greater weight gain. This is because they feel that they started up late and are trying to have all their children as fast as they can before they get into menopause. When the spacing between children is short, the woman's body does not have time to recover and burn the extra fats from the previous pregnancy naturally or through dieting and exercising before the next conception. When a woman stops breastfeeding, her hormones goes to rest, a year after this woman's weight naturally drops drastically.

The results further show a positive and statistically significant effect for husband's education on health. Higher levels of husband's education are associated with lower health (higher BMI). This result is contrary to expectation of Kanjanapan [16], as it is expected that when the husband is educated the wife's health and BMI should be better. However, this result can be justified by the fact that though the husbands can advise the wife on what to do to prevent high BMI, if she is not also educated and does not see the need for this herself, she will not adhere to the advice. It is common to see educated men with uneducated women who stick to their points of view about life no matter how the man tries to advise her. This is probably the reason why most educated men married to uneducated women end up sending their wives back to school, for them to be able to see things from their angles.

Muslims and Animists are significantly associated with lower BMI and better health compared to Catholics. This result is observed in our daily life. Muslims generally are slim and this is accounted for by their genetic makeup as

shown by Kinga et al. [18]. Their genes hinder the storage of fat in their body. It simply converts and uses the energy they consume thus preventing the increase of their BMI. In addition to the genetic makeup, their diet also prevents them from getting fat. They take a lot of fat (milk and butter), protein (meat) and small carbohydrate. Most of the time even when they cook corn fufu, they process their maize to remove the extra starch from it before cooking. Their meals mimic that of the “banting” diet (70% fat, 25% protein and 5% starch) used by a group of people for weight loss. Knowledge of ovulation has a positive but statistically insignificant effect on BMI. The constant term was positive (12.92315) with the BMI of women. This is to say that women’s BMI will be increased in the absence of the other variables in our model. The coefficient of multiple determinations (Adjusted R-squared) was 0.2522. This shows that 25.2% of the variation in health is explained by the factors included in the model. The F-ratio or F-statistics for all models (0.000) show that the overall model is statistically significant at 1% percent level of significance.

#### *Determinants of women’s fertility*

This work further investigates the determinants of fertility in Cameroon. The results on Table 3 further uses the IV Probit (model I) and 2SLS (model II) techniques to present the results of the determinants of fertility. Variables like Knowledge on ovulation negatively (-0.0365387) and statistically significantly influence the number of children a woman has. This implies that, women with good knowledge on their ovulation had fewer children compared to women with poor knowledge. Majority of those who rely on traditional family planning methods to space children depend on their knowledge on ovulation. This is to say that a woman with no knowledge on ovulation has higher chances of having many pregnancies and thus children if she does not resort to modern family planning methods.

Education is negatively associated with the number of children a woman has. This result is in line with the review of Schultz which stipulated that fertility was lower among better-educated women [28]. Bbaale’s results also confirm the hypotheses that female education, especially at the secondary and post-secondary levels reduces fertility [4]. Education is strongly correlated to age at first marriage. Age at first marriage is in turn correlated to number of children thus education is correlated to the number of children a woman has. Most educated women especially at the tertiary level believe in the quality than the quantity of children they have. They prefer to have few children they can raise well than having many children they cannot care for. The standards of raising children for educated women are also high thus making it difficult for them to have many. Educated women whether working or not will send their children to the best schools visit the best hospitals, want to dress and feed the children well.

Richest women (-0.5549731) have lower number of children when compared to poorest. This is in line with the findings of Schultz who saw an inverse association between income per adult and fertility among countries, across households [28].

This result can be attributed to mentality issues. The rich, like the educated believe in the quality while the poor like the uneducated believe in the quantity of children. The rich most times have so many people to care for that compensate for the few children they are raising. The richer a man or woman gets; the more extended family depends on him or her for their daily bread. However, those in the poorest class most often have only their children to care for. Most times these women in the poorest group are not even the direct sponsors of most of the children they have. Women in the poorest group can also have, as many children as they want because they can give then any level of care they can afford, however those in the richest group in addition to other extended family and friends’ responsibility, must adhere to a level of care the society expects of them thus, prefer to have just few children. Women in the richest wealth index equally have jobs that demand more time, making it difficult to have many children compared to those in the poorest group whom most times are in the informal sector where they can go to work when and how they feel like.

The coefficient of age is positive (0.2055303) meaning that older women have more children than younger women. This finding is in line with that of Sorokowski et al. who specified that age positively correlated with the number of children that the women had [30]. Older women in the data set had many children compared to younger women. This is because most of these old women did not go to school and thus married and started having children earlier thus had many children.

Husband’s education that is being in primary, secondary and tertiary levels of education compare to no education negatively but statistically and insignificantly influence the number of children a woman has. This implies that wives with husbands with tertiary education have lower fertility compared to those with no education, primary and secondary education. Ahmad’s finding which showed a significant effect of wife-husband education on number of children ever born confirms these findings [1]. Educated men like educated women place priority on the quality than the quantity of children they have. To raise these children with such quality, usually entails many finances that they can afford only for few children. In addition, educated men most times have jobs that do not warrant disturbances from young kids. At a certain level of promotion, these men see having another child as years of sleeplessness and thus hindrance to their peaceful sleep and career.

Religion had a negative, but statistically insignificant influence on the number of children a woman has. Being a Protestant reduced fertility levels compared to Catholics. On the other hand, Muslims show higher fertility rate compared to Catholics. Kevin concluded that religion plays an influential role in determining fertility when three conditions are satisfied: firstly, the religion articulates behavioural norms with a bearing on fertility behaviour; secondly, religion holds the means to communicate these values and promote compliance and thirdly, religion forms a central component of the social identity of its followers [17].

Catholics for example, have strong teachings against modern contraceptive use. To them, anything that stops the ability for woman to conceive is preventing procreation and stopping the creation of a new life thus, it is a sin. Most Catholics who seek to use only natural methods of family planning as prescribed by the church end up having more children than previewed. This is due to unplanned pregnancies resulting from the failed contraceptive method. Muslims like Catholics also believe in natural family planning methods thus having many children like the Catholics. In addition, Muslims are known to marry early and are most often unemployed, justifying them having more children than Catholics.

Age of first cohabitation (-0.1476154) reduces the number of children the woman has. This implies that the higher the age at first cohabitation the lower fertility (number of children) of the woman. This result is in line with the findings of Mosammat *et al.* who specified that the relationship between marriage and fertility suggest that women who marry at a younger age produce more children than women who marry late [21]. That is, if a woman marries say at 18, she has about 32 years to get to menopause. Within these 32 years' assuming she has two years' spacing between children as prescribed medically, she will be able to have 16 children. However, a woman who marries at 30 years has maximum 10 children to get to menopause. Most first pregnancies from women above

35 are usually considered high-risk pregnancies as these women have higher chances of delivering through cesarean section (CS) than first pregnancies at low age. When these women have CS, it goes a long way to reduce the number of children they will have as women who deliver through CS are advised to have a maximum of four children. Marrying late is also related to the number of children the woman has through the education and occupation. Research has proven that most women who marry late are educated or in professions that give them less time for themselves. This education and job also play on the woman's mentality on having many children. This is because their desire to return to work makes them to prefer fewer children.

Not being married or formally married compared to being married (-0.8183042) has a negative and statistically significant effect on the number of children they had. This result is in line with the finding of Mosammat *et al.* like Kanjanapan who said women who experience marital dissolution are presumed to lose a period of exposure to risk of childbearing during the period between marriages, although this fertility deficit is often made up in subsequent marriage [21]. This result is accounted for by the fact that, married women have children at a more steady intervals compared to single and divorcee women. This makes them more likely than single women to have many children.

*Table 3. Determinants of women's fertility.*

Variables Dependent variable (fertility)		IV Probit (standard error)	2SLS (standard error)
Knowledge on ovulation		-0.0365387*** (0.007603)	-0.0364181*** (0.0083679)
Contraceptive use		0.5238346*** (0.0417657)	0.5236452*** (0.0417705)
Education	Primary	-0.1618674*** (0.0467972)	-0.1618077*** (0.052219)
	Secondary	-0.4609844*** (0.0564301)	-0.4617203*** (0.0591248)
	Tertiary	-0.816023*** (0.0921151)	-0.814115*** (0.0794258)
	Base group (No education)		
Residence	Rural	0.1754379*** (0.0422581)	0.1731578*** (0.0427526)
	Base group (urban)		
	Poorer	-0.0745113 (0.0489848)	0.0755132 (0.0548551)
Wealth	Middle	-0.1578114*** (0.0568121)	-0.1610517*** (0.0618754)
	Richer	-0.3279761*** (0.0675096)	-0.3322502*** (0.0714572)
	Richest	-0.5549731 (0.0751255)	-0.5596579*** (0.0752241)
	Base group (Poorest)		
Age		0.2055303*** (0.0016809)	0.2053716*** (0.0020131)
Husband's education	Primary	-0.0322094 (0.0480752)	-0.0337985 (0.0550721)
	Secondary	-0.0257079 (0.0525477)	-0.0268128 (0.0577655)
	Tertiary	-0.0916847 (0.0630255)	-0.0967206 (0.0665317)
	Base group (No education)		
Religion	Protestant	-0.048227 (0.0345508)	-0.0482606 (0.0327035)
	other Christians	-0.0464039 (0.045752)	-0.0474823 (0.0478853)
	Muslims	0.0448594 (0.0534395)	0.0438413 (0.0546067)
	Animists	-0.0843718 (0.098454)	-0.0839775 (0.0947244)
	None	-0.1346304 (0.0969369)	-0.1342378 (0.1156676)
	Base group (Catholic)		
Marital status	Not married or formally married	-0.8183042*** (0.0553653)	-0.8212072*** (0.0612802)
	Base group (married)		
Age at first cohabitation		-0.1476154*** (0.0032738)	-0.1475652*** (0.0037983)
Year	2011 and 2018	0.2937905*** (0.0391884)	0.2946288*** (0.036369)
	Base group (1991, 1998, 2004)		
Constant		-0.5657371*** (0.1583048)	-0.5544772*** (0.1609271)
F (22, 18277) = 480.17		0.000	
Number of observations		18,320	18,347

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

Source: Computed by authors using Stata 16.

Being a resident in the rural area compare to urban area increased the chances of having more children by 17.5%. Women in rural areas have more children compared to those in urban areas probably because their job which is predominantly agriculture give them more time to have children. In addition, the educational level of women in the rural areas is relatively lower to those in the urban. The educated women in the rural areas have the tendency to migrate to urban areas in search of greener pastures thus few children. More so, the cost of living and child upbringing in the rural area is low with food almost readily available, leading to high fertility rate. Literature also specifies that the lack of recreational facilities to occupy the men in the early hours of the evening make these men see their wives as the main source of distraction in the evening after farm work further leading to high fertility of women in rural areas.

Women interviewed in 2018 data have more children compare to previous years. Though this result looks contradictory, it is worth noting that women interviewed in the 2018 DHS were also made of old women with many children. That is, the data considers old women below 64 who had stopped giving birth as of 2018. In addition, unlike the previous data sets, the 2018 have so many women from the rural areas thus increasing the mean child per woman when considering those from rural areas. The previous data sets concentrated in the urban areas giving small mean number of children for women in that data. The constant term is negative meaning that in the absent of all the variables included in the model, the constant term will negatively influence the number of children the women have. The coefficient of multiple determination (Adjusted R-squared) is 0.5235. This shows that 52.3% of the variation in fertility is explained by the factors included in our model. The F-ratio

or F-statistics (0.000) shows that the overall model is statistically significant at 1% percent level of significance.

## 5. Conclusion and Policy Implementation

Assessing the relationship between fertility and health in Cameroon, the results showed that fertility has a positive and statistically significant effect on health. From the results, we reject the null hypothesis that fertility had no significant relationship effect on health in Cameroon. This work recommends that women should space child birth for at least two years to protect their health and give their bodies enough time to shed weight. Women are also advised to avoid some of the negative consequences fertility has on their health by attending antenatal care and going for regular checkups. Women can also improve their health by doing physical exercises and eating a good diet to stay fit after every child.

## 6. Proposals for Further Study

This study proposes a further investigation of the effect of fertility on women's health using self-assessed health to capture women's health status than the BMI used in this study.

## Acknowledgements

We would like to express special appreciation and thanks to Prof Tafah Edokat Edward Oki and to Prof. Dobdinga Cletus Fonchamnyo for supervising this work. Sincere thanks go to Prof Njong Mom Aloysius, Dr Ndamsa Dickson and the entire teaching and support staff of the Faculty of Economics and Management Science of The University of Bamenda for their contributions toward this work.

## Appendix

*Table 4. Summary Statistics.*

Variable	Observation	Mean	Std Deviation	Min	Max
Women employment	48,931	0.5754021	0.4942869	0	1
Fertility	50,131	2.790988	2.855486	0	18
Health (BMI)	22,310	2581.68	1246.83	1245	9999
Education	No education	50,131	0.205641	0	1
	Primary	50,131	0.346193	0	1
	Secondary	50,131	0.405857	0	1
	Tertiary	50,131	0.042309	0	1
Wealth	Poorer	40,759	0.238377	0	1
	Poorest	40,759	0.188621	0	1
	Middle	40,759	0.170809	0	1
	Richer	40,759	0.164405	0	1
Age	Richest	40,759	0.175618	0	1
		35,604	28.77109	15	64
	No education	31,245	0.159226	0	1
	Primary	31,245	0.257033	0	1
Husband's education	Secondary	31,245	0.277644	0	1
	Tertiary	31,245	0.306097	0	1



Variable		Observation	Mean	Std Deviation	Min	Max
Religion	Catholics	43,419	0.367834	0.4822215	0	1
	Protestant	43,419	0.333379	0.4714262	0	1
	other Christians	43,419	0.129851	0.3361433	0	1
	Muslim	43,419	0.087750	0.2829337	0	1
	Animist	43,419	0.013635	0.1159698	0	1
	None	43,419	0.067551	0.2509768	0	1
Husband's occupation	Do not work	33,763	0.142079	0.3491359	0	1
	professional/technical/managerial	33,763	0.257033	0.2174491	0	1
	Clerical	33,763	0.042769	0.2023382	0	1
	Sales	33,763	0.104464	0.3058654	0	1
	agriculture-self employment	33,763	0.332376	0.4710718	0	1
	agriculture employee	33,763	0.041169	0.1986846	0	1
	household and domestic	33,763	0.008264	0.0905287	0	1
	Service	33,763	0.058022	0.2337887	0	1
	skilled manual	33,763	0.138791	0.3457334	0	1
	unskilled manual	33,763	0.082309	0.274839	0	1
	never married	35,604	0.298337	0.4575347	0	1
	currently in union	35,604	0.648719	0.4773772	0	1
	formally in union	35,604	0.052944	0.2239238	0	1
Marital status						
Age at first cohabitation		33,945	17.07804	5.506687	0	57
Age at first sex		36,588	14.73109	6.141504	0	49
Age at first birth		34,907	21.50878	7.309356	10	49
Life time sex partners		36,047	3.573057	3.589169	1	90
Contraceptive use		41,539	0.712679	0.4525177	0	1
Skip meal		14,677	0.481434	0.4996722	0	1
Residence	Urban	50,131	0.514173	0.4998041	0	1
	Rural	50,131	0.4858271	0.4998041	0	1

Standard errors in parentheses \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

## References

- [1] Ahmad, S., G. (1985). Effect of Education on Marital Fertility in Four Muslim Populations. *Comparative Study*, 41 (1-2), 23-37.
- [2] Åsa, K., Karen M., and Carina H. (1999). Women's Health at Work. *Research gate*. [https://www.researchgate.net/publication/265754069\\_Women%27s\\_Health\\_at\\_Work](https://www.researchgate.net/publication/265754069_Women%27s_Health_at_Work)
- [3] Baum, C., L., and Ruhm, C., J. (2007). Age, Socioeconomic Status and Obesity. *Growth NBER Working Paper*, No. w13289.
- [4] Bbaale, E. (2010). Female Education, Contraceptive Use, and Fertility: Evidence from Uganda. *The Journal of Sustainable Development*, 6 (1), 20-47.
- [5] Beguy, D. (2009). The impact of female employment on fertility in Dakar (Senegal) and Lomé (Togo). *Demographic Research*, 20 (7), 97-128.
- [6] DHS. (1991). Cameroon Demographic Health Survey and Multiple Indicators. [www.dhsprogram.org](http://www.dhsprogram.org)
- [7] DHS. (1998). Cameroon Demographic Health Survey and Multiple Indicators. [www.dhsprogram.org](http://www.dhsprogram.org)
- [8] DHS. (2004). Cameroon Demographic Health Survey and Multiple Indicators. [www.dhsprogram.org](http://www.dhsprogram.org)
- [9] DHS. (2011). Cameroon Demographic Health Survey and Multiple Indicators. [www.dhsprogram.org](http://www.dhsprogram.org)
- [10] DHS. (2018). Cameroon Demographic Health Survey and Multiple Indicators. [www.dhsprogram.org](http://www.dhsprogram.org)
- [11] Esteban, O., Sandra, T., and Max, R. (2018). Women's employment. Our World in Data. <https://ourworldindata.org/female-labor-supply>
- [12] Fisher, G., P. (1992). 3 Generally Accepted Theories Explain the Causes of Obesity. *Deseret Digital Media*, <https://www.deseret.com/1992/6/5/18987708/3-generally-accepted-theories-explain-the-causes-of-obesity>
- [13] Goldin, C., and Lawrence F. (2002). The power of the pill: Oral contraceptives and women's career and marriage decisions. *Journal of Political Economy*, 110 (4), 730-770.
- [14] Ingrid, W. (1980). Employment and Women's Health: An Analysis of Causal Relationships. *International Journal of Health Services*. <https://doi.org/10.2190/8QQ5-KR69-627U-61M6>
- [15] Judith, H., and LaRosa, R., N. (1988). Women, work, and health: Employment as a risk factor for coronary heart disease. *American Journal of Obstetrics and Gynecology*, 158 (6), 2, 1597-1602.
- [16] Kanjanapan, W., I. (1985). Marital Status Composition and Fertility: A Comparative Analysis of World Fertility Survey Data. *PMID*, (8), 153-75.
- [17] Kevin, M. (2004). When Does Religion Influence Fertility? *Population and development review*, 30 (1), 25-56.
- [18] Kinga, B., M., Yvonne, T., and Nji, C. (2019). Socioeconomic status and obesity in the Bamenda Municipality on the Northwest Region. *Cameroon, Journal of Economics and management sciences*. 1 (1), 2664-8237.

- [19] Maslow, A., H. (1943). A theory of human motivation. *Psychological Review*, 50, 370–396.
- [20] Maydeu-Olivares, A., Shi, D., and Rosseel, Y. (2019). Instrumental Variables Two-Stage Least Squares (2SLS) vs. Maximum Likelihood Structural Equation Modeling of Causal Effects in Linear Regression Models Structural Equation Modeling. *A Multidisciplinary Journal*, 26 (6), 876-892.
- [21] Mosammat, Z., N., Mohammad, S., Z., and Shafiqul, S., M., I. (2013). Age at first marriage and its relation to fertility in Bangladesh. *Chinese Journal of Population Resources and Environment*, 11, 3.
- [22] Nagata, J., M., Valeggia, C., Barg, F., and Bream, K. (2009). Body mass index, socio-economic status and socio-behavioral practices among Tz'utujil Maya women. *Economic of Human Biology*, 19104.
- [23] Nathan, H., L. (2017). The Relationship between Waist-Hip Ratio and Fertility. Research from traditional societies provides dramatic new evidence. <https://www.psychologytoday.com/us/blog/beastly-behavior/201706/the-relationship-between-waist-hip-ratio-and-fertility>
- [24] Norman, R., J., and Clark, A., M. (1998). Obesity and reproductive disorders: A review. *Reprod Fertil Dev*, 10 (1), 55-63.
- [25] Payne, J. (2004). The impact of a reduced fertility rate on women's health. *BMC Womens Health*, PMID, 15345074.
- [26] Quinel, R. (2009). The Relationship of Socioeconomic Status and Obesity in Youth. A Master Of Nursing Washington State University. <https://pdfs.semanticscholar.org>.
- [27] Rena, R., Karen, A., Matthews, S., and Ingrid, W. (1989). Employment and Women's Health: Effects of Paid Employment on Women's Mental and Physical Health. *American Psychologist*, 44 (11), 1394-1401.
- [28] Schultz, T., P. (2005). Fertility and Income. *Economic Growth Center Yale University Center Discussion Paper*, No. 925.
- [29] SDG, (2010). Sustainable Development Goals. Cameroon. [www.un.org](http://www.un.org).
- [30] Sorokowski, P., Butovskaya, M., Sorokowska, A., Karwowski, M., Sabiniewicz, A., Fedenok, J. and Dronova, D. (2017). Waist-to-hip ratio, body-mass index, age and number of children in seven traditional societies. *Scientific Reports*, 7.
- [31] Stoebenau, K., Rohini P. and Anju, M. (2013). Has Fertility Decline Contributed to Improvements in Women's Lives? *ICRW-FE*, 012-2013.
- [32] Tsafack, A., R., N., and Zamo-Akono, C., M. (2010). Fertility, Health and Female Labour Force Participation in Urban Cameroon. *International Business Research Archives*. 3 (2), 136.
- [33] UNSD. (2020). United Nations Statistics Division data base. <https://unstats.un.org/home/>
- [34] WHO, (2019). Mental health aspects of women's reproductive health; A global review of the literature. <https://apps.who.int/iris/handle/10665/43846>
- [35] Zijian, G., and Dylan, S., S. (2016). Control Function Instrumental Variable Estimation of Nonlinear Causal Elect Models. *Journal of Machine Learning Research*, 17 (1), 1-35.