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A Statistical Modeling Approach of Examining Hypertension-Related Risk Factors in Adults

Abdulazeez Sikiru Adeyinka
Department of Mathematical Sciences
Kaduna State University, Kaduna.
e-mail - ysabdul94@gmail.com **Tel :** +2348065616611, +2348023607591

Abstract
Hypertension is an increasingly important health issue, not just in the developed nations but also in the developing countries of the world including those of Sub-Saharan Africa. Hypertension is a problem if we consider its 'silent' nature, few persons are usually aware of their hypertensive status and also fewer persons seek treatment. This has led to unacceptably high morbidity and mortality from potentially preventable complications such as coronary heart disease, heart failure, strokes and chronic renal failure. Some selected risk factors associated with hypertension are evaluated. The severity of hypertension and associated risk factors amongst adult patients attending Yusuf Dantsoho General Hospital is studied. The data used in this research work was obtained from the medical record department of Yusuf Dantsoho General Hospital. After the analysis, the overall prevalence of hypertension in the study was found to be 45.0% and among the categories those that are divorce have higher prevalence of hypertension which is 33.50%, Non diabetic and those whose parents are hypertensive have same prevalence of 33.0% whereas those below 25 years of age have least prevalence of 1.50% of hypertension. Among the risk factors used in the research only age (46-55), sex, diabetics, and parent hypertensive status were found to be significant at 0.10.

Keywords: Hypertension, Systolic blood pressure, diastolic blood pressure, logistic regression, Multicollinearity

1. Introduction
Hypertension, commonly known as high blood pressure, stands as a prominent global public health issue due to its substantial impact on the overall health burden and its pivotal role as a leading risk factor in the onset of various disease processes. In 2001, elevated blood pressure played a significant role, contributing to 54% of stroke cases, 47% of ischemic heart disease incidents, 75% of hypertensive disease occurrences, and 25% of other cardiovascular diseases worldwide. The negative impact of hypertension on health status is clear, especially taking into account the disability, decreased quality of life, and mortality associated with stroke and cardiovascular disease. In 2001, 7.6 million deaths (13.5% of all deaths) and 92 million disability life-years (6% of total) were attributable to systolic blood pressure greater than 115 mmHg. It is saddening to note that such pervasive negative effects are related to such a modifiable cause. Hypertension is characterized by a systolic blood pressure equal to or exceeding 140 mmHg and/or a diastolic blood pressure equal to or exceeding 90 mmHg. Systolic blood pressure represents the maximum arterial pressure during the heart's contraction, while diastolic blood pressure indicates the

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minimum pressure between the heart's contractions. Elevated blood pressure necessitates the heart to exert additional effort in propelling blood throughout the body, putting stress on the blood vessels and potentially causing them to stiffen, clog, or weaken. This condition may lead to atherosclerosis, wherein blood vessels become harder and narrower, increasing the likelihood of blockages from blood clots or fragments of fatty material dislodging from the vessel walls. Consequently, this elevated risk of blockages may result in conditions such as ischemic stroke, hemorrhagic stroke, and ischemic heart disease, (Cooper *et al.*, 1997). Previous research findings revealed that hypertension is responsible for 45% of death due to heart disease and 51% of death due to stroke worldwide, and billions of people being affected globally (Addo *et al*, 2007). In the case of Nigeria, hypertension is the most common cardiovascular disease reported with the death rate of 13.62% per 100,000 population as at 2014 (Ogah, 2012; WHO, 2014). Yusuf Dantsoho General Hospital is a public hospital, located at Tudun Nupawa, Kaduna South Local Government, Kaduna State. It was established on 1st January, 1989, and operates on 24hrs basis. Yusuf Dantsoho General Hospital is a licensed hospital by the Nigeria Ministry of Health, with facility code 18/10/1/2/1/0002 and registered as Secondary Health Care Centre. The Yusuf Dantsoho General Hospital offers the following medical services: Dermatology, Ophthalmology, General Surgery, Anesthesia, Pediatric Surgery, Antenatal Care (ANC), Immunization, HIV/ AIDS Services, Tuberculosis, Non-Communicable Diseases, Family Planning, Intensive Care Services, Communicable Diseases, Hepatitis, Child Survival, Accidents and Emergency, Nutrition, Health Education and Community Mobilization, Maternal and newborn care, Obstetrics, Gynecology. According to the seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure JNC 7th report (2004) defined and classified hypertension in adults. The diagnosis of hypertension is made when the average of 2 or more diastolic BP measurements on at least 2 subsequent visits is ≥ 90 mm Hg or when the average of multiple systolic BP readings on 2 or more subsequent visits is consistently ≥140 mm Hg. Isolated systolic hypertension is defined as systolic BP ≥140 mm Hg and diastolic BP <90 mm Hg. Individuals with high normal BP tend to maintain pressures that are above average for the general population and are at greater risk for development of definite hypertension and cardiovascular events than the general population. (Owusu-Dabo, 2008). The assessment of high blood pressure typically involves the use of a device known as a sphygmomanometer. This device comprises an inflatable rubber cuff, an air pump, and a column of mercury or a digital display that indicates pressure in an air column, along with electronic blood pressure machines. Blood pressure readings are commonly expressed in millimeters of mercury (mmHg). It is important to note that the diagnosis of high blood pressure is not reliant on a single reading, except in cases where the reading is exceptionally high (above 170-180/105-110). The cause of hypertension is not yet known unless it is secondary high blood pressure. However, there are many underlying factors associated with the occurrence. These factors include: aging, excessive salt intake, sedentary lifestyle as well as genetic factors. Age is unavoidable, age increases with time. (Ogah, 2012) refers to aging as a biological process with a decline in the performance of most organs. Less activity as a result to ageing also causes high blood pressure. Impaired ability of the arteries to expand when blood is

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pumped can be attributed to hardening of the structural changes in the arteries. Hormonal changes as a result to ageing can as well cause high blood pressure. Changes as decrease in estrogen production, underactive thyroid and overactive thyroid can as well influence the rise in the blood pressure, (Toposh & Narinder, 2015).It is known that high blood pressure usually develops in elderly women after menopause due to hormonal changes. Salt is not a major cause of hypertension. However, it is a contributing factor especially among salt sensitive persons. Excessive intake of salt accounts greatly to the occurrence of high blood pressure and other cardiovascular diseases. Several studies conducted over the years recommend reduction of salt intake as the key to prevention and control of high blood pressure, (Toposh & Narinder, 2015).

According to a recent study Dietary Reference Intakes (DRIs), sodium consumption should be 1500milligram per day; equivalent to a teaspoon. The maximum level researched not to pose risk for consumption is 2500 milligrams per day. However, research estimates daily consumption on the average westernized meal as 3000 to 4500milligram. This figure accounts twofold of the maximum recommendation. Sedentary life style is a medical term used to describe lifestyle with little or no physical activity. Sedentary lifestyle is dangerous to health as smoking. This is due to the fact that it contributes to most death as a result from heart diseases. The high growing rate of sedentary lifestyle could be attributed to economic growth, modernization, urbanization as well as globalization of food (Ogah, 2012). Advance in technology today has also reduced level of morbidity at work. Most jobs demand sitting behind the desks for long hours during the day. This is followed by long hours enjoying television or video games at leisure time. As a result, to this, most diseases as high blood pressure are directly related to the lack of exercise. (Pobee *et al.,* 1977). Obesity stands as a significant public health challenge, characterized by the excessive accumulation of body fat and weight. It constitutes one of the contributing factors to the development of high blood pressure. While genetic factors can predispose individuals to weight gain, the interplay between energy intake and physical activity remains a crucial determinant. The Body Mass Index (BMI), derived from weight and height measurements, is a key indicator. As recommended by both the National Institute of Health (NIH) and the World Health Organization (WHO), a normal BMI for adults aged 18 and above falls within the range of 18.5-24.9. A BMI exceeding this range increases the risk of obesity-related conditions, including high blood pressure, (Toposh & Narinder, 2015). The heart reacts differently to basic activities of the day such as eating and drinking. High consumption of alcohol has been related to the rise of blood pressure over the years, (Ulasi *et al*., 2010) This is due to the fact that, the kidney and liver works extra hard in getting rid of waste from the bloodstream therefore, more pressure is exerted on the arteries. Excessive alcohol intake can also increase the chance of other medical issues as obesity that may lead to an increase in blood pressure. (Sheldon, 2010). Hypertension also referred as the silent killer. Most people who have high blood pressure usually do not have symptoms. In some cases, (Jugal *et al.*, 2016). people with high blood pressure may have a pounding feeling in their head or chest, a feeling of lightheadedness or dizziness. Other signs include ear noise or buzzing, irregular heartbeat, nose bleeding, tiredness and vision changes. If there are no warning signs, people with high blood pressure may go years without knowing that they have the condition. High blood pressure can lead to hypertensive complications in other parts of the body because of the damage to the blood vessels and excessive pressure on the artery walls which damages vital organs. The higher blood pressure and the longer it goes uncontrolled, the greater the damage. (Jugal *et al.*, 2016). Uncontrolled high blood pressure which leads to hypertensive complications includes: Heart Attack, Stroke, Kidney failure or Kidney damage, Loss of vision and Sexual dysfunction.

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Hypertensive awareness and management are far from optimal as treatment, awareness and control of hypertension were no more near the rule of halves. In this study, the level of awareness of hypertension was 15.5% and 19.8% in males and females respectively. The global prevalence of hypertension is on the increase. In 2000, 972 million people had hypertension with a prevalence rate of 26.4%. These are projected to increase to 1.54 billion affected individuals and a prevalent rate of 29.4% in 2025 (Kearney et al., 2004).

2. Materials, Method and Results

The data used in this research work was obtained from the medical record Department, at Yusuf Dantsoho General Hospital. The data covered a period of three (3) years from 2019-2022. The Binary Logistic Regression Analysis and Variance inflation factor (VIF) where carried out using the IBM SPSS Statistics 23. Logistic regression sometimes called the logistic model or logit model, analyzes the relationship between multiple independent variables and a categorical dependent variable, and estimates the probability of occurrence of an event by fitting data to a logistic curve. There are two models of logistic regression, binary logistic regression and multinomial logistic regression. Binary logistic regression is typically used when the dependent variable is dichotomous and the independent variables are either continuous or categorical. When the dependent variable is not dichotomous and is comprised of more than two categories, a multinomial logistic regression can be employed. In the relationship between coronary heart disease (CHD) and serum cholesterol is nonlinear and the probability of CHD changes very little at the low or high extremes of serum cholesterol. This pattern is typical because probabilities cannot lie outside the range from 0 to 1. The relationship can be described as an 'S'-shaped curve. The logistic model is popular because the logistic function, on which the logistic regression model is based, provides estimates in the range 0 to 1 and an appealing S-shaped description of the combined effect of several risk factors on the risk for an event. Logistic regression is part of a category of statistical models called generalized linear models. This broad class of models includes ordinary regression and ANOVA, as well as multivariate statistics such as ANCOVA and log linear regression. An excellent treatment of generalized linear models is presented in Agresti (1996). Logistic regression enables the prediction of a discrete outcome, such as group membership, based on a set of variables that can be continuous, discrete, dichotomous, or a combination of these. Typically, the dependent or response variable is dichotomous, representing categories like presence/absence or success/failure. Discriminant analysis is another method for predicting group membership, but it is limited to scenarios with only two groups and requires continuous independent variables. In cases where the independent variables are categorical or a mix of continuous and categorical, logistic regression is the preferred choice. Logistic regression does not require many of the principal assumptions of linear regression models that are based on ordinary least squares method–particularly regarding linearity of relationship between the dependent and independent variables, normality of the error distribution, homoscedasticity of the errors, and measurement level of the independent variables. Logistic regression can handle non-linear relationships between the dependent and independent variables, because it applies a non-linear log transformation of the linear regression. The error terms (the residuals) do not need to be multivariate normally distributed–although multivariate normality yields a more stable solution. The variance of errors can be heteroscedastic for each level of the independent variables. Logistic regression can handle not only continuous data but

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also discrete data as independent variables. However, some other assumptions still apply. First, logistic regression requires the dependent variable to be discrete mostly dichotomous. Second, since logistic regression estimates the probability of the event occurring (P(X=1)), it is necessary to code the dependent variable accordingly. That is the desired outcome should be coded to be 1. Third, the model should be fitted correctly. It should not be over fitted with the meaningless variables included. Also it should not be under fitted with meaningful variable not included. Fourth, logistic regression requires each observation to be independent. Also the model should have little or no multicollinearity. That is, independent variables are not linear functions of each other. Fifth, whilst logistic regression does not require a linear relationship between the dependent and independent variables, it requires that the independent variables are linearly related to the log odds of an event. Lastly, logistic regression requires large sample sizes because maximum likelihood estimates are less powerful than ordinary least squares used for estimating the unknown parameters in a linear regression model. The dependent variable in logistic regression is usually dichotomous, that is, the dependent variable can take the value 1 with a probability of success θ, or the value 0 with probability of failure 1-θ. This type of variable is called a Bernoulli (or binary) variable. Although not as common and not discussed in this treatment, applications of logistic regression have also been extended to cases where the dependent variable is of more than two cases, known as multinomial or polytomous. (Tabachnick et al., 1996). As mentioned previously, the independent or predictor variables in logistic regression can take any form. That is, logistic regression makes no assumption about the distribution of the independent variables. They do not have to be normally distributed, linearly related or of equal variance within each group. The relationship between the predictor and response variables is not a linear function in logistic regression, instead, the logistic regression function is used, which is the logit transformation of p:

$$logit(p) = \log\left(\frac{p}{1-p}\right) \tag{1}$$

Where p= the constant of the equation and, p-1 = the coefficient of the predictor variables.

This expression on the right is called a logistic function (logit model), it cannot yield a value that is either negative or greater than 1; consequently, it restricts the estimated value of p to the required range. Therefore, in other to handle the binary valued response, we apply a mapping from the predicted domain onto the [0, 1] interval. This mapping is an example of S-shaped function, also called the sigmoidal functions; which is an example of nonlinear regression. Hence, both theoretical and empirical considerations suggest that when the response variable is binary, the shape of response function will frequently be curvilinear. The response function is shaped either as a little S or as a reverse little S and that they are approximately linear except at the ends.
Recall that if an event occurs with probability p, odds in favor of the event tends to 1

Thus, if a success occurs with probability, p then odds in favor of success are:

$$odds(success) = \frac{p}{1-p} = \frac{p}{q} \tag{2}$$

Taking the natural logarithms of each side of this equation;

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Where the link function is shown below;

$$f(x)=\frac{L}{1+e^{-k(x_i-x_0)}} \tag{3}$$

The goal of logistic regression is to correctly predict the category of outcome for individual cases using the most parsimonious model. To accomplish this goal, a model is created that includes all predictor variables that are useful in predicting the response variable. Several different options are available during model creation. Variables can be entered into the model in the order specified by the researcher or logistic regression can test the fit of the model after each coefficient is added or deleted, called stepwise regression.

Stepwise regression is used in the exploratory phase of research but it is not recommended for theory testing Shaper *et al.*(1969). Theory testing is the testing of prior theories or hypotheses of the relationships between variables. Exploratory testing makes no a-priori assumptions regarding the relationships between the variables, thus the goal is to discover relationships. Backward stepwise regression appears to be the preferred method of exploratory analyses, where the analysis begins with a full or saturated model and variables are eliminated from the model in an iterative process. The fit of the model is tested after the elimination of each variable to ensure that the model still adequately fits the data. When no more variables can be eliminated from the model, the analysis has been completed.

Multicollinearity refers to predictors that correlate with other predictors in the model. It reduces the precision of the coefficients, which weakens the statistical power of the regression model. Variance inflation factors (VIF) average can be used to detect the multicollinearity, which are defined for each predictor variable as;

$$VIF=\frac{1}{1-r_K^2}=\frac{1}{1-R_i^2}\,. \tag{4}$$

Where R_i^2; is the multiple coefficient of determination for regression of Y on the other explanatory variables (a regression that does not involve the response variable). When is it close to 1, it indicates significant correlation with the remaining explanatory variables. Moreover, for assessing multicollinearity the mean of the VIF values is also computed with the following formula: If the VIF=1 then there is no multicollinearity. If the VIF is greater than 1 but less than 5 then, there is moderate multicollinearity. Again, if VIF is between 5 and 10 then there is high multicollinearity. In general, a value of VIF larger than 10 is indicative of serious Multicollinearity problems. If multicollinearity is a problem in your model remove highly correlated predictors from the model that is, if one has two or more factors with high VIF; remove one from the model, because they supply redundant information. Removing one of the correlated factors usually doesn’t drastically reduce the R-squared.

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Prevalence of Hypertension

Hypertension Status					
		Non-hypertensive	Hypertensive	Non-hypertensive	Hypertensive
Variables	**Categories**	**Count**	**Count**	**Prevalence %**	**Prevalence %**
Gender	Male	55	32	27.50	16.00
	Female	55	58	27.5	29.00
Age Group	<=25	4	3	2.00	1.50
	26-35	16	7	8.00	3.50
	36-45	25	25	12.50	11.50
	46-55	27	34	13.00	17.00
	56+	38	23	19.00	11.50
Marital Status	Married	13	5	6.50	2.50
	Divorce	79	67	39.50	33.50
	Window/Widower	9	8	4.50	4.00
	Single	9	10	4.50	5.00
Employment Status	Self-Employed	25	24	12.50	12.00
	Employed	57	46	28.50	23.00
	Unemployed	9	4	4.50	2.00
	Retired	19	16	9.50	8.00
Highest Educational Qualification	Primary	17	12	8.50	6.00
	Secondary	27	20	13.50	10.00
	Tertiary	59	53	29.50	26.50
	Uneducated	7	5	3.50	2.50
Diabetic Status	Nondiabetic	62	66	31.00	33.00
	Diabetic	48	24	24.00	12.00
Life Style and Exercise	Moderate	10	3	5.00	1.50
	Light	30	36	15.00	18.00
	Sedentary	70	51	35.00	25.50
Parent Hypertension Status	No	49	24	24.50	12.00
	Yes	61	66	30.50	33.00
Hypertension Status	Non-hypertensive	**110**	**-**	**55.00**	**-**
	Hypertensive	**-**	**90**	**-**	**45.00**

The result in table 1 shows frequency of hypertensive and non-hypertensive patient among the categories and the prevalence of hypertension among those categories, it can be clearly seen that the overall prevalence of hypertension in the study was found to be 45.00% which means that out of the 200 patients 90 of them were found to be hypertensive and 110 people were found to be

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non-hypertensive corresponding to 55.00%, among the categories, those that are divorced have higher prevalence of 33.50%. Non-diabetic patients and those whose parents are hypertensive have same prevalence of 33.00% whereas those at or below 25 years of age have less prevalence of 1.50% of hypertension.

Table 2: Omnibus Tests of Model Coefficients

		Chi-square	Df	Sig.
	Step	33.537	18	.014
Step 1	Block	33.537	18	.014
	Model	33.537	18	.014

Table 3: Model Summary

Step	-2Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	241.718	.154	.207

The result in table 2 and 3 shows how good the model is, that is, its predictive ability, eight explanatory variables have been added in to the model which reduced the -2likelihood by 33.537 with 18 degree of freedom. The -2likelihood has a chi-squared distribution, the significance of adding the eight explanatory variables in to the model is given in table 4.2 by .014 which is less than the conventional significance level of 0.1 which mean that it is significances.

From table 3, the Nagelkerke R Square is 0.207 which implies that 20.7% of the variation in the dependent variable can be explained by the explanatory variables.

Table 4: Variables in the Equation

Variables in the Equation								
	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
							Lower	Upper
Sex(1)	-.720	.354	4.133	1	.042	.487	.272	.871
Maritalstatus			2.798	3	.424			
Maritalstatus(1)	-1.248	.936	1.778	1	.182	.287	.062	1.339
Maritalstatus(2)	-.815	.586	1.936	1	.164	.443	.169	1.160
Maritalstatus(3)	-1.124	.776	2.097	1	.148	.325	.091	1.165
Empstatus			.839	3	.840			
Empstatus(1)	.037	.526	.005	1	.944	1.037	.437	2.463
Empstatus(2)	-.170	.449	.142	1	.706	.844	.403	1.767
Empstatus(3)	-.583	.831	.492	1	.483	.558	.142	2.191
Eduqual			2.161	3	.540			
Eduqual(1)	-.057	.764	.006	1	.940	.944	.269	3.316

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Eduqual(2)	.126	.745	.029	1	.866	1.134	.333	3.862
Eduqual(3)	.550	.697	.623	1	.430	1.733	.551	5.452
Diab(1)	.837	.349	5.764	1	.016	2.310	1.302	4.098
Exer			3.305	2	.192			
Exer(1)	.707	.737	.920	1	.338	2.027	.603	6.814
Exer(2)	1.191	.762	2.443	1	.118	3.290	.939	11.524
Phs(1)	-.930	.356	6.841	1	.009	.395	.220	.708
AgeGroup			4.619	4	.329			
AgeGroup(1)	.181	.968	.035	1	.852	1.198	.244	5.883
AgeGroup(2)	-.103	.721	.020	1	.887	.902	.276	2.955
AgeGroup(3)	.345	.462	.557	1	.456	1.412	.660	3.020
AgeGroup(4)	.817	.424	3.708	1	.054	2.264	1.127	4.549
Constant	-.694	1.241	.313	1	.576	.499		

From the above table 4 it can be seen that the constant, Sex (1), Diab (1), Phs (1) and Age Group (4)with p - value .042, .016, .009, .054 respectively are all statistically significant at 10% which means that they contribute to hypertension. The odd ratio of 0.487for Sex (1) indicates that a male is 0.487times more likely to have hypertension compared to a female, the odd ratio of 2.264 for Age(4) indicates that a person whose age is between 46-55 is 2.264 times more likely to have hypertension compared to a person whose age is at least 55, an odd ratio of 2.310 for Diabetic(1) indicates that a person who is diabetic is 2.310 times more likely to have hypertension compared to a non-diabetic person, an odd ratio of 0.395 for Parent (1) indicates that a person whose parent are non-hypertensive is 0.395 times more likely to have hypertension compared to a person whose parent are hypertensive.

Now, using those variables that are significant only to fit the model, therefore the logistic logit function is given as: -.694-.720 sex (1) + .837Diabbetic (1) + (-.930 Parent (1)) + .817 Age Group

Table 5: Collinearity Statistics

Model	Collinearity Statistics	
	Tolerance	VIF
Gender	.8908	1.1225
Age Group	.7560	1.3228
Marital Status	.7816	1.2795
Employment Status	.9019	1.1088
Highest Educational Qualification	.9582	1.0437
Diabetic Status	.9313	1.0737
Life Style and Exercise	.9628	1.0386
Parent Hypertension Status	.9786	1.0219

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Table 5 shows Tolerance and VIF which is a measure of multicollinearity, the VIF and Tolerance it indicates that there is no multicollinearity among the explanatory variables since none of the tolerance is less than 0.1 and none of the VIF is greater than 10.

3. Discussion

The overall prevalence of hypertension in the study was found to be 45.00% which means that out of the patients45% people were found to be hypertensive and 55% people were found to be non-hypertensive, among the categories, those that are divorced has higher prevalence of hypertension which is 33.50%. Non diabetic and those whose parents are hypertensive has same prevalence of 33.0% of hypertension cases where as those at or below 25 years of age have less prevalence of 1.50% of hypertension. From the logistic regression analysis result age (4), sex, diabetics, parent hypertensive status, marital status (4) and the constant where found to be significance at 10% level of significance and also the none of the VIF is greater than 10 to signify the existence of multicollinearity. The R-Square which is 20.7% indicates that 20.7% of the variation in the dependent variable can only be explained by the independent variables.

The fitted logistic model obtained is given as:

-.694 -.720 sex (1) + .837Diabbetic (1) + (-.930 Parent (1)) + .817 Age Group

4. Conclusion

Based on our analysis, the VIF and Tolerance obtained in the analysis leads to the conclusion that multicollinearity does not exist among the explanatory variables because none of the VIF is greater 10 nor any of the tolerance less than 0.1. Based on the research and the analysis carried out, it is recommended that: for all persons with hypertension, the potential benefits of a healthy diet, weight control, and regular exercise because these lifestyle treatments have the potential to improve blood pressure control and even reduce medication needs. Those with hypertension and diabetics should limit the intake of foods rich in fats and cholesterol and increase consumption of fruits and vegetables. They should avoid harmful habits, smoking, alcoholic consumption and reduce the intake salt. Hypertensive patient should check their blood pressure regularly, take the medications that the doctor prescribes regularly and take time to learn how to manage stress. Those with hypertension should avoid salted potato or corn chips, reduction in saturated fat, salted peanuts, fried chicken or other fried foods. Hypertensive patient should try to have a regular servings of whole wheat bread, whole grain cereals such as pasta, potatoes, increase intake of fiber, beans, nuts low fat cheeses, low fat milks and fish. A non-hypertensive patient should maintain a healthy weight, exercise regularly, avoid smoking, avoid alcoholic consumption, reduce the intake of food with high cholesterol and follow a healthy eating plan and limit the amount of salt in his or her food.

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