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To Analyze the Influencing factors on Child mortality in Ambo Town: Using Binary Logistic Regression Model

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Abstract: The main objective of this study is to observe the influencing factors on child mortality in Ambo town and identifying a most affecting factor. A logistic regression model is use to assess the relative effect of the variable hypothesized to influence status of child mortality. The analysis considers types of child diseases, parent education level and source of drinking water. The finding in the output of SPSS suggests that out of the categories in the types of disease, HIV is more determine status of child and primary educated parents also the most factors that influence status of child mortality. In other case unprotected source of water also more affected the response variable. Finally these finding specified that; improve parent education level and using pipe source of water is advisable.

Key **Words**: Child Mortality, Diseases, Parent Educational level, Source of drinking water, Logistic Regression

1. Introduction

1.1. Back ground of the study

Health is vital part of a national development policy which is aimed to improve the quality of life of all citizens. Infant and child hood illness and death represent the main health problem in developing countries.

Child mortality is a factor that can be associated with the well being of population and taken as one of the development indicators of health and socio economic status and also indicates the life quality of a given population as measured by life expectancy.

Children problems in developing countries are quite different from those industrial areas: firstly there are many children they may comprise 40% population. Secondly, quarter, a third, or in some rural areas, even one half all children born die during the first five years of life usually one half of all deaths takes place in the age group below five years in which the major health problems of country are concentrated, more than 97% of all death below age of five years took place in less developed countries, since Ethiopians one of those country infant and child mortality is also high.

1.2 statement of the problems

The purpose of this study is to examine factors that affect child mortality in Ambo town. Basic research questions that were answered by this study are:

1. Which type of disease more affects child mortality?
2. What are the major factors that determine the status of child in Ambo town?
3. Which factors are highly associations with status of mortality?

1.3 Objective of the study

1.3.1 General objectives

The main objective of this study is to determine the major factors that are associated to child mortality in Ambo town.

1.3.2 Specific objectives

- To identify the major factors that influence status of child in the study community
- To know which type of disease are contribute for status of child mortality.
- To describe how the parent level of education affect status of child mortality

2. Literature Review

Several studies investigate the factors that associated with child mortality by using ET Taha and N Kumwenda[1] analytical frame work of child survival. According to their analytical frame work of as discussed earlier, proximate determinants (biomedical factors) where identified and categorized into five general groups: maternal (fertility) factors, environmental-sanitation factors, availability of nutrient factors, injury and personal illness factors. However, some of these factors are not considered in this study. According to N Walker *et al.*, [2] analysis found that child mortality is highly associated with mother's educations that increase the awareness of how to care her children before birth and after birth and enables her to change feeding and child care practice by shaping and modifying the traditional familial relationships. Education plays an important role to improve knowledge of medical and health care. Particularly mother's education enhances to improve more effective preventative and health practice, this increase her productivity and influence child mortality.

Kumar and Gemechu [3] used data from Ethiopia DHS survey (2005) and employs cross tabulation techniques to examine the selected socio-economic, bio-demographic and maternal health factors that determine child mortality in Ethiopia. The result shows that among socio-economic variables birth interval with preceding birth and mother education have significant impact to lowering the risk of child mortality.

Two-third of disease is preventable. Malnutrition and the lack of safe water and sanitation contribute to half of all these children's disease. Research and experience shows that most of the children who died each year could be saved by low tech, evidence based, cost effective measures such as vaccines, antibiotics, micronutrients, supplementation, insecticide, treated bed net, improved family care and breastfeeding practice, and oral rehydration therapy[4]

Many researchers indicate that child mortality in urban area is smaller than rural areas. This variations is occurred due to unequal distribution of socio-economic factors and health facilities, for example in rural area the distribution of health resource more likely limited than urban areas because of the lack of modernization and limited health facilities, rural areas are expected to have higher risk of child mortality in case of Ethiopia

3 Methodology

3.1 Study Area

Ambo town is located in the central part of Ethiopia in Oromia regional state. Ambo woreda is located 114km from Addis Ababa in the western shoa zone on the road to nekempte. It was founded in 1874 and got municipal status in 1916. Ambo is one of the reform towns in the region and has a city administration.

3.2 Study variables

Two types of variables are considered in study these are:-

Dependent variable:- Child mortality.

Independent variables:-

- ✓ Sex of child
- ✓ Age of child
- ✓ Types of disease
- ✓ Age of mother at birth of child
- ✓ Parent education level
- ✓ Economy of parent
- ✓ Birth interval
- ✓ Source of water
- ✓ Size of family

3.3 Method of Data Collection

Data collection is the act of assembling and gathering the need of information in the context of our objective of study .The most crucial method we will plan to use in this study is secondary source of data which is collected in the CSA.

3.4 Method of data Analysis

The collected data is summarizing and interpreting by both descriptive and inferential statistics.

3.4.1 Descriptive Statistics

Descriptive statistics is a type of statistics which deals with method and techniques of organization, presenting reporting and arranging the data without making generalization Beyond the data, tables and graph is ultimately use for this study.

3.4.2 Inferential Statistics

Inferential statistics describes the data with making inferences by generalization and by summarizing source of numerical data.

3.4.2.1 Chi-square test of independence

Chi-square test is one of the most appropriate ways to use with categorical variables; it is non parameter test method (distribution free). It is uses to determine the significant association between the two variables .It used to test the hypothesis test that the row and column variable are independent or not. Chi-square is also a function of its degree of freedom. The test statistics is given by

$$\chi^2 = \frac{\sum_{i=1}^{r}\sum_{j=1}^{c}(O_{ij} - E_{ij})2}{E_{ij}} \sim \chi^2_{\alpha}((r-1)(c-1))$$

Where: - E_{IJ}-is the expected frequency corresponding to (i, j) th

O_{IJ}- is observed frequency

$(r-1)(c-1)$ =Degree of freedom

r- Number of rows

c- Number of columns

The test statistics χ^2 has (r-1) (c-1) degree of freedom and α level of significance.

Decision rule: reject H_0 if the calculated value is greater than the tabulated value (the significance level α=0.05) or reject H_0 if p-value is less than α = 0.05.

Chi-square use for different purpose among those the most important are the following.

-To test goodness of fit

-To test independent

-To test homogeneity

Assumption of chi-square

- ❖ All individual observation in the sample should independent.
- ❖ Sample must be drawn from the population interest.

- Each cell and every individual objective is independent of each other.
- Each number qualifies for one and only one cell in the table.
- It required sufficiently large expected frequency for each cell.

3.4.2.2 Logistic Regression

A logistic regression is technique for making predictions when the dependent variables is dichotomous and the independent variables may be categorical and mix of continuous and categorical. Logistic is a special case of generalized linear model in which the mean of the response variable is related to explanatory variables through a regression equation.

Binary or binomial logistic regression is the form of regression which is used when the dependent variable is dichotomous and independent variables are any type (discrete and continuous).

The dependent variables can take probability of success 'p' and '1-p'probability of failure. Logistic regression is used in various areas of social sciences and medical research.

3.4.2.3 Model of Logistic regression

One of the statistical techniques for this study is binary logistic regression and the model for logistic regression. Since the model is used to test the association of the two variables, we used odd ratio:

$$\text{Log it}\left(\frac{P}{1-P}\right) = \exp(\beta_1 + \beta_2 X_1 + \beta_2 X_2 + \ldots + \beta_k X_K)$$

where :

- ✓ P = is probability of a live.
- ✓ 1-P= is probability of a death.
- ✓ β_0= constant term.
- ✓ x_1, x_2 ….x_k= are the independent variable.
- ✓ β_1, β_2 …$\beta_k$coefficient of independent variable.
- ✓ e= 2.718

The ratio of probability success to probability of failure is P/1-P is odd ratio.

$\frac{P}{1-P} = \exp(\beta_1 + \beta_2 X_1 + \beta_2 X_2 + \ldots + \beta_k X_K)$ means that $\exp(\beta_j)$ where (j= 1, 2 …k) is a factor by which the odds of occurrence of success change by a unit increase in the j^{th} independent variable. If we take the natural logarithm of odd ratio obtain estimated model given by

$$Zi = \ln\left(\frac{p}{1-p}\right) = Zi = \beta_0 + \beta_1 x_1 + \ldots + \beta_K X_K$$

If $Z = \ln\left(\frac{p}{1-p}\right)$ is positive, it means that the value regresses increases.

If $Z = \ln\left(\frac{p}{1-p}\right)$ is negative, the odds that the regress and equals 1 decreases as the value of X increases.

ODD RATIO (OR): is the measures of how much the grater or less the odds are to subject possessing the risk of factors that to experience particular outcomes. We can write as follow: $\frac{pi}{1-pi} = e^{zi}$ is called odd ratio. The general formula of binary logistic regression model with one independent variable is given by:

$$\ln\left(\frac{p}{1-p}\right) = \exp\beta x$$

Where: p is probability of success for value of x

X is the in dependent variables (risk factor)

1-p is probability of failure

Odds = $\frac{p}{1-p}$ new the odds for another group would also be $\frac{p}{1-p}$ that group the odds and log it is related as follows:

$$\text{Log (\_odds)} = \text{log it (p)} = \ln\left(\frac{p}{1-p}\right)$$

$$P = \frac{e^{\beta o + \beta X}}{1 + e^{\beta o + \beta X}}$$

3.4.2.4 Assumption of logistic regression

Logistic regression doesn't make of the assumption of linear regression and general linear models that are based on ordinary least squares algorithm particularly regarding linearity, normality, Homoscedasticity, and measurement level

- It does not need a liner relationship between the dependent and independent variables.
- Outcome variables are dichotomous in case of binary logistic regression.
- It requires large number to be accurate.
- Logistic regression does not make the key assumptions of linear regression and GLM that are based on ordinary least square algorithms.

3.4.2.5 Estimating the Parameters in a Logistic Regression Model

The maximum likelihood is used to estimate the parameters of logistic regression. MLE is the method used to calculate the log it coefficients this contrasts to the use of OLS estimation of coefficient in regression.

3.4.2.6 Overall Significance the Logistic Regression Model

To test the overall significance for the logistic regression model we used Hosmer and Lemeshow chi-square test of goodness of fit.

4. Result and Discussion

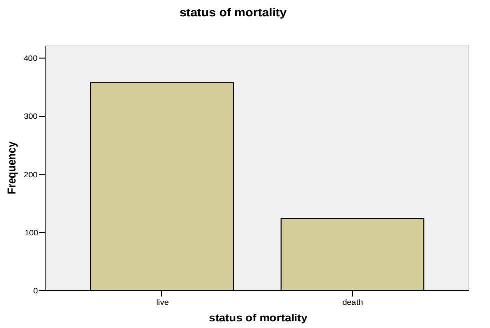
4.1 Descriptive Statistics

Descriptive statistics describes the data in the form of table, diagram and graph. We also analyze the raw data in this statistics based on their behavior. Due to our data is categorical the frequency table include only the count of variables and their percentage. In other case the bar graph and pi-chart are used for qualitative variables and histogram is used in quantitative data.

Frequency table: **Status of mortality**

Status of mortality	Account	Percent
Alive	358	74.3
Death	124	25.7
Total	482	100.0

As we see from the above table for status of mortality around **74.3%** of them are alive and only **25.7%** are exposed to death.



The above graph shows that most of the child status **(74.3%)** is alive.

Types of diseases	count	Percent
diaries	107	22.2
malaria	87	18.0
pneumonia	61	12.7
HIV	29	6.0
other	198	41.1
Total	482	100.0

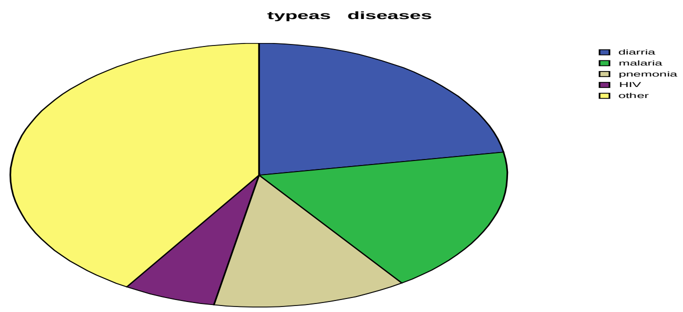
As we see from the table 4.2 above **22.2%**of diaries, **18.0%**of malaria, **12.7%**of pneumonia, **6.0%**of HIV**, 41.1%**of other disease is the factors that affect

Child mortality

Status of child	types diseases					Total
	diaries	malaria	pneumonia	HIV	other	
live	86	76	47	15	134	358
death	21	11	14	14	64	124
Total	107	87	61	29	198	482

Status of mortality	types diseases					Total
	diaries	malaria	pneumonia	HIV	other	
live	86	76	47	15	134	358
death	21	11	14	14	64	124
Total	107	87	61	29	198	482

The above cross tab table shows that out of **107** children affected by diaries most of them **86** are alive and only **21** are died. In a general case most of the children **198** are affected by different unknown disease and the least of them only **29** are exposed to HIV.



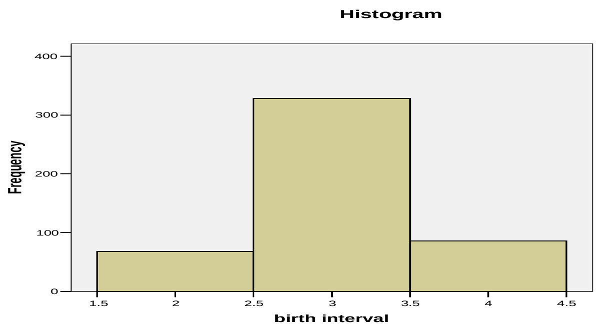
The above bar chart shows that most of the children **(41.1%)** of them are affected by different unknown disease and only **6.0%** are affected by HIV

Age of mother at birth of child	count	Percent
Below 18 age	62	12.9
18 to 35 age	312	64.7
Greater than 36 age	108	22.4
Total	482	100.0

Based on the above table we can conclude that most age of mothers at birth 0f child **(64.7%)** is lies between **18-35** ages.

	age of mother at birth of child			
Status of mortality	<18	18-35	>=36	Total
live	41	239	78	358
death	21	73	30	124
Total	62	312	108	482

Based on the above table from the total of **312** children with the mother age at birth of children **18-35**, most of them **239** are alive and only **73** are died. In other case out of the total children **482** only **62** of them are found the age of mother at birth of child **<18.**



The above graph shows that least of age of mothers at birth of child **(12.9%)** is <**18** age are exposed to factors that affect child mortality.

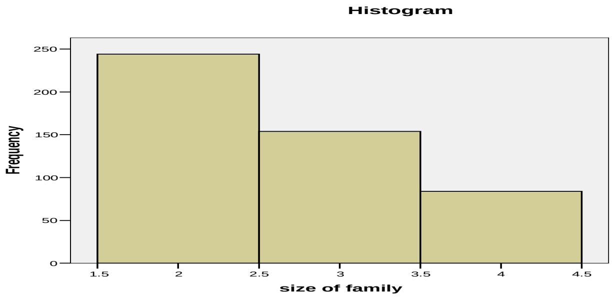
Size of family

Size of family	Frequency	Percent
1-3	244	50.6
4-6	154	32.0
>=7	84	17.4
Total	482	100.0

Based on the above table researchers can concluded that factor that affects child mortality is more affected **1-3** size of family.

Size of family	age of mother at birth of child			Total
	Below 18 years	18 to 35	Greater than 35	
1-3	62	152	30	244
4-6	0	154	0	154
>=7	0	6	78	84
Total	62	312	108	482

The above table shows that out of **312** children with age of mother at birth interval of child **18-35** most of the children **154** are found in the parent with **4-6** size of family.



The above histogram shows that the size of family >=7 is only **84**.

The researcher can conclude that as the economy of the parent increase the number of death is decrease. In other case out of **102** children with **<400** economy of parent only **42** of them are survive. In similar fashion out of the total of **136** children with **400-800** economy of parents most of the children **(98**) of them are alive. This indicates that as the economy of parent increase the mortality of children can be decreased.

4.2Result and discussion of inference statistics

4.2.1 Chi - square test (Test of association)

Chi-square test is one part of inferential statistics that used to test the association of explanatory variables with that of response variables. This test is used only if the variables are categorical and have nominal and ordinal measures**.**To do so there is the general hypothesis for this study.

The null hypothesis is the value that we interested to reject. Optionally we are obligated to accept the alternative hypothesis.

Therefore based on the probability of rejecting the type I error and level of significance we decide to reject or fail to reject the null hypothesis. If the p-value is less than the usual level of significance we forced to reject the null hypothesis otherwise fail to reject

The general form of hypothesis is:

H_O: There is no association between the explanatory variables and response variable.

H_1: There is an association between the explanatory variables and response variable

Therefore based on the a bove general form of hypothesis, we also conclude the SPSS output as follow sequentially.

Status of child	sex of children		Total
	female	male	
live	163	195	358
death	58	66	124
Total	221	261	482

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.057	1	.811		
Continuity Correction(a)	.018	1	.893		
Likelihood Ratio	.057	1	.811		
Fisher's Exact Test				. 835	.446
Linear-by-Linear Association	.057	1	.811		
N of Valid Cases	482				

H_O: status of mortality is independent of sex.

H_1: status of mortality is dependents of sex.
Decision: Since **p-$_{value}$ =0.811**> α =0.05 we fail to reject the null hypothesis.
Conclusion: we can conclude that there is no an association between status of mortality and sex of children at 5% level of significance.

Count

Status of child	Types diseases					Total
	diaries	malaria	pneumonia	HIV	other	
live	86	76	47	15	134	358
death	21	11	14	14	64	124
Total	107	87	61	29	198	482

Chi-Square Tests

	Value	Df	Asymp.Sig.(2-sided)
Pearson Chi-Square	22.349	4	0.000
Likelihood Ratio	22.553	4	0.000
Linear-by-Linear Association	13.057	1	0.000
N of Valid Cases	482		

H_O: there is no association between status of mortality and types of disease
H_1: there is association between status of mortality and types of disease
Decision: due to **p-$_{value}$=0.00** is less than α =0.05 we reject the null hypothesis.
Conclusion: therefore we have an evidence to say that there is an association between status of mortality and type's 0f disease at 0.05% level of significance.

Status of child	parent education level				Total
	not learning	primary	secondary	higher	
live	101	146	98	13	358
death	55	39	24	6	124
Total	156	185	122	19	482

Chi-Square Tests

	Value	Df	Asymp.Sig.(2-sided)
Pearson Chi-Square	12.185	3	0.007
Likelihood Ratio	11.912	3	0.008
Linear-by-Linear Association	5.919	1	0.015
N of Valid Cases	482		

H_O: there is no association between status of mortality and parent education level
H_1: there is association between status of mortality and parent education level
Decision: due to **p-$_{value}$=0.007** < α **=0.05** we reject the null hypothesis
Conclusion: therefore at 5% level of significance we have an evidence to say that there is an association between status of mortality and parent education.

Status of child	age of mother at birth of child			Total
	<18	18-35	>=36	
live	41	239	78	358
death	21	73	30	124
Total	62	312	108	482

Chi-Square Tests

	Value	Df	Asymp.Sig.(2-sided)
Pearson Chi-Square	3.276	2	0.194
Likelihood Ratio	3.166	2	0.205
Linear-by-Linear Association	0.253	1	0.615
N of Valid Cases	482		

H_0: there is no association between status of mortality and age of mother at birth of child
H_1: there is association between status of mortality and age of mother at birth of child
Decision: due to **p-$_{value}$=0.194** $> \alpha = 0.05$ we fail to reject the null hypothesis.
Conclusion: At 5% level of significance we can conclude that there is no association between status of mortality and age of mother at birth of child

Status of child	economy of parent <400	400-800	801-1500	>1500	Total
live	42	98	86	132	358
death	60	38	21	5	124
Total	102	136	107	137	482

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	95.853	3	.000
Likelihood Ratio	101.417	3	.000
Linear-by-Linear Association	89.067	1	.000
N of Valid Cases	482		

H_0: there is no association between status of mortality and economy of parent
H_1: there is association between status of mortality and of economy of parent
Decision: due to p-$_{value}$ is less than level of significance (α =0.05) we reject the null hypothesis.
Conclusion: therefore we have an evidence to say that there is an association between status of mortality and of economy of parent at 0.05% level of significance.

Count

status of mortality	size of family 1-3	4-6	>=7	**Total**
live	120	154	84	358
death	124	0	0	124
Total	244	154	84	482

H_0: there is no association between status of mortalit and size of family
H_1: there is association between status of mortality and f size of family.
Decision: due to p-$_{value}$ is less than then level of signific nce we reject the null hypothesis.
Conclusion: therefore at 5% level of significance we car conclude that there is no enough evidence to say that there is no association between status of mortality ar l size of family

Count

Status of child		Source of drinking water			Total
		Pipe	Protected	Unprotected	
	Alive	249	74	35	358
	Death	66	39	19	124
Total		315	113	54	482

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	10.852[a]	2	.004
Likelihood Ratio	10.574	2	.005
Linear-by-Linear Association	9.309	1	.002
N of Valid Cases	482		

H_O: status of mortality is independent of source of drinking water.
H_1: status of mortality is depending on source of drinking water.
Decision: since p_{value}=004 of the above Pearson chi-square is less than α=0.05 we reject the null hypothesis.
Conclusion: At 5% level of significance a researcher can conclude that source of drinking water can determine the status of mortality.

Count

Status of child		birth interval			Total
		1 year	2-4	>=5	
	Alive	40	257	61	358
	Death	28	71	25	124
Total		68	328	86	482

Chi-Square Tests

	Value	Df	Asymp.Sig.(2-sided)
Pearson Chi-Square	11.856	2	0.003
Likelihood Ratio	11.139	2	0.004
Linear-by-Linear Association	1.983	1	0.159
N of Valid Cases	482		

H_o: there is no association between status of mortality and birth interval.
H_1: there is association between status of mortality and birth interval.
Decision: since p_{value} (.003) is less than α=0.05 we reject null hypothesis.
Conclusion: we conclude that at **5%** level of significance there is association between status of mortality and birth interval.

Status of child	age of children			Total
	<2	2-4	>4	
live	48	79	231	358
death	71	31	22	124
Total	119	110	253	482

H_o: there is no association between status of mortality and age of children.
H_1: there is association between status of mortality and age of children.
Decision: since **p-value (.00)** is less than α =0.05 we reject null hypothesis
Conclusion: therefore at 5% level of significance we can conclude that there is an association between status of mortality and age of children.

The summery table of chi-square for explanatory variables

variables	Pearson chi-square		
	value	df	Sig(two tail)
Sex of child	0.057	1	0.811
Type of disease	22.349	4	0.000
Parent education level	12.185	3	0.007
Age of mother	3.276	2	0.194
Economy of parent	95.853	3	0.000
Size of family	162.844	2	0.000
Source of drinking water	10.852	2	0.004
Birth interval	11.856	2	0.003
Age of child	110.480	2	0.000

4.2.2 Binary Logistic regression

Logistic regression or logit regression is a type of probabilistic statistical classification model. It is also used to predict a binary response from a binary predictor used for predicting the outcome of a categorical dependent variable (i.e., a class label) based on one or more predictor variables (features). That is, it is used in estimating empirical values of the parameters in a qualitative response model. The probabilities describing the possible outcomes of a single trial are modeled, as a function of the explanatory (predictor) variables, using a logistic function. Frequently (and subsequently in this article) "logistic regression" is used to refer specifically to the problem in which the dependent variable is binary—that is, the number of available categories is two.

Logistic regression measures the relationship between a categorical dependent variable and one or more independent variables, which are usually (but not necessarily) continuous, by using probability scores as the predicted values of the dependent variable.

Hosmer–Lemeshow test

The Hosmer–Lemeshow test uses a test statistic that asymptotically follows a χ^2 distribution to assess whether or not the observed event rates match expected event rates in subgroups of the model population.

Coefficients: After fitting the model, it is likely that researchers will want to examine the contribution of individual predictors. To do so, they will want to examine the regression coefficients. In linear regression, the regression coefficients represent the change in the criterion for each unit change in the predictor. In logistic regression, however, the regression coefficients represent the change in the logit for each unit change in the predictor. Given that the logit is not intuitive, researchers are likely to focus on a predictor's effect on the exponential function of the regression coefficient – the odds ratio. In logistic regression, there are several different tests designed to assess the significance of an individual predictor, most notably the likelihood ratio test and the Wald statistic.

Separate logistic regression

Under this study we the individual explanatory variable with that of response variable so as to see their odd and significance.

To so the variables that are tested in this model are that of associated one because logistic regression is the test of studying strengthens of their association. Therefore sex of children and age of mother at birth of child have not association with status of child and don't be included in the model.

The following SPSS output elaborate fact for the individual associated variables.

Variables in the Equation

	B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B)	
							Lower	Upper
Disease			20.905	4	.000			
Disease (1)	-.523	.404	1.675	1	.196	.593	.268	1.309
Disease (2)	.199	.390	.260	1	.610	1.220	.568	2.619
Disease (3)	1.341	.444	9.110	1	.003	3.822	1.600	9.130
Disease (4)	.671	.287	5.466	1	.019	1.956	1.115	3.432
Constant	-1.410	.243	33.548	1	.000	.244		

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Interpretation: therefore the odd ratio states that, according to type of disease, **HIV** is **3.822** times as likely to determine status of child as **diarrhea** in separate logistic model. In other case relative **to diaries**, other **unknown diseases** are **1.956** as likely to develop the status of child as diaries. But it is impossible to write an interpretation about malaria and pneumonia in this separate logistic regression, because they are not significant.

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B)	
								Lower	Upper
Step 1[a]	parentedn			11.946	3	.008			
	parentedn(1)	.165	.521	.101	1	.751	1.180	.425	3.277
	parentedn(2)	-.547	.525	1.083	1	.298	.579	.207	1.621
	parentedn(3)	-.634	.544	1.359	1	.244	.531	.183	1.540
	Constant	-.773	.494	2.454	1	.117	.462		

It is not possible to interpret the above table because parent education level in a separate logistic regression is not significant.

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B)	
								Lower	Upper
Step 1[a]	Economy			69.323	3	.000			
	Economy (1)	3.630	.498	53.123	1	.000	37.714	14.209	100.103
	Economy (2)	2.326	.494	22.164	1	.000	10.237	3.887	26.959
	Economy (3)	1.864	.517	13.015	1	.000	6.447	2.342	17.742
	Constant	-3.273	.456	51.619	1	.000	.038		

Interpretation: Therefore the odd ratio states that, according to the level of parent economy, children with parent's economy **400-800,801-1500** and **>1500** are **37.714**, **10.237** and **6.447** times as likely to influence status of children as **<400** parent's economy.

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B)	
								Lower	Upper
Step 1[a]	Family size			.000	2	1.000			
	Family size (1)	21.236	4385.401	.000	1	.996	1669318702.892	.000	.
	Family size (2)	.000	5451.774	.000	1	1.000	1.000	.000	.
	Constant	-21.203	4385.401	.000	1	.996	.000		

The SPSS output for the size of family in separate test of logistic regression shows that it is not significant so it can't be further interpretation about their strength of association.

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B)	
								Lower	Upper
Step 1[a]	Source of water			10.662	2	.005			
	Source of water (1)	-.717	.317	5.120	1	.024	.488	.262	.909
	Source of water (2)	-.030	.347	.007	1	.932	.971	.492	1.916
	Constant	-.611	.285	4.596	1	.032	.543		

Interpretation: the odd for protected source of water in case of child status is **0.4488** times that of Tap. Unprotected source of water is not significant in this output, so we can't think about their strength of association.

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B)	
								Lower	Upper
Step 1[a]	Birth interval			11.456	2	.003			
	Birth interval (1)	.535	.342	2.447	1	.118	1.708	.873	3.340
	Birth interval (2)	-.394	.273	2.092	1	.148	.674	.395	1.150
	Constant	-.892	.237	14.109	1	.000	.410		

To interpret the logistic odd ratio the probability for the occurrence of the type I error is less than the usual level of significance. But in this table cannot fill the rule and we forced to don't interpret the odd ratio.

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B)	
								Lower	Upper
Step 1[a]	Age			59.661	2	.000			
	Age (1)	2.367	.308	58.972	1	.000	10.662	5.828	19.505
	Age (2)	1.494	.325	21.197	1	.000	4.456	2.359	8.419
	Constant	-2.448	.261	88.234	1	.000	.086		

Interpretation: since the p-value shows that all the categories of age of children is significant, the odd can be interpret as follow. The odd for **2-4** and >**4** of children is 0 time as likely as <**2** age's of children.

Logistic regression for multiple explanatory variables: The overall test of the odds and strength of the variables is study in logistic regression with multiple explanatory variables including their categories. There is a special case in which the associated variable are not be significant, this is because the existence of hetroscedastisity in the independent variables. The information of one variable is found in other's variable and affects one another.

The overall interpretation for this test is discussed under the corresponding table below.

Classification Table[a]

			Predicted		
			Status of Mortality		Percentage Correct
	Observed		Live	Death	
Step 1	Status of mortality	Live	358	0	94.0
		Death	71	53	42.7
	Overall Perce				85.3

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Interpretations:

From the above table, rather than using a goodness-of-fit statistic, we often want to look at the proportion of cases we have managed to classify correctly. For this we need to look at the classification table, which tells us how many of the observed values of the dependent variable 0 for a live or 1 for a death respectively have been correctly predicted. The overall accuracy of the model to predict subject's child status, in Table above shows that out of the **482** sampled included in the model **85.3%** were correctly predicted. The sensitivity is given by **42.7%** and the specificity is given by **94.0%,** which indicates that **42.7%** of a death child and **94.0%** of a live child were correctly predicted in their respective categories

Variables in the Equation

	B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B) Lower	Upper
diseas			25.920	4	.000			
diseas(1)	1.079	.465	5.390	1	.020	2.941	1.183	7.312
diseas(2)	4.084	1.065	14.705	1	.000	59.405	7.365	479.120
diseas(3)	6.722	1.479	20.647	1	.000	830.461	45.719	15084.808
diseas(4)	6.684	1.465	20.830	1	.000	799.610	45.316	14109.362
parentedn			47.467	3	.000			
parentedn(1)	-6.630	1.369	23.440	1	.000	.001	.000	.019
parentedn(2)	-11.858	1.736	46.641	1	.000	.000	.000	.000
parentedn(3)	-11.981	1.840	42.401	1	.000	.000	.000	.000
sourceofwater			25.384	2	.000			
sourceofwater(1)	4.679	1.116	17.597	1	.000	107.708	12.098	958.926
sourceofwater(2)	6.002	1.212	24.526	1	.000	404.130	37.580	4345.915
Constant	-1.398	.244	32.917	1	.000	.247		

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As we explain in the entrance of the logistic regression with multiple explanatory variables there are associated variables that are not included in the model due they not significant jointly. They also affect the other variable not to be significant. Here in our case the variables that have association but not significant are economy of parents, size of family, birth interval and age of child. Therefore we ignore them not to be included in the model.

Based on the above SPSS output, the fitted model for logistic regression and interpretation for odds are as shown

$\text{Log it } (\frac{p}{1-p}) = \beta_0 + \beta_1 X_1 (1) + \beta_2 X_1 (2) + \ldots\ldots\ldots.. + \beta_9 X_3 (2)$

Where:- $X_1(1)$ is malaria , $X_1(2)$ is pneumonia and $X_3(2)$ is unprotected water

$\text{Log it } (\frac{p}{1-p}) = -1.398+1.079X_{1(1)}+4.084 X_1(1)+6.722X_1(2) + \ldots\ldots\ldots +6.002X_3(2)$

Interpretatio**n:** since the coefficient of all categories of independent variable in types of disease is negative it shows that types of disease influence the status of child negatively. The p-value for the types of disease in all categories is less than the usual (α= 0.05). So there is a significant association between child status and types of disease. In contrast due to all the coefficient the of parent education level and source of drinking water are positive ,we are evidential to say that there is positive relationship between status of children and the two explanatory variables.

Also p-value in both case=**0.00** is less than α=0.05 shows us there is a significant association between status of child and parent education level as well as source of drinking water.

Interpretation using odds ratio

The advantages of the log it link function are to provide estimates of the odds ratio for each predictor in the model.

The odds of **malaria** incase of status of child mortality is **2.941** times that of **diaries.** It also means the estimated odds were **94.1%** higher for the

malaria group. The odds of status of child mortality for **pneumonia**, **HIV** and **others unknown disease** are **59.405, 830.461** and **799.610** times that of **diaries** respectively. The odds of status of child mortality for primary parent education level are **0.001** times that of **illiterate** parents. It also means that the estimated odds were **0.01%** higher for **primary** Parent education level compare to **uneducated** parent.

The odds for the secondary educated and higher education level of parents have almost an equal effect with that of uneducated parents

The odds of status of child mortality for protected **source of water** are **107.78** times that of pipe source of water.

The odds of status of child mortality for unprotected source of water are **404.130** times that of pipe source of water.

Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	198.513	9	.000
	Block	198.513	9	.000
	Model	198.513	9	.000

In the above table since the corresponding p- value for the model is **0.000**, is less than level of significance (α=0.05), so we reject H_0 (β_j=0) , therefore the binary logistic model is fitted. This indicates that the overall significance of the model is significant.

Hosmer and Lemeshow Test

Step	Chi-square	df	Sig.
1	17.429	6	.078

Ho: The model is good fit.

H_1 : the model is poor fit or not good fit.

Decision: since the p-valued =**0.078** is greater than the level of significance (α =0.05) we fail to reject the null hypothesis.

Conclusion: therefore there is an evidence to say that the fitted model is good at 5% level of significance

Conclusions and Recommendations

5.1 Conclusions

From the above descriptive pi-chart table most of the children **(41.1%)** of them are affected by different unknown disease and only **6.0%** are affected by HIV.

Child status is independent of sex of child and ages of mother at birth child .In other case types of disease, parent education level and source of drinking water is significant affected status of child mortality. Out of the categories in parent education level, the logistic regression shows that the odd of status of child mortality for unprotected source of water are **404.130** times that of tap source of drinking water.

5.2 Recommendation

Depending on the output, we recommend that since the most the children (41.1%) are affected by different unknown disease, the administration of Ambo town as well as the health care center must have to give immediate solution to this problem. In addition, most of the Children affected by the factor that affect child mortality are with related to source of water so the concerned body has to consider all this responsibly. We have also got that more number of Childs affected for the reason of uneducated parent.

These results suggest that child health services should focus and identify such case and provides those good health care service and guidance**.**

6. References

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