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Analyzing Infant and Child (Under-five) Mortality in Zaria: A Regression Analysis Approach

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Abstract

This study was carried out using secondary data from Ahmadu Bello University Teaching Hospital Zaria on infant and child (under-five) mortality and delivery rates. Descriptive statistics, Regression and Correlation analysis are the statistical techniques used for the study. From the regression analysis result obtained, it showed that both infant and child mortality rates has a direct relationship with delivery rates. The correlation analysis result showed that there is a very strong and positive relationship between mortality and delivery rates. The study revealed that infant and child mortality rates will continue to decrease if there can be improvement in the factors under study.

Keywords: Infant and Child Mortality; Death and Birth Rates; Regression and Correlation; Anova; Trend; Demography.

Introduction

Mortality: (Death) according to World Health Organization (W.H.O) is the disappearance of all evidence of life at any time after birth has taken place. These can also be referred to as non-functionality of all parts or the whole body after birth. Mortality is the risk of dying in a given year, measured by death rate. In the entire universe, lately, there are thousands of people that die due to one cause or the other. If these causes of death are not noticed, recognized and given proper attention, we may not know the exact causes of various deaths per hour. The best way to do this and make recommendation is to apply statistical techniques to extract the information as it relates to the population or sample of interest.

Infant mortality refers to the death of a child born alive before its first birthday while child mortality is the death of a child aged between one and five years of age. Demographers have for a long time been interested in the study of mortality which is one of the components of population change. Infant and child mortality are among the best indicators of socio-economic development because a society's life expectancy at birth is determined by the survival chances of infants and children.

Child mortality is an important indicator of overall health development in a country. These estimates assess population and health programs and policies, as well as contribute to population projections. Childhood mortality measures also help identify specific populations that are at increased health risk.

Some measures of childhood mortality that are calculated using demography health survey (DHS) are as follows:

Neonatal mortality: the probability of dying within the first month of life.

Post Natal Mortality: The difference between infant and neonatal mortality.

Infant mortality: The probability of dying before the first birthday.

Under-five Mortality: The probability of dying before the fifth birthday.

During the twentieth century, almost all countries experienced decrease in child mortality rates. However, the timing and space of the decline varied substantially. Sustained reductions in child mortality began in the nineteenth century in Europe, North America and Japan continued gradually throughout the twentieth century. Major declines in other parts of the world generally began only after World War II. Mortality reductions in Asia, Latin America and Africa were usually much more rapid than they had been in countries that began mortality decline earlier. By 1999 there were great variations in child mortality among countries for example, although, less than 0.5 percent of children died before their fifth birthday in the more developed countries and more than 40 percent died by age 5 in developing countries.

The decline in child mortality sometimes has appeared to have stagnated. Such was due to the fact that many poor countries experienced severe debt crises and other problems. However, during the 1990s, the HIV/AIDS epidemic halted or reversed declines in child mortality in some Eastern and Southern African countries. For example, in Zimbabwe, Kenya and Mali in the period 1990-19994 there were 80 deaths of (under-5) years per 1000 live births by 1999 that rate increased to 118 deaths per 1000 live births.

Death in the pre-delivery period and between ages one and four are likely to be caused by external factors such as: infectious diseases, acute respiratory infections, diarrhea, measles, malaria, malnutrition and accidents. Two thirds of deaths are preventable such as malnutrition, malaria and the likes. Research and experience show that most of the children who die each year could be saved by technology, evidence based-cost effective measures such as vaccines, antibiotics, micronutrients supplementation, insecticide bed treated nets, improved family care. In addition to providing vaccine and antibiotics to children, education could be made available to nursing mothers about how they can make simple changes to living conditions such as improving hygiene in order to increase the health of their children existing and of those unborn[1].

The exclusion of any infant from the denominator or numerator in reported IMRs can be problematic for comparisons. Many countries, including the United States, Sweden and Germany Count an infant exhibiting any sign of life as alive, no matter the Month of ‘Gestation” or the “size”, but according to the United States Centre for Disease Control (CDC) researchers, some other countries differ in these practice. All of the countries named adopted W.H.O definition in the late 1980s or early 1990s which are used throughout the European Union. Therefore, this gives a clear view that there were differences within countries on what they describe as infant, child mortality and live births. These disparities made the UNICEF use a statistical methodology to account for reporting differences among countries due to the un-adherence to a given standard by regulatory bodies.

Another well documented example also illustrates this problems until the 1990s, Russia and the Soviet Union did not count as live birth or as an infant mortality, extremely premature infants (less than 1,000g, less than 28 weeks gestational age, or less than 35cm in length) that were born alive (breathed, had a heartbeat, or exhibited voluntary muscle movement) but failed to survive for at least seven days. Although, such extremely premature infants typically accounted for only about 0.005% of all live–born children, their exclusion from both the numerator and denominator in the reported IMR led to an estimated 22% - 25% lower reported IMR. In some cases, too, perhaps because hospitals or regional health departments were held accountable for lowering the IMR in their catchment area, infant deaths that occurred in the 12th month were transferred statistically to the 13th month (that is, the second year of life) and thus no longer classified as an infant death.

Irewolede[2] literature review,said, another challenge to comparability is the practice of counting, frail or premature infants who die, before the normal due dates as miscarriages (spontaneous abortions) or those who die during or immediately after child birth as still birth. Therefore, the quality of a country’s documentation or prenatal mortality can matter greatly to the accuracy of its infant mortality statistics. This point is reinforced by the demographer, who finds dubiously high ratios of reported still births to infant’s deaths.

Also,Sabitu K, [3]in his forward to a book, “Cause of Death Statistics” said that acute death of unusable health data in the country (Nigeria) is a serious impediment to system, if medical records generated from hospitals, particularly teaching hospitals are amended, refined and processed to meet the needs of health care practitioners, teaching hospitals would constitute a very dependable source of local and national health information.

Gayus [4] said, demographers who extrapolate age-specific rates in mortality, that is, forecast believe that decline tend to set in that is, the speed of mortality decline will not slow down, relative to past performance [5]. (There are exceptions, ever, the 1999 and 2003 technical panels slowed mortality decline at younger ages more than has occurred in the past. The 2003 panel also set the ultimate rate of Mortality decline to zero in 2020. The panel’s use of a zero rate reflected an unwillingness to forecast further into the future than the length of the observations in the past rather than believe is a biological limit). Some forecasts predict even faster gains in life expectancy [6]. Demographers who extrapolate linear increase in life expectancy tend to predict faster gains. In fact, because they rely more heavily on international trends to determine the U.S forecast. Demographers who study healthy sub-populations believe that fairly large advances in life expectancy are achievable through modifications in behavior.

In reasonable considerations, we can see that education and standard of living of a child bearing mother has great impact on the survival of a child and health status of children existing and those that are yet to come. So we shall see various opinions from different researchers on education and standard of living of a child bearing mother as a tool to increase or reduce the survival of an infant or child.

A. The Effect of Education on Mortality Rate

Education as a tool for social enlightenment and positive change has a lot of good to offer in virtually all spheres of life and particularly in the area of this cliché called infant and child mortality. Mothers, who are educated, will have increased confidence in the ability to take care of their children, therefore providing a healthier relationship between them and their environment [7]. Child and infant mortality as said earlier refers to the death of infants and children under the age of five. In 2009, 8.1 million under-five died, down from 8.8 million 2008 and 12.4 million in 1990. About half of child deaths that occur in Africa, approximately 60 countries make up 94% of under-five child deaths. Reduction of child mortality is the fourth of the United Nations Millennium Goals (UNMDGs).

Stephen S. [8] in his project work, referenced by [2] stated that there are considerable variations in the levels of infant and child mortality, according to the child’s age and sex, the mothers’ educational attainment, age at birth, nature and duration of marriage, parity and place of birth. It has been discovered that maternal education is the single most significant determinant of infant and child mortality [9].

Regression Analysis

Regression analysis is a statistical method used for investigating functional relationship among variable. (Alis.hadi), Cairo Egypt. Regression analysis is a conceptually simple measure of the average relationship between two or more variables. When a variable say Y, depends on the effect or changes in other variables say$\mathrm{X}_1, \mathrm{X}_2, \dots, \mathrm{X}_\mathrm{n}$, we say the variables Y and$\mathrm{X}_1, \mathrm{X}_2, \dots, \mathrm{X}_\mathrm{n}$, are related or there exists a functional relationship between them.

In the regression model, Y is the dependent variable or response variable and X is always referred to as the predictor or independent variable. Here are three equivalent ways to mathematically describe a simple linear regression model or equation,

$$\mathrm{Y} = \text{intercept} + \text{slope} + \text{error} \qquad 1$$

$$\mathrm{Y} = \text{constant} + \text{coefficient}\,\mathrm{X} + \text{error} \qquad 2$$

$$\mathrm{Y} = \beta_0 + \beta_1 \mathrm{X} + \mathrm{e} \qquad 3$$

This is called a simple linear regression model of Yon X. The values for β_0 and β_1 are fixed. The parameters, $\beta_0, \beta_1$and $\bar{y}$ and $\bar{x}$ can be computed as shown in equations 2.4 to 2.7.

$$\hat{\beta}_1 = \frac{n\sum_{i=1}^{n} x_i y_i - \sum_{i=1}^{n} x_i \sum_{i=1}^{n} y_i}{n\sum_{i=1}^{n} x_i{}^2 - \left(\sum_{i=1}^{n} x_i\right)^2} \qquad 4$$

$$\hat{\beta}_0 = \bar{y} - \hat{\beta}_1 \bar{x} \qquad 5$$

$$\bar{y} = \frac{1}{n}\sum_{i=1}^{n} y_i \qquad 6$$

$$\bar{x} = \frac{1}{n}\sum_{i=1}^{n} x_i \qquad 7$$

wheren = number of unit selected

a) Steps in Regression Analysis:

i. Statement of the problem

ii. Selection of potentially relevant variables.

iii. Data Collection

iv. Model Specification

v. Choice of fitting method

vi. Model fitting

vii. Model criticism and validation

viii. Using the chosen model for the solution of the posed problem.

b) Coefficient of Determination (R^2)

$$R^2 = \frac{SS_R}{SS_T} = 1 - \frac{SS_R}{SS_T} = 1 - \frac{\sum_{i=1}^{n} e_i{}^2}{\sum_{i=1}^{n} y_i^2} \qquad 8$$

where:

$$SS_T = \sum_{i=1}^{n}(y_i - \bar{y})^2$$

$$SS_R = \sum_{i=1}^{n}(\hat{y}_i - \bar{y})^2$$

$$SS_E = \sum_{i=1}^{n} e_i{}^2 = \sum_{i=1}^{n}(y_i - \hat{y})^2 = SS_T - SS_R$$

Adjusted R^2

This is preferred to the R-square because of preciseness

$$R^2_{adj} = 1 - \frac{SSe/_{(n-p)}}{SS_t/_{(n-1)}} \qquad 9$$

where:

SS_e = sum of squared residuals (errors)
n = number of observations
p = number of parameters
SS_t = total sum of squares

Coefficient of Correlation

Correlation analysis is a statistical technique used to measure the strength of relationship or correlation between two variables say X and Y. The basic concept of correlation is to find out how strong the relationship between the two variables X and Y is.

$$r = \frac{\sum_{i=1}^{n}(y_i - \bar{y})(x_i - \bar{x})}{\sqrt{\sum_{i=1}^{n}(y_i - \bar{y})^2 \sum_{i=1}^{n}(x_i - \bar{\bar{x}})^2}} \qquad 10$$

Analysis Results and Discussion

Table 1: Descriptive Statistics for Deliveries (2000-2010)

Statistics	Male	Female	Total Deliveries
Mean	1138.545	1051.455	2188.909
Standard Error	172.8205	150.0212	322.7171
Median	1092	985	2077
Standard Deviation	573.1808	497.5639	1070.332
Sample Variance	328536.3	247569.9	1145610
Kurtosis	-1.27822	-1.4246	-1.3543
Skewness	0.362691	0.339476	0.344762
Range	1659	1391	3050
Minimum	470	486	956
Maximum	2129	1877	4006
Sum	12524	11566	24078

Table 2: Descriptive Statistics for Infant Mortality (2000-2010)

Statistics	Male	Female	Total Infant Mortality
Mean	112.8182	81	193.8182
Standard Error	16.01353	12.94253	28.60763
Median	109	84	200
Standard Deviation	53.11086	42.92552	94.88079
Sample Variance	2820.764	1842.6	9002.364
Kurtosis	-1.88889	-1.38069	-1.74405
Skewness	0.250496	0.319138	0.263243
Range	129	123	246
Minimum	58	29	93
Maximum	187	152	339
Sum	1241	891	2132

Table 3: Descriptive Statistics for Child (Under-Five) Mortality (2000-2010)

Statistics	Male	Female	Total Child (Under-Five) Mortality
Mean	50.54545	39.54545	90.09091
Standard Error	8.611159	6.861439	15.15523
Median	47	49	96
Standard Deviation	28.55998	22.75682	50.26421
Sample Variance	815.6727	517.8727	2526.491
Kurtosis	-1.00383	-1.40271	-1.15969
Skewness	0.636519	0.041649	0.371984
Range	81	69	150
Minimum	21	8	29
Maximum	102	77	179
Sum	556	435	991

Table 4: Descriptive Statistics for the Entire Data

Statistics	**Deliveries**	**Infant Mortality**	**Child Under Five Mortality**
Average	2188.91	193.818	90.0909
Standard deviation	1070.33	94.8808	50.2642
Coeff. of variation	48.898%	48.9535%	55.7928%
Minimum	956.0	93.0	29.0
Maximum	4006.0	339.0	179.0
Range	3050.0	246.0	150.0
Stnd. Skewness	0.46681	0.356433	0.503668
Stnd. Kurtosis	-0.916864	-1.18073	-0.785116

These Tables (1 to 4) shows summary statistics for each of the selected data variables. It includes measures of central tendency, measures of variability, and measures of shape. The statistics of particular interest here are the standardized skewness and standardized kurtosis, which can be used to determine whether the sample comes from a normal distribution. Values of these statistics outside the range of -2 to +2 indicate significant departures from normality, which would tend to invalidate many of the statistical procedures normally applied to this data. In this case, the following variables show standardized skewness values outside the expected range:

Table 5: Correlations

	Deliveries	Infant Mortality	Child Under Five Mortality
Deliveries		0.8574	0.9021
		0.0007 (p-value)	0.0001 (p-value)
Infant Mortality	0.8574		0.8875
	0.0007 (p-value)		0.0003 (p-value)
Child Under Five Mortality	0.9021	0.8875	
	0.0001 (p-value)	0.0003 (p-value)	

This Table 5 shows Pearson product moment correlations between each pair of variables. These correlation coefficients range between -1 and +1 and measure the strength of the linear relationship between the variables. Also shown in parentheses is the number of pairs of data values used to compute each coefficient. The third number in each location of the table is a P-value which tests the statistical significance of the estimated correlations. P-values below 0.05 indicate statistically significant non-zero correlations at the 95.0% confidence level. The following pairs of variables have P-values below 0.05:

Deliveries and Infant Mortality

Deliveries and Child under Five Mortality

Infant Mortality and Child under Five Mortality

Simple Regression - Deliveries vs. Infant Mortality

Dependent variable: Deliveries
Independent variable: Infant Mortality
Linear model: Y = a + b*X

Table 6: Coefficients

Parameter	*Least Squares Estimate*	*Standard Error*	*T-Statistic*	*P-Value*
Intercept	314.254	413.919	0.759216	0.4671
Slope	9.67224	1.93518	4.9981	0.0007

Table 7: Analysis of Variance

Source	*Sum of Squares*	*Df*	*Mean Square*	*F-Ratio*	*P-Value*
Model	8.4219E6	1	8.4219E6	24.98	0.0007
Residual	3.03419E6	9	337133.		
Total	1.14561E7	10			

Correlation Coefficient = 0.857406

R-squared = 73.5146 percent

R-squared (adjusted) = 70.5718 percent

Standard Error of Est. = 580.631

Mean absolute error = 449.674

The output shows the results of fitting a linear model to describe the relationship between Deliveries and Infant Mortality. The equation of the fitted model is:
Deliveries = 314.254 + 9.67224*Infant Mortality
Since the P-value in the ANOVA table is less than 0.05, there is a statistically significant relationship between Deliveries and Infant Mortality at the 95.0% confidence level.

The R-Squared statistic indicates that the model as fitted explains 73.5146% of the variability in Deliveries. The correlation coefficient equals 0.857406, indicating a moderately strong relationship between the variables. The standard error of the estimate shows the standard deviation of the residuals to be 580.631. The mean absolute error (MAE) of 449.674 is the average value of the residuals.

Table 8: Predicted Values

	Predicted	*99% Prediction*	*Limits*	*95% Confidence*	*Limits*
X	*Y*	*Lower*	*Upper*	*Lower*	*Upper*
93.0	1213.77	-227.362	2654.91	620.787	1806.76
339.0	3593.14	2081.18	5105.1	2844.29	4341.99

This table shows the predicted values for Deliveries using the fitted model. In addition to the best predictions, the table shows:

(1) 95.0% prediction intervals for new observations

(2) 95.0% confidence intervals for the mean of many observations

The prediction and confidence intervals correspond to the inner and outer bounds on the graph of the fitted model.

Table 9: Comparison of Alternative Models

Model	*Correlation*	*R-Squared*
S-curve model	-0.8908	79.34%
Multiplicative	0.8900	79.22%
Square root-Y logarithmic-X	0.8863	78.55%
Logarithmic-Y square root-X	0.8819	77.77%
Double square root	0.8792	77.30%
Double reciprocal	0.8745	76.48%
Logarithmic-X	0.8739	76.38%
Square root-X	0.8683	75.39%
Exponential	0.8682	75.37%
Square root-Y	0.8668	75.13%

Linear	0.8574	73.51%
Squared-Y logarithmic-X	0.8281	68.57%
Square root-Y squared-X	0.8275	68.48%
Squared-Y square root-X	0.8258	68.20%
Squared-X	0.8216	67.50%
Squared-Y reciprocal-X	-0.8207	67.35%
Squared-Y	0.8189	67.05%
Reciprocal-Y squared-X	-0.8028	64.45%
Double squared	0.7914	62.63%

This table 9 shows the results of fitting several curvilinear models to the data. Of the models fitted, the S-curve model yields the highest R-Squared value with 79.3449%. This is 5.83035% higher than the currently selected linear model. However our model of interest is the linear model.

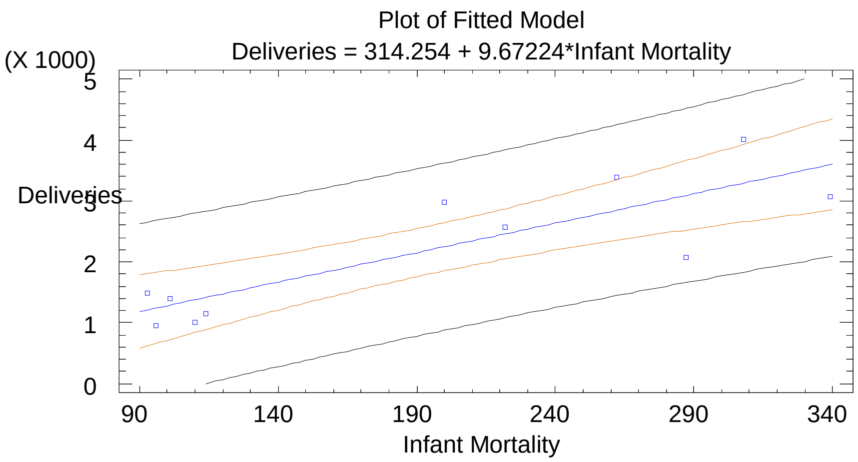

Figure 1: Simple Regression - Deliveries vs. Child under Five Mortality

Dependent variable: Deliveries
Independent variable: Child Under Five Mortality
Linear model: Y = a + b*X

Table 10: Summary of Coefficients

Parameter	*Least Square Estimate*	*Standard Error*	*T-Statistic*	*P-Value*
Intercept	458.283	312.538	1.46633	0.1766
Slope	19.2098	3.06275	6.27207	0.0001

Table 11: Analysis of Variance

Source	*Sum of Squares*	*Df*	*Mean Square*	*F-Ratio*	*P-Value*
Model	9.32314E6	1	9.32314E6	39.34	0.0001
Residual	2.13296E6	9	236996.		
Total	1.14561E7	10			

Correlation Coefficient = 0.902117

R-squared = 81.3814 percent

R-squared (adjusted) = 79.3127 percent

Standard Error of Est. = 486.822

Mean absolute error = 323.299

The output shows the results of fitting a linear model to describe the relationship between Deliveries and Child under Five Mortality. The equation of the fitted model is

Deliveries = 458.283 + 19.2098*Child under Five Mortality

Since the P-value in the ANOVA table is less than 0.05, there is a statistically significant relationship between Deliveries and Child under Five Mortality at the 95.0% confidence level.

The R-Squared statistic indicates that the model as fitted explains 81.3814% of the variability in Deliveries. The correlation coefficient equals 0.902117, indicating a relatively strong relationship between the variables. The standard error of the estimate shows the standard deviation of the residuals to be 486.822. The mean absolute error (MAE) of 323.299 is the average value of the residuals.

Table 12: Analysis of Variance with Lack-of-Fit

Source	*Sum of Squares*	*Df*	*Mean Square*	*F-Ratio*	*P-Value*
Model	9.32314E6	1	9.32314E6	39.34	0.0001
Residual	2.13296E6	9	236996.		
Lack-of-Fit	2.07482E6	8	259353.	4.46	0.3466
Pure Error	58140.5	1	58140.5		
Total	1.14561E7	10			

The lack of fit test is designed to determine whether the selected model is adequate to describe the observed data, or whether a more complicated model should be used. The test is performed by comparing the variability of the current model residuals to the variability between observations at replicate values of the independent variable X. Since the P-value for lack-of-fit in the ANOVA table is greater or equal to 0.05, the model appears to be adequate for the observed data at the 95.0% confidence level.

Table 13: Predicted Values

	Predicted	*95% Prediction*	*Limits*	*95% Confidence*	*Limits*
X	*Y*	*Lower*	*Upper*	*Lower*	*Upper*
29.0	1015.37	-210.278	2241.01	477.401	1553.33
179.0	3896.83	2592.03	5201.63	3197.04	4596.63

This table 13 shows the predicted values for Deliveries using the fitted model. In addition to the best predictions, the table shows:

(1) 95.0% prediction intervals for new observation

(2) 95.0% confidence intervals for the mean of many observations

The prediction and confidence intervals correspond to the inner and outer bounds on the graph of the fitted model.

Table 14: Comparison of Alternative Models

Model	*Correlation*	*R-Squared*
Multiplicative	0.9265	85.85%
Reciprocal-Y logarithmic-X	-0.9232	85.23%
Double reciprocal	0.9224	85.07%
Logarithmic-Y square root-X	0.9187	84.40%
Square root-Y logarithmic-X	0.9183	84.33%
Double square root	0.9166	84.02%
Square root-X	0.9084	82.52%
Reciprocal-Y square root-X	-0.9044	81.80%
Logarithmic-X	0.9037	81.67%
S-curve model	-0.9036	81.64%
Square root-Y	0.9035	81.64%
Linear	0.9021	81.38%
Exponential	0.8994	80.89%
Squared-Y	0.8848	78.29%
Square root-Y reciprocal-X	-0.8843	78.20%
Squared-Y square root-X	0.8770	76.91%
Reciprocal-Y	-0.8749	76.54%
Double squared	0.8749	76.54%
Squared-X	0.8630	74.47%
Squared-Y logarithmic-X	0.8596	73.88%
Reciprocal-X	-0.8591	73.81%
Square root-Y squared-X	0.8511	72.44%
Logarithmic-Y squared-X	0.8352	69.76%
Squared-Y reciprocal-X	-0.7962	63.39%
Reciprocal-Y squared-X	-0.7933	62.93%

This table shows the results of fitting several curvilinear models to the data. Of the models fitted, the multiplicative model yields the highest R-Squared value with 85.8495%. This is 4.46803% higher than the currently selected linear model. However our model of interest is the linear model.

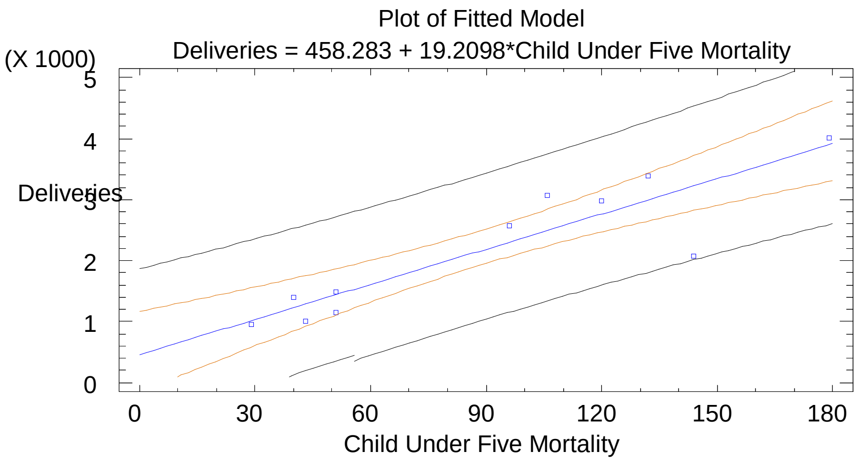

Figure 2: Multiple Regressions - Deliveries

Dependent variable: Deliveries
Independent variables:
Infant Mortality
Child under Five Mortality

Table 15: Coefficients

Parameter	*Estimate*	*Standard Error*	*T-Statistic*	*P-Value*
CONSTANT	328.953	352.85	0.932275	0.3785
Infant Mortality	3.0157	3.57967	0.842453	0.4240
Child Under Five Mortality	14.1575	6.75713	2.09519	0.0695

Table 16: Analysis of Variance

Source	*Sum of Squares*	*Df*	*Mean Square*	*F-Ratio*	*P-Value*
Model	9.49695E6	2	4.74847E6	19.39	0.0009
Residual	1.95915E6	8	244894.		
Total	1.14561E7	10			

R-squared = 82.8986 percent
R-squared (adjusted) = 78.6232 percent
Standard Error of Est. = 494.868
Mean absolute error = 316.797

The output shows the results of fitting a multiple linear regression model to describe the relationship between Deliveries and 2 independent variables. The equation of the fitted model is

Deliveries = 328.953 + 3.0157*Infant Mortality + 14.1575*Child under Five Mortality

Since the P-value in the ANOVA table is less than 0.05, there is a statistically significant relationship between the variables at the 95.0% confidence level.

The R-Squared statistic indicates that the model as fitted explains 82.8986% of the variability in Deliveries. The adjusted R-squared statistic, which is more suitable for comparing models with different numbers of independent variables, is 78.6232%. The standard error of the estimate shows the standard deviation of the residuals to be 494.868.

In determining whether the model can be simplified, notice that the highest P-value on the independent variables is 0.4240, belonging to Infant Mortality. Since the P-value is greater or equal to 0.05, that term is not statistically significant at the 95.0% or higher confidence level.

Table 17: Further ANOVA for Variables in the Order Fitted

Source	*Sum of Squares*	*Df*	*Mean Square*	*F-Ratio*	*P-Value*
Infant Mortality	8.4219E6	1	8.4219E6	34.39	0.0004
Child Under Five Mortality	1.07504E6	1	1.07504E6	4.39	0.0695
Model	9.49695E6	2			

This table shows the statistical significance of each variable as it was added to the model.

Table 19: Correlation matrix for coefficient estimates

	CONSTANT	Infant Mortality	Child Under Five Mortality
CONSTANT	1.0000	-0.4351	0.0199
Infant Mortality	-0.4351	1.0000	-0.8875
Child Under Five Mortality	0.0199	-0.8875	1.0000

This table shows estimated correlations between the coefficients in the fitted model. These correlations can be used to detect the presence of serious multicollinearity, i.e., correlation amongst the predictor variables. In this case, there is 1 correlation with absolute value greater than 0.5 (not including the constant term).

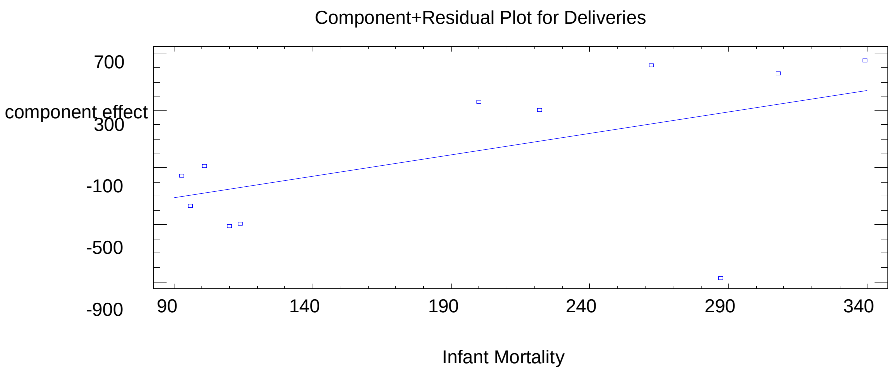

Figure 3

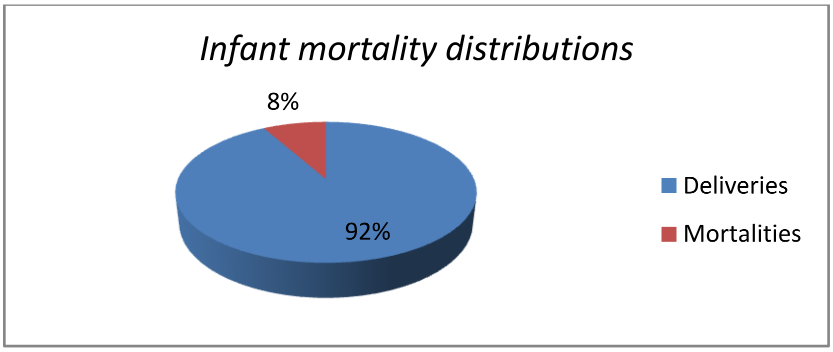

Figure 4

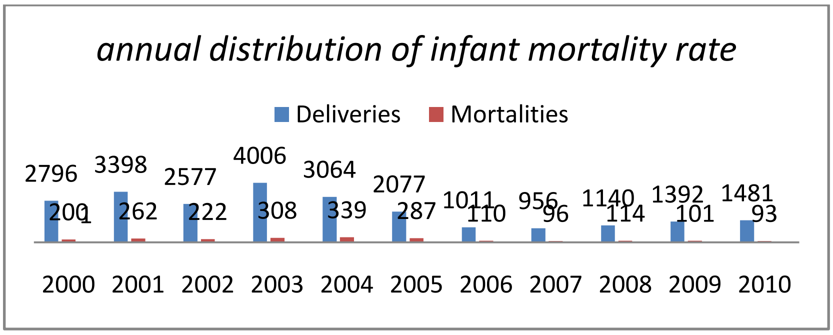

Figure 5

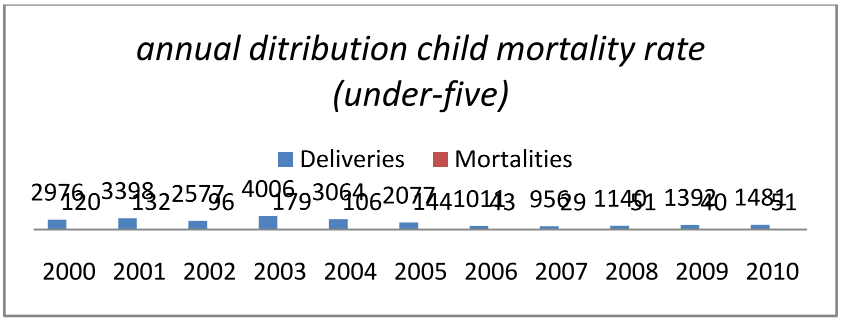

Figure 6

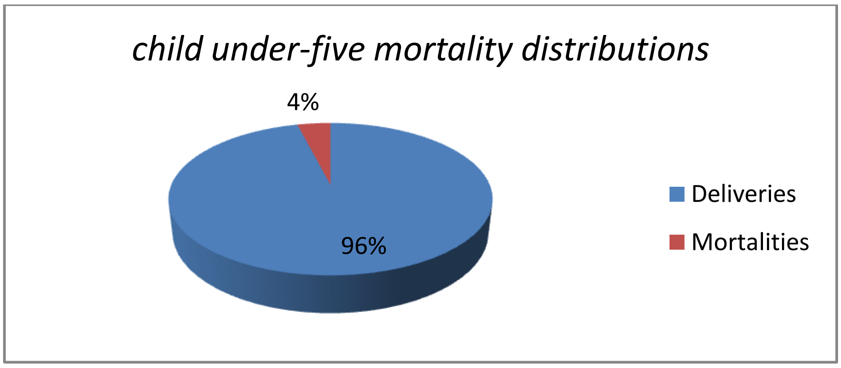

Figure 7

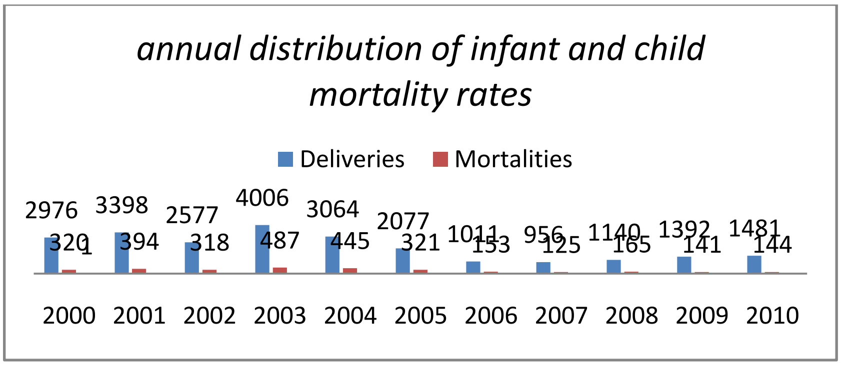

Figure 8

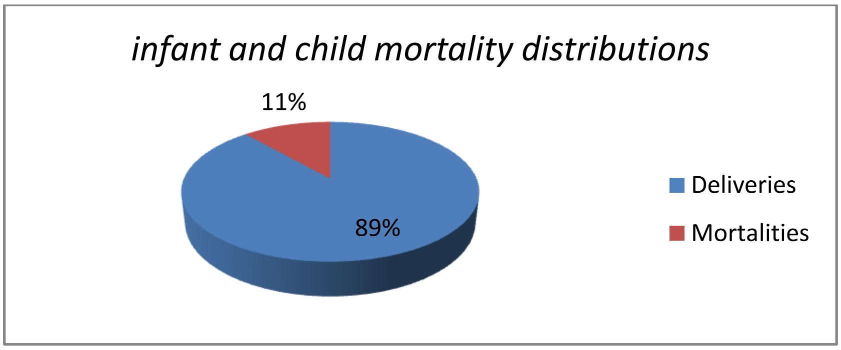

Figure 9

Conclusion

Finally, Based on the data collected on infant and under-five mortality and delivery rates and from the analysis carried out so far we have been able to see that death is a phenomenon that is consistent with human nature. It only requires some safety caution to avoid the unnatural aspect of it. But for the natural, it is inevitable because it is due to human nature and creation.

We have observed that, in recent years the rate of mortality is on the decline compared to earlier years with the exception of some years with a peculiar outbreak of certain sicknesses or diseases. We might incline this decline due to the availability of information and technological knowhow, that is, as mothers get informed on methods of taking good care of their children, the rate of infant and child mortality will continue to decrease.

This is clear that literacy has a significant role to play when it comes to the issue of child mortality in general. Also a good and conducive living environment cannot be over emphasized. Taking a careful look at the data obtained, male deaths are considerably higher than female death indicating sex differential. These might be as a result of the fact that in this region or part of the country, there exists, some sort of cultural restriction against the utilization of hospital services by the females resulting in less female admission. Therefore, this reason might be responsible for the higher rate of infant and child mortality in male compared to that of the female. However, the evidence of higher male deaths might be a strong case of epidemiological investigation.

Finally, from the regression analysis, correlation analysis and analysis of variance carried out, we observed a strong positive relationship between both variables under study, that is; delivery and mortality rates. That is to say as the number of deliveries increases the probability of mortality also increases.

Also, from the correlation coefficients obtained, we see a very strong positive relationship between infant, children (under-five), mortality rates and delivery rate. That is to say mortality is inevitable among children but can be controlled or prevented, as in the case of more developed countries (M.D.Cs).

Summary

Based on the mortality data collected from Ahmadu Bello University ABUTH, it shows that infants and child mortality has claimed a considerable percentage of life of children born that is, percentage of death, and it is simply because of some reasons like mother's educational attainment, poverty and other environmental factors.

From the analysis carried out and the results obtained, we observed that both mortalities will continue to decrease if there can be improvement in the factors stated above.

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