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Determinants of Infant Mortality in Angola

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ABSTRACT
Infant mortality is one of the most important development indicators in all countries. It is notoriously high with the least decline in sub-Saharan Africa with Angola being one of the countries in the world experiencing high infant mortality of 44.8 deaths per 1,000 live births. The aim of this study was to investigate the determinants of infant mortality in Angola. The study shows that the significant predictors of post-natal mortality are age of a mother, household wealth index and duration of breastfeeding. Low level of infant mortality cannot be brought down only by improvement in mother's conditions at individual level but there is a need to improve the new-born care basing on socioeconomic and environmental conditions at household level.
Keywords: Neo-natal mortality, post-natal mortality, logistic regression

Introduction

Globally, about seven million children under the age of five die every year (1000 child deaths per hour) and 99% of the deaths occur in the developing countries basing on estimations by United Nations International Children's Emergency Fund (UNICEF 2012). Infant mortality remains high with the least decline in sub-Saharan Africa. There is a causal relationship between the phenomena of health and wealth (Osayanmon Osawe, Wellington, 2014) therefore, wealthier nations are in better position to provide better health facilities and services hence decline in infant mortality. Children born in the Sub Saharan Africa in particular, have a life expectancy of 51 years on average and 10% of the children die in the first years of life (infants) making the study of infant mortality worthwhile by World Health Organization (WHO, 2008).

Angola like any other developing countries has its targets to reduce this unacceptable level of infant mortality. It has implemented the National Health Policy, which was approved in 2010 for health development up to the year 2025. The main priority of the policy is to reduce the number of deaths and improvement of the health sector. The country has also established the National Health Development Plan (NHDP) 2012-2025, which one of its main aim is to reduce maternal, and child mortality in Angola. With this plan, deliveries assisted by professional birth attendants increased to 49% from 36% in 2010, Women of childbearing ages have access to the tetanus vaccination, which its coverage is 80% and *Isoniazid Preventive Therapy* (IPT) coverage on pregnant women is 42% and 20% is for prevention of mother to child (WHO Regional Office for Africa, 2016).

Angola being one of the countries which was struck by Human Immunodeficiency Virus/ Acquired Immunodeficiency Syndrome (HIV/AIDS) and with approximately 25 000 children living with the disease, the country has also tried measures to reduce this counts. Between 2004 and 2015, 419 units were established to offer care for HIV positive pregnant women. The 2.3% of 492 348 pregnant women who tested for HIV/AIDS during antenatal consultations were positive. Of the 25 457 children who were tested 8.7% of them were positive and the government initiated support on these children and 47% of them started the anti-retro viral treatment (WHO Regional Office for Africa, 2016). On HIV/AIDS mortality for 13058 patient who were place on Anti-Retro Viral (ARV) treatment, 1046 of them were children and 211 (20.1%) of them died.

Angola experienced a prolonged civil war, which had an impact on the infant deaths from the 1970's until 2002, which took place for 27 years (Gyimah, A. 2018). During those war times, infant mortality was about 132 deaths per 100 live births in comparison to the recent 44 deaths per 1000 live births Due to destructions, which came after the devastating civil war, Angola has been facing high infant deaths.

Since the country's economy is based mainly based on exportation of oil by 95% according to Angola National Institute of Statistics, 2015-16, and the world oil prices determines their fate on economic improvement of the country. The country has not recovered from the recession from 2014 as its main source of income comes largely from oil, and this can be seen in public health sectors where pharmaceutical drug shortage is experienced. Waiting time for drugs, including big hospitals are very long, this is due to red tape and bureaucracy. The poor state of the economy comes with low wages for works, and public health officials have since migrated for opportunities, the country relies more on international help making Angola one of the poor country for child to live in.

Children in rural areas are more likely to die before reaching their fifth birthday in Angola, which is 98 deaths per 1000 live births including infant mortality. This was made in comparison to their counterparts who stay in urban areas who experiences deaths at 68 deaths per 1000 live births rate. Infants' deaths are also reduced by birth spacing of about 36 months. Most infants die when the spacing was done in less than 24 months after the birth of their siblings (Angola National Institute of Statistics-NIS, 2015-16). Infants in Angola also do die due to malaria, which is influenced by the tropical climate and poor sanitation. Malaria in this country is prone to infants who are from poorer households and is also the greater prevalence is amongst those in rural areas than urban areas.

This study focuses more on extending the borderline of knowledge by examining the determinants of infant mortality. It also attempts to build on the findings of the previous studies by advancing the existing knowledge beyond the understanding of infant mortality predictors at all levels as the risks of infants dying lies across all the level factors. Infants die mostly in their neo natal stages and once they reach the post-natal stage they are expected to survive past this stage. In Angola that is not the case as post-natal deaths are high and infant mortality is declining at a slower rate. For that reason this study is carried out with the objective to find the key determinants of infant mortality in Angola using logistic regression model.

Literature Review

The maternal factors included in the model for infant mortality are multiple birth, mother's age, length of preceding birth interval and sex of the child. High mortality of children from multiple births is common in areas of the developing world (Adedini, 2013). Mothers' age is identified as an important socio-economic factor in this framework in examining the level of infant mortality. This allows for infant mortality to be studied in relation to the mothers' age at first birth in order to identify the relationship between the women's age at childbearing and infant mortality (Ambalavanan et al, 2005). Teenage and older mothers having higher risks of child loss Kabir et al., 2001) since very young mothers are not fully mature biologically and their inexperience in taking proper care of the child increases mortality conversely. As for older women, they experience pregnancy related complications due to age (Adedini, 2013). Operating through the biological mechanism of improved production of breast milk and through the social mechanism of less competition with siblings for mother's attention and household resources, children get better nutrition and better care, thus improving their survival chances (Zernikow et al. 1998).

The effect of environmental contamination factor is the spread of diseases by air, water, food, skin washing (Mosley and Chen, 1983). Mortality rates are determined by hygiene at both the household and environment level (Alves et al., 2005). In several studies, household's socioeconomic status has been considered in terms of their drinking water source, sanitation, source of cooking fuel and income level status (Mosley and Chen, 1983). In seeking health care services, mother's behaviour is considered as either a preventive or curative treatment. The behaviour and knowledge of adults caring for children is critical in determining child's survival when they become ill. According to that child mortality was higher for mothers who did not attend antenatal visits and argue that immunization coverage is associated with lower child mortality (Ambalavanan et al., 2005). Deaths caused by respiratory diseases, diarrhoea, measles, tetanus and pertussis, which account for more than 60 per cent of all deaths of children in developing which also due to poor medical attention.

Maternal education plays a major role in the reduction of infant mortality. Educated mothers use health facilities and available resources to improve their health and that of the child (Apunda, 2016). Education persons are also better at some behaviours that are associated with child care and play a key role in child health improvement. Higher education lowered the rate of infant mortality through factors like hospital delivery, increased ante natal care for pregnant mothers and changing traditional family relationships (Jhamba, 1994). Hospital deliveries increased with the education level of an expectant mother and that of her spouse (Saffron Karlsen, 2011) and mothers without education had a higher risk of child mortality. Place of residence greatly influences child mortality (Amabalavanan, 2001), found out that infants born in urban and developed regions of the country than their counter parts who are born in rural, and under developed regions had lower rates of mortality. (Mojekwu et al, 2011,) argue that infants born to mothers residing in rural areas have high mortality rates due to unavailability of adequate health facilities.

Methodology

Study design and data collection: The data used for this study is from Demographic and Health Survey dating 2015-2016, and it is the first Demographic and Health Survey and fourth Multiple Indicator Cluster Survey conducted in Angola. The sample design for the 2015-16 Multiple Indicator and Health Survey (IIMS) provides estimates at the national and provincial levels, and for urban and rural areas. The average Angolan household has 4.8 members and 35% of households are headed by women. The population is very young and more than half of the population (51%) is under age 15.

Description of the variables:

Response variable:

Y: Infant mortality is the response/dependent variable of this study.

Discrete predictors or factors or independent variables

X_1: Age of a mother,

X_2: Marital status,

X_3: Household wealth index,

X_4: Highest education level of a mother,

X_5: Type of place of residence,

X_6: Source of drinking water,

X_7: Type of toilet facility ,

X_8: Ever breastfed and

Univariate analysis: In order to come up with distribution of the background characteristics of the study population, basic descriptive analysis was carried out. Statistical Package for Social Science (SPSS) is a cohesive system for analyzing data. The statistical analysis under this study is carried out using SPSS version 23.

3.4 Logistic regression model: This study uses the Logistic regression model to assess the factors that contribute to infant mortality in Uganda. Logistic regression is a linear model for the logit transformation of a binomial parameter [Agresti]. Logistic regression models are Generalized Linear Models (GLMs) with binomial random component and logit link. In logistic regression the dependent variable is binary or dichotomous i.e. it only contains the data coded as 0 = dead and 1= alive (failure and success). The goal of logistic regression is to find the best fitting model to describe the relationship between the dichotomous characteristic of interest (dependent variable, response or outcome variable) and a set of independent (predicator or explanatory) variables. There is a reference cell when using odds ratio. A common denominator across all ratios are computed when computing ratios. The first j-th category is picked as the baseline and comparisons are made with each of the j-1 category.

The logistic regression with multiple explanatory variables the model for $(x)=P(Y=1)$ at values X_1, $X_2,\ldots,X_{10}$. Logistic regression generates the coefficient (and its standard error and significant levels) of a formula to predict a logit transformation of the probability of presence of the characteristics of interest:

Legit $[\pi(x)] = \beta_0+\beta_1X_1+ \beta_2X_2+\ldots+ \beta_8X_8$

Where, $\pi(x)$ is the probability of the presence of the characteristics of interest. The alternative formula directly specifying (x) is:

$$\pi(x) = \frac{\exp\left[\beta_0 + \beta_1 X_1 + \beta_2 X_2 + ... + \beta_8 X_8\right]}{1 + \exp\left[\beta_0 + \beta_1 X_1 + \beta_2 X_2 + ... + \beta_8 X_8\right]}$$

3.5 Goodness of Fit: The goodness of fit of this study is assessed by describing how well the model fits the observed data. It can also assess how well a given probability distribution fits the data and how the regression model fits the data. The Hosmer and Lemeshow goodness of fit test is used to evaluate whether the number of expected values from the logistic regression shows the number of observed values in the data.

Results

***Socio-economic and demographic characteristics of mothers*:** Table 1 shows the frequency distribution of the background characteristics of the study population. Of all the respondents 29% of them were women aged 20-24, followed by those who were aged 25-29 by 21.8%. In comparison to all other groups, women aged 40-44 and 45-49 had the lowest response proportion of 7.7% and 2.7% respectively. Most of the respondents were among those who were never married (88.3%) compared to 11.1% and 0.7% of those, who were married and widowed respectively. A higher proportion of the population reported to be poor, (61.7%) as compared to only 22.5% of those who are average and 15.8% of those who are rich. Also the results show a higher percentage (45.3%) among respondents with primary education level followed by those with no primary level of education (34.2%) and lastly those with secondary and higher level (20.5%). Lastly the results shows that (52.0%) of the respondents were from rural areas followed by 48.0% of those from urban areas.

The results shows that of the 60% respondents, their source of water is wells and springs that is 63.9%, followed by those who obtained their water from other means by 22.8% and piped water by 13.3%. The majority 44.3%, of the respondents used other types of toilet facilities followed by those who used flush toilet and pit latrine toilet by 32.6% and 23.2% respectively. A larger proportion of respondents who had never breastfeed were 70.0% compared to those who have breastfed 30.0%.

Table 1: Background characteristics of the study population

Variable Characteristics	Frequency	Percentage
Age of Mother		
15-19	78	13.1
20-24	175	29.4
25-29	130	21.8
30-34	85	14.3
35-39	66	11.1
40-44	16	7.7
45-49	16	2.7
Sub-Total	**596**	**100**
Marital Status		
Single	526	88.3
Married	66	11.1
Widowed	4	0.7
Sub-Total	**596**	**100**
Household Wealth Index		
Poor	368	61.7
Middle	134	22.5
Rich	94	15.8
Sub-Total	**596**	**100**
Highest Education Level of Mother		
No education	204	61.7
Primary	270	22.5
Secondary and higher	122	15.8
Sub-Total	**596**	**100**
Place of Residence		
Urban	286	48.0
Rural	310	45.0
Sub-Total	**596**	**100**

Source of Drinking Water		
Piped water	79	13.3
Well and Spring Water	381	63.9
Others	136	22.8
Sub-Total	**596**	**100**
Type of toilet facilities		
Flush toilet	194	32.6
Pit latrine toilet	138	23.2
Others	264	44.3
Sub-Total	**596**	**100**
Ever Breastfed		
Breastfed	417	30.0
Never Breastfed	179	70.0
Sub-Total	**596**	**100**

Out of 596 infants deaths experienced in Angola, 316 (53%) of them were neo-natal deaths and 280 (47%) of them were post-natal deaths.

Logistic regression results

Goodness of fit of model: Hosmer and Lameshow was carried out to check the goodness of fit of model. The question to answer here does the model fit the data well?. Upon fitting the Hosmer and Lemeshow test, it was revealed that the level of significance is greater than 0.05 and this represents a non-significance of a model. Therefore, the model is said to be good fitting in this case.

Table 2: Hosmer and Lemeshow Test Result

Step 1	Chi-Square	df	Sig
1	9.262	8	0.321

Test of Model Co-efficient: The Omnibus Tests of Model Co-efficient gives the result of the Likelihood Ratio (LR) test, which indicates whether the inclusion of a block of variables contributes significantly to the model fit. The chi-square figure for the new block added in the model shows a change of 112.613 for 1 additional degree of freedom at 0.05 level of significance. The chi-square for the model has a p-value less than 0.05; this also indicates that the model, which includes a full set of predictors, is significant improvement of the null model.

Model Summary: The pseudo R^2 values measures the proportion of deviation of infant mortality accounted for by the predictors. From the figures we conclude that approximately 33.8% (Cox & Snell R^2) or 45.6% (Nagelkerke R^2) of the variation in infant mortality can be predicted from a linear combination of the eight independent variables.

Table 3: Model Summary

Step	-2Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	257.002	0.338	0.456

Logistic regression model odd ratio's (OR): This Logistic regression model is the adjusted model, which shows the effect of all variables on infant mortality. The odd ratio (OR) which is the exponential of estimated Logistic regression coefficients along with its 95% confidence interval is depicted Table 4.

When holding other variables constant, the results shows that the odds of post-natal deaths for a unit increase in the age of a mother was reduced by 8.5%. This implies that the odds of post-natal mortality did not increase with an increase in the age of a mother. The odds of post-natal deaths for those who were married was 78.2% more than the odds of those who were single and for those who were widows is 29.7% more than the odds of those who were single. This means those who were married and widows experienced high infant deaths than those who were single, with the married experienced most deaths than the widows. The odds of post-natal deaths for children born from middle-income households was 32.9% more than the odds of those who were from poor households. The odds of those who were rich was 55.3% less than the odds of those who were poor. This implies that children born from middle-income households' experienced more post-natal deaths than those who were from poor households and

those who were rich had less post-natal deaths than those who were poor. The odds of post-natal deaths for women with primary education was 32.2% more than the odds of those with no education. The odds of those with secondary and higher education was 4.7% more less the odds of those with no education. This show that post-natal deaths were prone to women with primary education than those with no education. Additionally this implies that post-natal deaths were high among women who had primary education than those who have secondary and Higher education. Compared to respondents who resided in urban areas, those who resided in rural areas were associated with a 19.8% increase in the risk of post-natal deaths than their counterparts. The odds of post-natal deaths for those who used well and spring water was 63.8% more than the odds of those who used piped water. This mean that more deaths occurred on those who consumed well and spring water than those who consume piped water. The odds of post-natal deaths for those who used pit latrine toilet was 34.1% more than those who used flush toilet. The odds for post-natal deaths for those who used other forms of toilet was 18% more than the odds for those who used flush toilet. This implies that those who used flush toilet were less prone to post-natal deaths as compared to all other forms of toilet facilities. The odds of post-natal mortality for those who had ever breastfed but not currently breastfeeding was about 32% times more than the odds of those who had never breastfed. This implies that those who had breastfed but not currently breastfeeding were prone to post-natal deaths than those who had never breastfed.

Table 4: Adjusted Odds Ratios (OD); 95% Confidence Intervals and P- Values for Factors Associated with Infant Mortality

Variable Characteristics	**Adjusted-Model**		
	OR	**95% CI**	**p-value**
Age of a Mother	0.915	0.805, 1.040	0.001
Marital Status			0.064
Single	1		
Married	1.782	0.120, 26.548	
Widowed	1.297	0.082, 20.606	
Household Wealth Index			0.093
Poor	1		
Middle	1.329	0.700, 2.524	
Rich	0.447	0.198, 1.008	
Highest Education Level of Mother			0.076
No education	1		
Primary	1.322	0.689, 2.538	
Secondary and higher	0.953	0.539, 1.685	
Place of Residence			0.020
Urban	1		
Rural	0.802	0.452, 1.422	
Source of Drinking Water			0.058
Piped water	1		
Well and Spring Water	1.638	0.791, 3.392	
Others	0.802	0.494, 1.303	
Type of toilet facilities			0.083
Flush toilet	1		
Pit latrine toilet	1.341	0.761, 2.363	
Others	1.180	0.684, 2.035	
Ever Breastfed			0.000
Breastfed	1		
Breastfed but not currently breast feeding	31.825	6.407, 61.733	

Discussion

The present study used the Logistic regression model to analyse the infant mortality of Angola. The data used for this study is from Demographic and Health Survey dating 2015-2016, and it was the first Demographic and Health Survey and fourth Multiple Indicator Cluster Survey (MICS) conducted in Angola. Some basic socio-economic and demographic information of mother (respondent) were fitted into model. The findings indicate that, age, education, wealth status, and breast fed have significant effect on infant mortality level in Angola. These findings are in accordance with earlier studies conducted in some part of Africa1 Adedini, S. A. (2013), Apunda, R. (2016); Jann Lay Anne(2009), Okechukwu D et al. (2017).

Age of women is one of the most important biological determinants of infant mortality. Current analysis shows that the odds of post-natal mortality did not increase with an increase in the age of a mother. This finding is in agreement with the findings of Adedini, S. A. (2013), Apunda, R. (2016), Kabir (2001). This study indicates that children born from in middle income households' experienced more post-natal deaths than those who were from poor households and those who were rich have less post-natal deaths than those who were poor Okechukwu D et al. (2017). Most of studies conducted in various countries with reference to infant mortality determinants produced significant inverse relationship between women's education and infant mortality. In the present study we also found that as level of education increased, infant mortality reduced. Women who had secondary or higher education had less infant mortality than the women without education or those with primary education. These findings are similar with reports in previous studies showed in African region Jhamba (1994), Okechukwu D et al. (2017), Saffron Karlsen et al. (2011).

Conclusions

Using Logistic regression modelling approach, we reported the effects of possible determinants of infant mortality in Angola. Clearly, societal factors have great influence on the level of infant mortality in Angola. Infant mortality level in Angola was found to be more among the more educated and rich women. Overall, it is concluded that Logistic regression model explicitly explained the association of infant mortality with socioeconomic and demographic predictors.

Limitation Of The Study

Among others, one limitation is that this study is based on cross-sectional data so we were unable to detect causality but only association between the dependent variable and the included explanatory variables. However, the results do show the predictors of infant mortality among Angola women.

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