

# Newborn Survival

*Cynthia Kineza*

## I.Objective

The main objective of this study is to estimate how child survival depends upon characteristics of the mother and her environment and on the newborn infant, his or her status immediately following birth. Most specifically what are the risk of death for newborn being introduced in a world with these characteristics that could affect his/her survival ( TreatmentA , delivery at home, age of mother, low birth weight, gender.. ). For a health care worker, the ministry of Health implementing policies, a regular mother concerned about her child survival,... our audience is diverse and this analysis will strive to provide the adequate information for any individual interested in neonatal health most specifically newborn survival

## II.Methods

### Exploratory Data Analysis:

To start of the analysis, we created plots of each variable of interest against the indicator of child surviving or not. Let  $Y_i$  be child survival indicator for each  $i$  subject. We observe that children with lowbirth weight and who are not receiving the treatment have a higher probability of dying than those who are receiving it; newborn infants who were breastfed in the first 12 hours have the lowest probability of death among the other groups(12-12,24+,no breastfeeding).only 0.22% mothers did not breastfeed their children, these were ignored to only study trends of breastfeeding timeframes. The probability of death with mother's age fluctuates and around 35 years old, boys become the ones with higher risk of death, further analysis will be done to see the relationship between gender and death risk. There is evidence that higher risk of death is associated with absence of electricity in the home, newborn with mothers who have more than 12 years of education have higher chances of survival, infants receiving their first dose between 5 and 10 hours have the highest probability of survival and risk of death when dose is given after 10 hours, homebirth increases probability of death of newborns, 99% of newborns were given both doses and 99.64% had their second doses (alone), the rate of refusal was very low. For land ownership, infants whose mothers lease by crop have highest risk of mortality than those who own and lease their home.This is obviously related to women land's rights in promoting empowerment which transcend in increasing children health wellbeing(1). Transformed covariates: Land ownership into two groups: Those who own their own land(48%), versus who partially or totally do not own their land (52%) this includes (Lease by cash, lease by crop, own+lease). Here it would be more interesting to see if having a land versus not having one changes mortality of infants. place of birth delivery into two groups: at home (37%) versus assisted at Centers(or hospitals)(62%).Doses: newborns with both doses versus those who did not take both doses. Time of first dose in hours: 0-300(0-5hrs) "1" ; 300-600(5-10hrs) "2" and >600 "3". Education: 0-6years "Primary" ; 6-12years "Secondary" and >12 "Graduated High School"

Figure 1

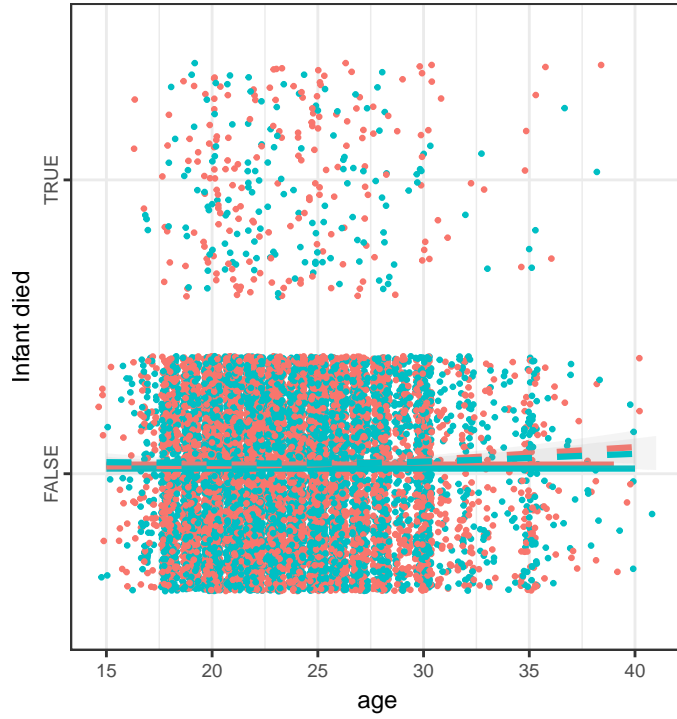
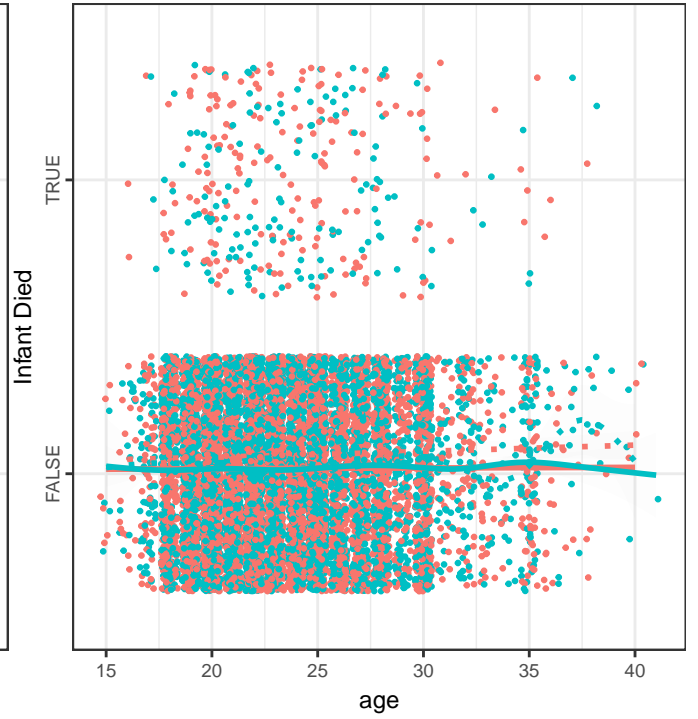


Figure 2



### Model Fitting:

Logistic Regression was utilized because the outcome was binary, 1-Died 0-Alive. We checked for missing values and there was likely none in the dataset. Using series of likelihood ratio tests, we tested for significance of interaction terms and spline terms by comparing full and reduced models. The expected spline term at age 25 was found non significant, so was the interaction of age and treatment, gender and treatment were as well insignificant. Three way interaction terms of sex, weight and treatment was found insignificant. However interaction between place of delivery and treatment of Vitamin A was significant ( $p = 0.0021$ ) and also interaction of low birthweight and treatment of Vitamin A was statistically significant ( $p = 0.003$ )

### Model Validation:

In order to assess robustness to extreme values, the most influential points were 9308 and 4660 were removed and the model was refit, yielding results very similar to the model with all the data. The science behind the question at hand suggests that the observations would be independent, since the death of one child born from another mother would not affect the death of another child, but there are external factor: a nurse not taking good care of newborns, an infection starting at a birthing center, etc. To assess the independence of the data correlation was measured and estimated to be 0.0086, suggesting independence (The most important assumption for the validity of statistical inferences from a logistic model is independence of the binary responses) The model was ensured to be a good fit by examining discrepancies between observed and predicted values, by plotting Pearson Residuals across predicted values which checks specification of the mean model by looking for evidence of systematic differences between the model's predicted probabilities and the observed frequency of positive outcomes overall and in sub-groups and by evaluating ROC curves.

Therefore, our final model is:  $\text{logitPr}(Y_i = 0) = \beta_0 + \beta_1 \text{Gender}_i + \beta_2 \text{Age}_i + \beta_3 \text{Education}_i + \beta_4 \text{Electricity}_i +$

$$\beta_5 \text{Lowbirthweight}_i * \text{Treatment}_i + \beta_6 \text{BreastFeedingTimeFrame}_i + \beta_7 \text{Homedelivery}_i * \text{Treatment}_i + \beta_8 \text{Breastfeeding}_i + \beta_9 \text{LandOwner}_i + \beta_{10} \text{Doses}_i$$

## II. Results

Difference of odds of girls not surviving compared to boys is 1.04 with (95% CI: 0.822, 1.31). There is a difference in odds of death of 1.03 for 1 unit increase in age for mothers with (95% CI: 1, 1.06). The difference in odds of death in newborns is 3.55 for mothers who did less than 6 years compared to ones who did more than 12 years of education and with (95% CI: 0.902, 25.7), but there is a difference in odds of death of 2.62 for mothers who did 6 to 12 years compared to those who did more than 12 years of education with (95% CI: 0.654, 19.1). The odd ratio of infant death born in places with electricity versus without electricity is 0.936 with (95% CI: 0.736, 1.19). While, the odd ratio of infant dying when they have lowbirthweight versus when they have good weight (odds ratio) is 3.81 with (95% CI: 2.76, 5.3). Furthermore, the odd ratio of infant death when they are taking the treatment versus when they are not is 0.83 with (95% CI: 0.55, 1.25). For timeframe of first dose: the odds ratio of infant death when they were given their first dose between 5-10 hours versus 0-5 hours is 1.06 with (95% CI: 0.537, 1.87) while the odds ratio of infant death when they were given their first dose between more than after 10 hours versus 0-5 hours is 0.826 with (95% CI: 0.176, 2.46). The odds ratio of infant death between mothers who had at home delivery versus those who went to the hospital or birthing center is 0.942 with (95% CI: 0.677, 1.3). We also observe as well that, the odds ratio of infant dying when they were breastfed within 12-24hours versus within first 12hrs is 1.29 with (95% CI: 0.941, 1.75). Compared to, the odds ratio of infant death when they were breastfed +24hours versus the first 12hours is 1.52 with (95% CI: 0.937, 2.36). In terms of land ownership, the odds ratio of infant mortality when the mother own their own land versus when they do not is 1.27 with (95% CI: 1.01, 1.61). The difference between the odds ratio of infant mortality comparing lowbirthweight vs normalbirthweight in the treatment group and the odds ratio comparing lowbirthweight vs normalbirthweight in placebo group is 0.52 with (95% CI: 0.324, 0.831). While, the difference between the odds ratio of infant mortality comparing homebirth vs facility birth in the treatment group and the odds ratio comparing homebirth vs facility birth in placebo group is 2.03 with (95% CI: 1.27, 3.27).

## III. Conclusion

Based on our above results, we can see that the odds of an infant not surviving is highly influenced by age of the mother, gender of the child, education, electricity in the home, birthweight, treatment, Time Breast Feeding started, Place of Delivery, time of first dose in hours, Land Ownership. Birthweight and Education status happened to be the ones with highest odds ratio. A surprising fact was to see how land rights for women changes survival of their children. Future work that could be proved to be fruitful in this area would be including other readily available covariates (height and weight of mother, mother being widow or married, distance to nearest hospital, poverty level, . . . .). An app could be made to provide new mothers the latest information on risks of mortality of newborns, it would be a great tool to educate women on newborn health risks and hopefully encourage them to seek medical attention during their pregnancies.

## APPENDIX

|                      | Odds | L:CI | U:CI  |
|----------------------|------|------|-------|
| Baseline             | 0.39 | 0.05 | 2.28  |
| Gender               | 1.04 | 0.82 | 1.31  |
| Age                  | 1.03 | 1.00 | 1.06  |
| Education:0-6years   | 3.55 | 0.90 | 25.66 |
| Education:6-12years  | 2.62 | 0.65 | 19.06 |
| Electricity          | 0.94 | 0.74 | 1.19  |
| LowBirthWeight       | 3.81 | 2.76 | 5.30  |
| Treatment            | 0.83 | 0.55 | 1.25  |
| FirstDose:5-10hrs    | 1.06 | 0.54 | 1.87  |
| FirstDose:>10hrs     | 0.83 | 0.18 | 2.46  |
| HomeBirth            | 0.94 | 0.68 | 1.30  |
| Breastfeeding:12-24  | 1.29 | 0.94 | 1.75  |
| Breastfeedind:>24    | 1.52 | 0.94 | 2.36  |
| LandOwner            | 1.27 | 1.01 | 1.61  |
| Dose                 | 0.00 | 0.00 | 0.01  |
| Lowbirthweight:Treat | 0.52 | 0.32 | 0.83  |
| Treat:HomeBirth      | 2.03 | 1.27 | 3.27  |

### Resources

(1)Do Women's Land Rights Promote Empowerment and Child Health in Nepal? <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3657746/>