

INFANT MORTALITY IN THE UNITED STATES:  
SOCIOECONOMIC FACTORS PREDICTING INFANT SURVIVAL IN LATE NEO-  
NATAL AND POST NEO-NATAL INFANTS FROM BIRTH CERTIFICATE DATA

by

Mark Brunk-Grady

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## ABSTRACT

### INFANT MORTALITY IN THE UNITED STATES SOCIO ECONOMIC FACTORS PREDICTING INFANT SURVIVAL IN LATE NEO- NATAL AND POST NEO-NATAL INFANTS FROM BIRTH CERTIFICATE DATA

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Mark Brunk-Grady

The University of Wisconsin-Milwaukee, 2020  
Under the Supervision of Professor Shengtong Han

According to the Centers for Disease Control and Prevention, the infant mortality rate in the United States in 2018 was 5.6 deaths per 1000 live births. Infant mortality is defined as a child being born alive but dying before their first birthday. This study aimed to determine if adding socioeconomic factors to traditional predictive survival models improved the predictive power in terms of survival for late and post neonatal infants. Secondly, this study looked to develop a risk score to and predict which mothers would be classified as “High” or “Low” risk for infant death.

Data were analyzed from a retrospective cohort study using 2016 Period Linked Birth/Infant Death Data Set from the Centers for Disease Control and Prevention. Kaplan-Meier curves, which model estimated survival functions, were created for the parameters of interest and compared unadjusted survival statistics using Log-rank test. A risk score was developed using Cox Proportional Hazards model from potential predictors. From the start of 2016 through the end of 2017 there were 20,334 infant deaths in the United States. Of these, 7979 (39.2%) occurred after the first week of life, 7477 without congenital abnormalities. Time dependent ROC were used to determine the AUC at each time point from a base model consisting of Apgar score at five minutes, gestation age at birth, and birthweight, and compared them to a model with

socioeconomic factors added. Goodness of fit tests were also investigated to see how each model fits the data overall. Kaplan Meier curves of the risk categories on training and validation test sets were not statistically significantly different from each other for both the “High” and “Low” risk groups (Brier score 0.096) indicating that the prediction of risk category is very good.

The model with socioeconomic factors included had better predictive power compared to the base model with very similar AUC values for months 1-5 and then higher AUC values for months 6-11. As well, goodness of fit tests showed that the socioeconomic status (SES) model fit the data much better (Base  $p < 0.001$ , SES  $p = 0.046$ ). Concordance was also a bit higher for the SES model compared to the Base model, 63.76% vs 63.14%. Kaplan Meier curves indicate that there is potential to utilize baseline clinical information to predict whether an infant should be considered as high risk for mortality within the first year of life. With this information, physicians will be able to direct their attention to patients that may require more social or medical interventions.

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To  
my wife,  
without whom none of this would be possible

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# Chapter 1 Introduction

## 1.1 Disparities in Infant Mortality Rate

The infant mortality rate (IMR) is a significant indicator of a nation's overall health. Infant mortality is defined as a child with a live birth not living to their first birthday. IMR is linked to other health factors such as maternal health, quality and access to medical care, practices in public health, and socioeconomic status (SES) <sup>[1]</sup>. It is widely known that IMR varies significantly among different racial and ethnic groups in the United States, however, the mechanisms that drive these differences are not well studied. The availability of data on birth certificates indicative of SES is limited, however, according to William Nersesian at the Metropolitan Pediatric Specialists in Edina, Minnesota, SES indicators available from birth certificates that are related to infant mortality are race and ethnicity, parental education, parental age, maternal marriage status, amount of prenatal care, multiparity, health insurance status, having a previous live-birth, interval between pregnancies, substance abuse, migrant status, place of birth, and by whom the birth was attended <sup>[2]</sup>. While it has been well documented that infant mortality within the first week of life is influenced strongly by birthweight and gestational age at delivery, post-neonatal mortality, defined as greater than seven days old, is increasingly driven by parental socioeconomic status and the care provided to the infant <sup>[3,4]</sup>.

Given the well-known disparities in SES between race and ethnic groups, a study by Todd Elder, John Goddeeris, and Steven Haider in 2016 attempted to examine to what extent IMR differences related to SES. It was found that while SES characteristics available on birth certificates are limited, the IMR discrepancies for non-Hispanic blacks,

Puerto Ricans, Asians, and First Nations people as compared to non-Hispanic whites are all driven by three main predictors, maternal education, maternal marital status, and maternal age; these three predictors are also closely related to income and thus poverty for new mothers <sup>[5]</sup>. Further findings from the study show that the IMR differences by race and ethnicity exhibit several similarities suggesting that SES plays a significant role in the IMR <sup>[5]</sup>. Research routinely shows that socioeconomic disadvantage is correlated with a greater risk of poor birth outcomes in the United States. Globally, the U.S. has among the highest infant mortality rates of developed nations but also has the highest proportion of gross national product spent on health care, suggesting that health care is not the only factor contributing to higher IMR and racial disparity in IMR <sup>[6]</sup>. In a study by Alice Chen, Emily Oster, and Heidi Williams in 2016 that compared the US to selected European countries it was found that during the post-neonatal period the US had an excess mortality ranging from 0.45 deaths per 1000 (relative to Belgium) to 1.1 deaths per 1000 (relative to Austria). During the post-neonatal period, the IMR in Austria was 0.81 per 1000 with the U.S. being predicted at 1.89 per 1000 given the same birthweight distribution, which is surprising as Austria and the U.S. are very similar in terms of birthweight distribution and neonatal mortality <sup>[7]</sup>. For these reasons and others, it is imperative to investigate what is causing the higher IMR so action can be taken to rectify the issue by identifying factors that need to be addressed.

Further, the actionable determinates of health disproportionately affect persons who are socioeconomically disadvantaged. Some of these downstream factors include personal behavior, social factors, such as education level, wealth, and family size, environmental factors, and access to quality health care. More and more studies show

that SES alone may not fully account for the disparities in IMR. Rabah Kamal, Julie Hudman, and Daniel McDermott note that the Black-White infant mortality gap is not fully explained when adjusting for maternal characteristics and that structural racism as a primary risk factor for non-Hispanic black mothers could be key in explaining the difference in IMR based in large on the amount of stress it places on mothers of color throughout their lives <sup>[8]</sup>. An example of structural racism in the health care system is shown by racial minorities receiving less intensive and lower quality health services compared to non-Hispanic whites due to providers' prejudices and acceptance of negative racial stereotypes <sup>[9]</sup>. As SES improves, it is expected that birth outcomes also improve. Studies have shown that while birth outcomes do improve, but they do not improve at the same rate for each race and ethnic group. In fact, the IMR gap widens as SES improves and non-Hispanic blacks have lower income and wealth on average compared to non-Hispanic whites with the equivalent education level and having higher expenditures for basic needs with more dependents <sup>[9]</sup>.

A study in South Carolina women concluded that maternal stress was associated with pre-term birth in mothers in disadvantaged neighborhoods, but not in mothers who lived in more advantaged neighborhoods, suggesting that other social and infrastructural resources help to buffer stress as well as more positive techniques being utilized to adapt to stress demonstrated in another study that showed the odds of having a pre-term birth was approximately two times greater for mothers with low social support compared to those with high social support <sup>[6]</sup>. This disparity is related to processes of unequal income distribution and mediating influences of psychosocial factors associated with maternal race and ethnicity and it is suggested that neighborhood income

inequality relates directly to societal underinvestment in the health and social services required to improve infant and maternal care and access to material resources, socioeconomic status, and neglect of existing infrastructure, thus, it follows that there is an unequal distribution of burdens of diseases and other adverse health outcomes including low birth weight or preterm birth <sup>[10]</sup>. In another study it is suggested that stressful life events and neighborhood resources are important determinants of prenatal health during pregnancy and postpartum however operate in different manners to influence low birthweight or preterm birth outcomes <sup>[11]</sup>.

## 1.2 Objectives

IMR for the first week of life has been well examined with most prediction models utilizing metabolic factors for infants with very low birthweights and those born very prematurely. However, much less work has been done on causes of infant death past the first week of life, especially for those infants that were not born very prematurely or with a very low birthweight. In order to identify important risk factors, this research is an attempt to help fill that gap.

Most studies investigating infant mortality have utilized logistic regression to form predictive models and more recent studies have made use of different machine learning classifiers to try to predict survivability. This research investigates the IMR starting after the first week of life for those infants who did not have congenital defects employing survival analysis methods as it is imperative to investigate how time plays a part in infant survival.

The use of socioeconomic factors and how they relate to infant survival is largely under studied even though it is widely known that lower SES is closely related to poorer health outcomes. The use of logistic regression for modeling infant survival does not account for how the risk of infant death changes with time. This motivates the use of Cox Proportional Hazards modeling in this study. During the first week of life, infants change drastically in terms of development. This trend continues through the first year of life, and thus how the predictors model survival, must also change. It is hypothesized that that as time passes, the drivers behind survival rates will shift from metabolic factors to socioeconomic factors. This shift will aid in finding the populations that may require more social interventions.

### 1.3 Summary of Thesis

This thesis is organized as five main chapters. Chapter 1 gives a brief background of the disparities in IMR and the objectives for this study. Chapter 2 lays out the details of the dataset used. The method of statistical analysis will be explained in Chapter 3. Chapter 4 discusses the results of the study and Chapter 5 summarizes the results and their implications. Lastly, the R code for the study and additional tables and graphs are given in the Appendices.

# Chapter 2 Data Description

## 2.1 Data Source

The data is the 2017 Period/2016 Cohort Linked Birth/Infant Death Public Use File compiled by the Centers for Disease Control and Prevention (CDC). This is the most recent linked dataset available and consists of all births in 2016 and all infant deaths from those born in 2016.

## 2.2 Infant Birth and Death Dataset

The birth certificate data can be summarized into the place and month of birth, parental characteristics, pregnancy information, medical risk factors, obstetric procedures, labor and delivery complications, delivery method, infant abnormalities, maternal morbidities, and sex of the infant. The death certificate information can be summarized as infant age at death and cause of death as denoted by 10<sup>th</sup> revision of the International Classification of Diseases (ICD 10). As of 2005, no geographic information is available in the public use dataset, however, it is noted that thirty-six jurisdictions (thirty-four states, New York City, and D.C.) linked 100% of their infant deaths; sixteen states have below a 100% linkage rate. Five states have a linkage of under 99%: Alaska (98.0%), California (98.3%), Texas (98.7%), Connecticut (98.8%), and Arizona (98.9%).

The raw birth and death certificate data consisted of 259 variables with 3,946,058 live births with 22,927 linked infant death records. There were 106 (0.4%) unlinked deaths that were excluded from the study. This study is focused on those infants who survived from at least the seventh day of life up to and including the 364<sup>th</sup> day of life to

mother's born within the United States. An equal number of observations were randomly selected from the portion of infants that lived through their first birthday. Other exclusion criteria were those observations that were not reported in both the numerator and denominator files for each variable, marked in the dataset using reporting flags, 1 for being reported in both datasets, 0 for missing from at least one dataset were excluded as they would falsely skew results. Variables were left out of modeling that recoded observations, e.g. multiple reports of race, gestation age measures, education level. Predictor values related to the quality of measurement were also removed, such as those indicating if an observation was imputed. Missing observations were grouped into a separate level for each variable during data compilation by the CDC. After the above exclusion and random selection from the sample of infants that lived through their first birthday, there are 14,954 records remaining with 82 variables. Two more variables were created from the data, a continuous risk score and categorical risk, giving 84 final potential predictors.

# Chapter 3 Methodology

## 3.1 Research Questions

The factors relating to SES of interest are maternal race, maternal education, if the infant is being breastfed, if the mother is a recipient of the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), maternal marriage status, and how the pregnancy will be paid for. Breastfeeding and marriage status are not direct measures of SES; however, they are highly correlated with it and are thus being considered as measures of SES in this study. Metabolic factors which will be used as a baseline measure are Apgar score at 5 minutes, gestation age at birth, and birthweight. The Apgar score is a measure of five components to evaluate clinical signs of neonatal depression <sup>[12]</sup>. This study aims to determine if the SES factors given can improve the prediction of infant survival compared to metabolic measures only and if a risk score can be used to determine potential increased risk of death in infants based on data available from birth certificates. The first hypothesis is that socioeconomic factors available on a birth certificate will have better prediction of survival compared to a model with birth certificate metabolic factors. The secondary hypothesis is that a risk score can be developed from birth certificate data to identify those mothers who are at a high risk for infant death.

## 3.2 Participants

Participants in this study are mothers and their infants born in the United States in 2016. The subpopulation that was studied were those infants who experienced death within the first year of life and an equal number of randomly selected observations who

did not die during the first year of life, none of which exhibited any congenital abnormalities. Specifically, this study examines those infants that experienced death after their first six days of life until the 364<sup>th</sup> day of life. The average level of each of the socioeconomic factors of interest are non-Hispanic white women (47.9%) aged 25-29 (28.0%) with a high school diploma (29.3%) not receiving WIC benefits (55.1%) that breast fed their infants (64.2%) and started prenatal care in the first trimester (69.4%) with 11-12 prenatal visits (20.0%) who were on Medicaid (51.2%) and had a Doctor of Medicine as their attending health care provider (83.8%). There were an equal percentage of married and unmarried women (48.0% and 47.9% respectively). The complete data are summarized in Appendix A Tables 3.1-3.4 which are separated by survival status. Approval from the Institutional Review Board was not required as the data is publicly available and lacks all personal identifying information.

### 3.3 Statistical Analysis

All statistical analyses were conducted using R statistical software version 3.6.1. Cox Proportional Hazard models, from the Survival package, were used to investigate potential relationships between a base model of metabolic factors and survival as well as a model with the base factors and socioeconomic factors available on infant birth certificates <sup>[13]</sup>. The hazard ratios were used to compare event frequency among each predictor level compared to the reference groups. The hazard ratio is a measure of the probability of an event in the treatment group compared to that in the control group at a specific time. A hazard ratio greater than 1 indicates that the probability of event is

greater for the treatment group and a value less than 1 indicates a greater probability of the control group.

Predictor selection for the base model was performed using forward selection based on the Akaike information criterion (AIC) while predictors for the socioeconomic model were added based on current research relating each factor to health outcomes. The two models were compared using time dependent Receiver Operating Curves (ROC) and comparing the area under the curve (AUC) at each time point with Z tests using the survivalROC package <sup>[14]</sup>. The AUC is the percentage that a randomly selected pair of observations are correctly classified. This study focuses on the change in AUC values to determine how model prediction improves.

A risk score was created from the beta coefficients from all potential predictors on a training dataset created by randomly splitting the full dataset into two halves. The beta coefficients from the training dataset were then applied to the test dataset and validated using Kaplan Meier (KM) plots and obtaining the Brier score. Due to the skewness of the risk score the median value was used to separate the predictor into “High” and “Low” risk categories. KM plots are used to visualize time-to-event, in this study the event is death, with differences in hazard function being tested by the log-rank test. The KM estimator is used to estimate the survival function of a sample population. The Brier score is a means to verify accuracy of a prediction, measured from 0 to 1, with a lower value indicating a better prediction.

The Sensitivity, Positive Predictive Value (PPV), and Accuracy were evaluated for the created risk categories as they predict infant survival. The Sensitivity is defined as the percentage of all infant deaths that were correctly predicted. The PPV is defined

as the percentage of true positives compared to all predicted infant deaths. The Accuracy of the model is the percentage of all infants who were classified correctly, either as living or dead.

# Chapter 4 Results

## 4.1 Univariate Analysis

Univariate Cox Proportional Hazard models showed that all predictors of interest were statistically significant when predicting survival status apart from infant sex ( $p = 0.525$ ). All univariate results are in Table 4.A1 in Appendix A. In the Cox model of maternal race regressed on survival, infants born to non-Hispanic black, First Nations or Alaskan Native (AIAN), and mothers identifying with two or more races all had significantly better survival rates at alpha 0.1 compared to non-Hispanic white mothers (HR= 0.95, 95% CI= [0.90-1.00],  $p= 0.068$ ; HR= 0.69, 95% CI= [0.50-0.88],  $p< 0.001$ ; HR= 0.86, 95% CI= [0.73-0.99],  $p= 0.023$ , respectively). As this goes against traditional findings, it should be noted that this may be due to the fact that there is a much higher proportion of minority infants dying in the first week of life compared to non-Hispanic whites. Highest level of maternal and paternal education attainment were both significant overall ( $p< 0.001$  and  $p< 0.001$ ) when regressed on survival by Cox regression, but only Bachelor's and Master's degree attainment within paternal education were significantly different from the reference group, both of which having lower survival rates (HR= 1.22, 95% CI= [1.08-1.37],  $p= 0.007$  and HR= 1.26, 95% CI= [1.08-1.45],  $p= 0.014$ ). Cox regression of maternal marriage status on infant survival was observed to have significantly higher survival rates for those who were unmarried and whose marriage status is unknown compared to those mothers that were married (HR= 0.86, 95% CI= [0.81-0.90],  $p< 0.001$ ; HR= 0.90, 95% CI= [0.81-0.99],  $p= 0.022$ ).

Prenatal care predictors from the birth certificate, when prenatal care began and how many prenatal visits to healthcare providers occurred, were significant when

regressed individually on infant survival overall ( $p < 0.001$  and  $p < 0.001$ ). As the number of prenatal visits increases in the range of 9-18 visits, the hazard ratios become less than 1 and thus improved survival rates (all  $p < 0.1$ ) compared to a mother having no prenatal visits. As prenatal care starts later, there were observed increases in infant survival hazards. For those mother's starting prenatal care in the 2<sup>nd</sup> trimester, the hazard ratio was 0.93 (95% CI= [0.87-0.99],  $p = 0.013$ ), and for the 3<sup>rd</sup> trimester the hazard ratio was 0.83 (95% CI= [0.73-0.93],  $p < 0.001$ ). The attending health care provider, when regressed on infant survival, was significant ( $\alpha = 0.1$ ) in terms of infant survival for both certified nurse midwives (HR= 0.81, 95% CI= [0.70-0.91],  $p < 0.001$ ) and other midwives (HR= 0.67, 95% CI= [0.27-1.07],  $p = 0.053$ ) compared to doctors of medicine.

From Cox regression models for breast feeding, WIC benefits, and Payer, infants being breast fed, those receiving WIC benefits, and those having Medicaid all had lower hazards of infant death. The hazard ratio for those not being breast fed was 1.11 (95% CI= [1.05-1.16],  $p < 0.001$ ) indicating a higher risk of infant death. Similarly, for those mothers and infants receiving WIC benefits the hazard ratio was 0.89 (95% CI= [0.85-0.94],  $p < 0.001$ ) indicating a significantly lower risk of infant death. Those mothers and infants covered by Medicaid had 14% lower risk of death compared to those with a private insurance payer (95% CI= [1.09-1.19],  $p < 0.001$ ).

The metabolic factors of interest, Apgar score at 5 minutes, gestation age, and birth weight, were all positively related to infant survival though Cox regression, meaning that as each of them increased in level, hazard ratios all decreased and were less than 1 (all  $p < 0.1$ ). The risk category that was created from the beta coefficients

showed increased risk of infant death for the “High” risk group compared to the “Low” risk group (HR= 1.42, 95% CI= [1.38-1.47],  $p < 0.001$ ).

Univariate analysis shows there are many potential metabolic and SES predictors of infant survival. All predictors of interest, except infant sex, will be further investigated using KM curves and multivariate analyses.

#### 4.2 Kaplan Meier Analysis

Kaplan Meier analyses were performed to investigate infant survival between each predictor level. Figure 4.2.1, as below, shows survival curves for each level of maternal race with the median survival times indicated by the dashed lines.

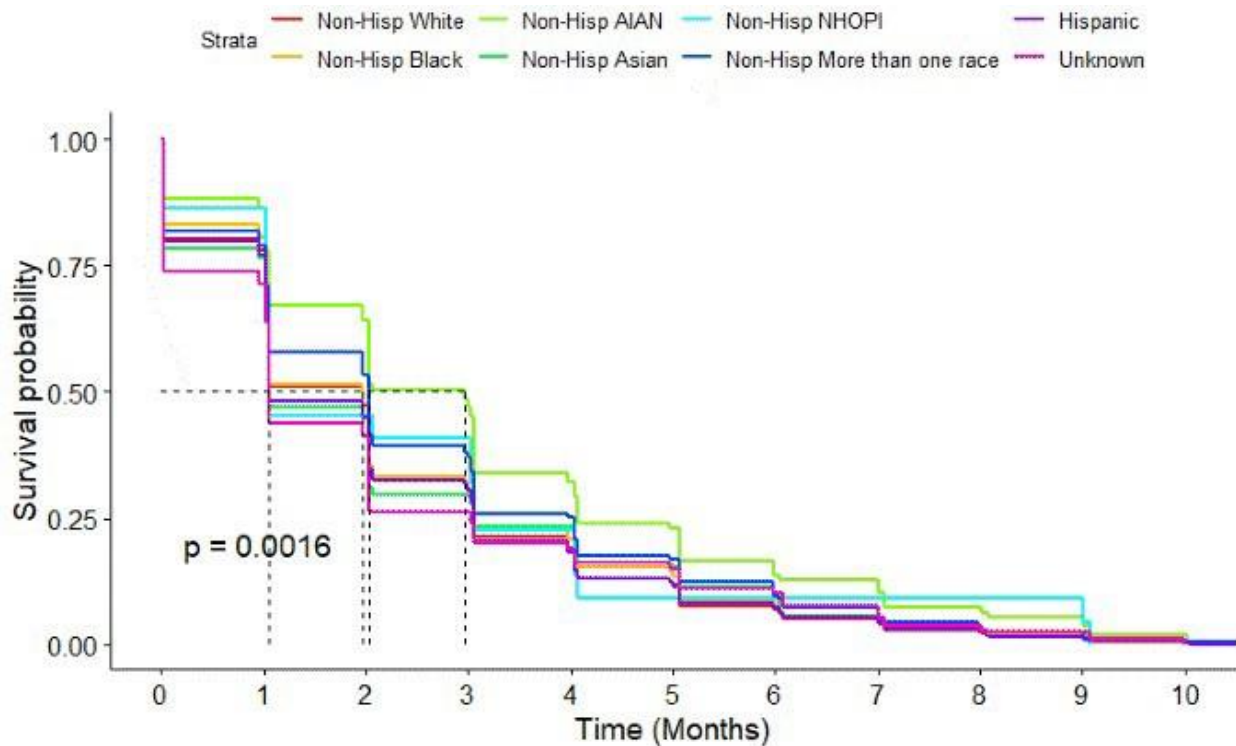


Figure 4.2.1 Maternal Race Kaplan Meier Curve

In this population, infants of non-Hispanic black mothers and those with more than one race identified, had a median survival time one month greater than non-Hispanic whites.

Further, those infants born to First Nations and Alaskan Native mothers had a median survival two months longer than those of non-Hispanic white mothers (log-rank  $p=0.0016$ ).

Other maternal characteristics showed similar significance levels between groups. Maternal age, shown in Appendix A Figure 4.2.1, shows median survival times for infants of mothers who were in age groups 15, 16, 18, 19, 20-24, and 25-29 all being a month longer than those infants born to mothers aged younger than 15 (log-rank  $p<0.001$ ). Highest maternal education (Appendix A Figure 4.2.A2) and paternal education (Appendix A Figure 4.2.A3) attainment showed significant differences in infant survival for the groups, however, lower education was associated with higher median survival times for both factors (log-rank  $p<0.001$  and  $p<0.001$ ). For both mothers and fathers, higher degree attainment was associated with worse infant survival, with exception of maternal doctoral degree attainment. Maternal marriage status (Appendix Figure 4.2.A4) showed significant differences in infant survival between the married and unmarried groups. Infants from unmarried mothers were associated with higher survival times, 1.05 months compared to 2.04 months (log-rank  $p<0.001$ ).

As in the univariate Cox Proportional Hazard models above, prenatal care showed significant differences in survival curves between each group. As indicated in Appendix Figure 4.2.A5, as the number of prenatal visits increases to at least 7, the median infant survival increases by about 1 month (log-rank  $p<0.001$ ). In the below figure showing the survival curves of the trimester in which prenatal care began, Figure 4.2.2, those who started prenatal care in the second or third trimesters had higher

survival compared to those who did not have any prenatal care or those that started in the first trimester.

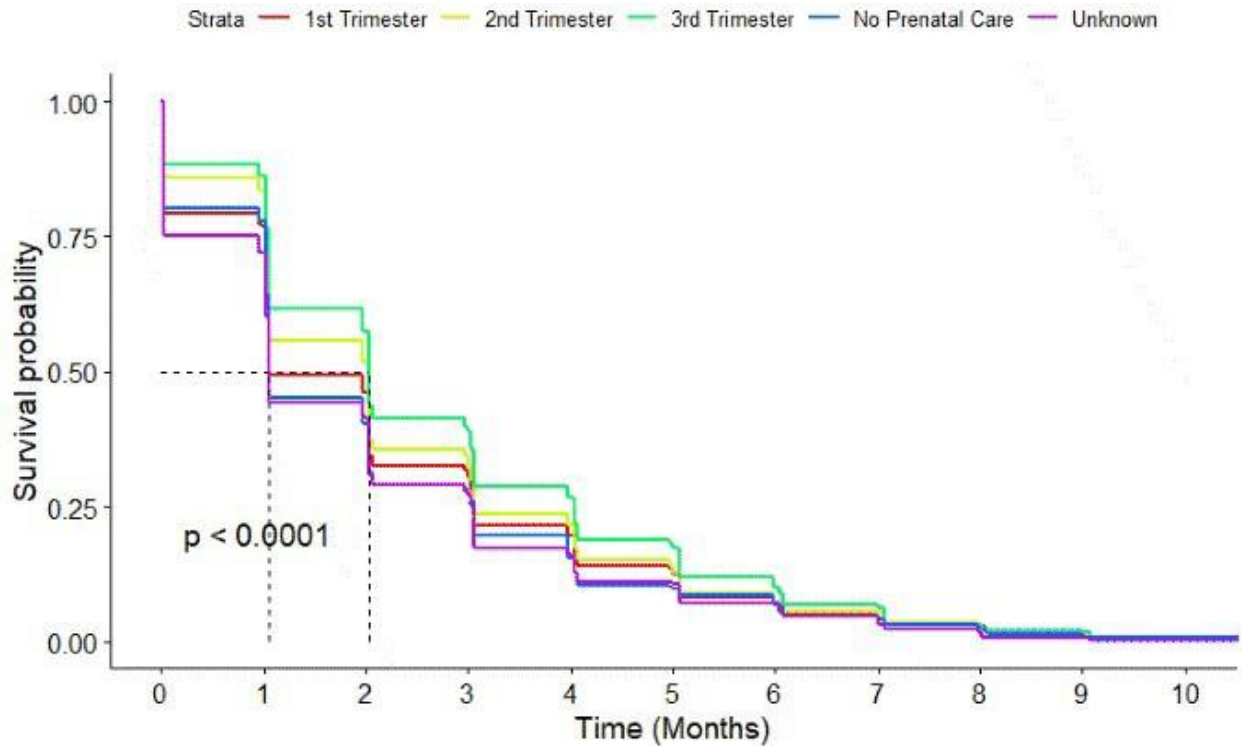


Figure 4.2.2 Prenatal Care Start Kaplan Meier Curve

Not only is prenatal care significant, but the attending provider is as well. As can be seen in Figure 4.2.3, both certified nurse midwives and other midwives had greater survival rates compared to doctor's of medicine, while doctors of osteopathy had very similar survival rates compared to doctors of medicine (log-rank  $p= 0.001$ ).

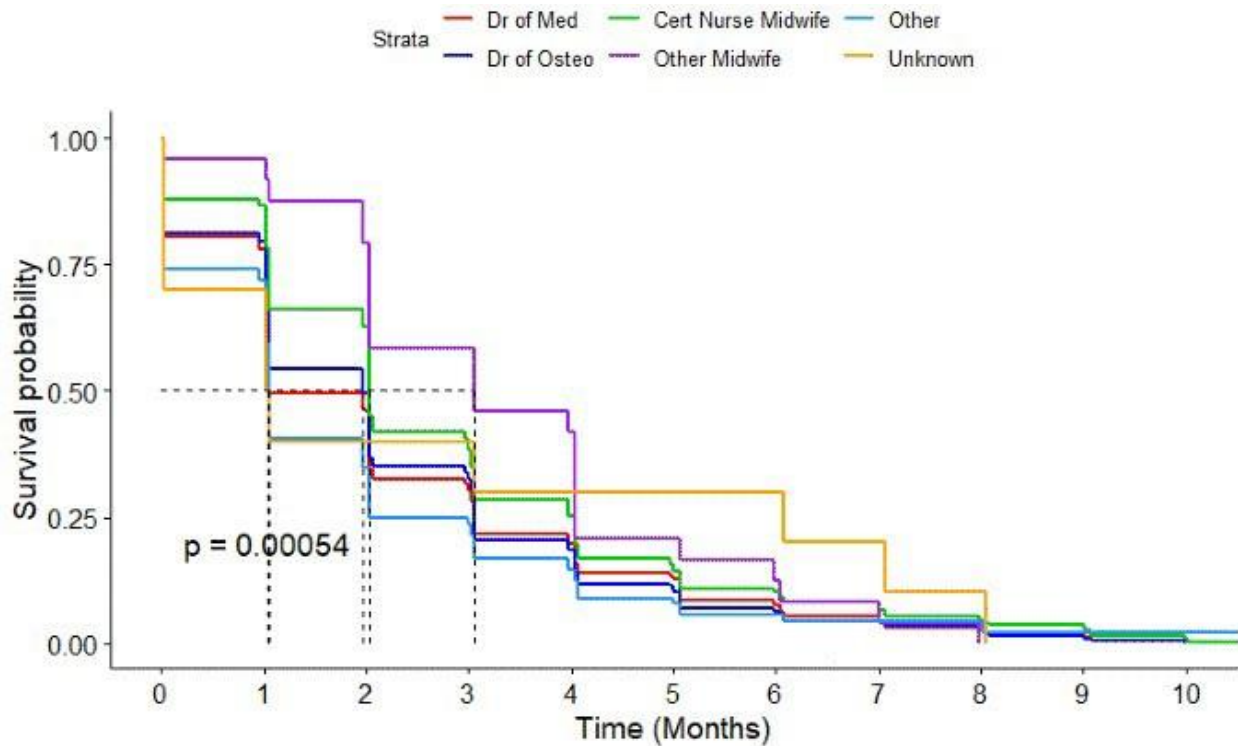


Figure 4.2.3 Attending Health Care Provider Kaplan Meier Curve

Consistent with the Cox regression, breast feeding, receiving WIC benefits and having Medicaid are shown to extend infant survival. The median survival for infants who were breast fed (Appendix Figure 4.2.A6) was 1.97 compared to 1.05 for those who were not (log-rank  $p < 0.001$ ). For those mothers and infants receiving WIC benefits (Appendix A Figure 4.2.A7), the median survival time was 2.04 months compared to 1.05 for those who did not receive WIC benefits (log-rank  $p < 0.001$ ). For those mothers and infants having private insurance, the survival curve was lower than for any other known payer with a median survival of 1.05 months, shown in Appendix A Figure 4.2.A8 (log-rank  $p < 0.001$ ). The metabolic factors, five-minute Apgar score, gestation age, and birthweight (Appendix A Figures 4.2.A9-11), all show increased survival with increasing levels (log-rank  $p < 0.001$ ,  $p < 0.001$ , and  $p < 0.001$ , respectively). These results follow patterns of known research.

## 4.3 Multivariate Analysis

### 4.3.1 Base Cox Model

As a base for comparison, a Cox Proportional Hazards model was fit with the metabolic predictors of interest, Apgar score at 5 minutes, gestation age at birth, and birth weight. These were chosen as they are widely known to influence infant survival. The model is summarized below in Table 4.3.1. Each level of Apgar score has a decrease hazard ratio compared to the reference group, all significant at  $\alpha = 0.1$ . A similar trend is seen for each gestation age group as well. Each level of gestation age is significantly different from the reference group ( $p = 0.1$  or less). While birthweight was significant in univariate analysis ( $p < 0.001$ ), when added with the Apgar score and gestation age, the individual levels are no longer significant ( $p = 0.58$  and  $p = 0.36$ ).

Table 4.3.1 Multivariate Cox Regression Base Model

	<u>HR</u>	<u>95% LCL</u>	<u>95% UCL</u>	<u>p</u>
Apgar 5 mins.				
4-6	0.91	0.83	1.01	0.06
7-8	0.71	0.65	0.78	< 0.001
9-10	0.64	0.58	0.70	< 0.001
Unknown	0.79	0.64	0.98	0.03
Gestation Age (weeks)				
20-27	0.19	0.03	1.35	0.10
28-31	0.15	0.02	1.08	0.06
32-33	0.13	0.02	0.94	0.04
34-36	0.14	0.02	0.98	0.05
37-38	0.12	0.02	0.88	0.04
39	0.12	0.02	0.87	0.04
40	0.12	0.02	0.88	0.04
41	0.12	0.02	0.88	0.04
42+	0.17	0.02	1.32	0.09
Unknown	0.16	0.02	1.34	0.09
Birthweight (grams)				
1500-2499	0.96	0.85	1.10	0.58
2500-8165	0.93	0.81	1.08	0.36
Unknown	1.90	0.68	5.32	0.22

#### 4.3.2 SES Cox Model

As the SES factors are entered into the model, the metabolic factors increase in terms of their hazard ratios across all levels. The full SES model summary is shown in Table 4.3.2 in Appendix A. Notably non-Hispanic white and Hispanic infants have higher hazard ratios compared to other races. As well, higher levels of maternal education attainment now become significant. At the master's degree level, the hazard ratio is 0.82 (95% CI= [0.67-1.00],  $p= 0.05$ ) and at the doctoral level, the hazard ratio is 0.68 (95% CI= [0.52-0.90],  $p= 0.01$ ). Mothers who are unmarried have lower hazard ratio compared to married mothers (HR= 0.93, 95% CI= [0.88-0.99],  $p= 0.02$ ) and those who breast fed their infants had improved survival compared to those who did not (HR= 1.12, 95% CI= [1.06-1.18],  $p < 0.001$ ).

#### 4.3.3 Model Comparison and Diagnostics

The goodness of fit test from the survMisc package in R for the base model indicated that the model does not fit the data well ( $X^2= 1686.2$ ,  $df= 9$ ,  $p < 0.001$ ) while the SES model does fit the model well at  $\alpha= 0.1$  significance ( $X^2= 17.235$ ,  $df= 9$ ,  $p= 0.045$ )<sup>[15]</sup>. Further, the concordance, which is a measure of goodness of fit in survival models, was higher for the SES model compared to the base model (63.76% compared to 63.14%), indicating a slightly better model, however this may also be due to sampling. Both models were used to examine the time dependent ROC's to see how the survival prediction changed at each time point. ROC plots are in Appendix A Figures 4.3.A1-2 and are summarized below in Table 4.3.2. The base Cox model has a higher AUC at each time point through the first year of life compared to the SES Cox model.

Table 4.3.2 AUC of time dependent ROC at each time point

Month	1	2	3	4	5	6	7	8	9	10	11
Base	0.927	0.765	0.742	0.725	0.704	0.686	0.674	0.667	0.663	0.657	0.656
SES	0.897	0.731	0.687	0.651	0.618	0.592	0.576	0.567	0.561	0.553	0.551
Differ	-0.030	-0.034	-0.055	-0.074	-0.086	-0.094	-0.098	-0.100	-0.102	-0.104	-0.105

Multivariate analyses show that the addition of the socioeconomic factors to the base model of metabolic factors improves model fitting and but lowers survival prediction.

#### 4.4 Risk Score Analysis

To create a risk score, a Cox Proportional Hazard model was fit on a training dataset to all potential covariates. The resulting estimates of the log-hazard for each predictor were then added together based on parental and infant demographics. The estimates from the training dataset were then used to create a risk score on a test dataset. These scores were then put into categories “Low” and “High” split by the median score from the training dataset. KM curves of risk category on survival were then plotted for both the training and test datasets, seen in Figure 4.4.1.

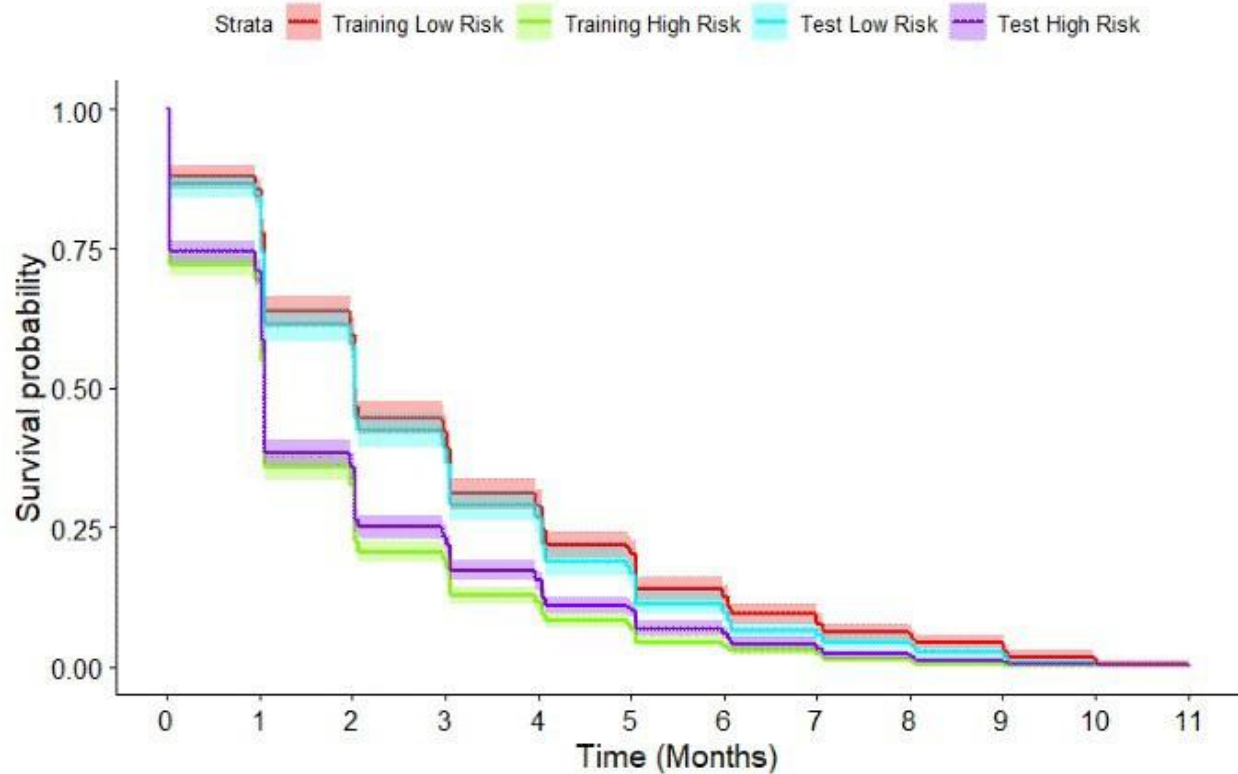


Figure 4.4.1 Kaplan Meier Curve of Risk Categories on Training and Test Datasets

The curves were then evaluated using the Brier score, which gave a value of 0.096, indicating that risk category predictions between the training and test datasets are very close to each other. Evaluating the risk score's ability to predict survival from the training dataset on the test dataset, the sensitivity, positive predictive value (PPV), and accuracy were calculated. The sensitivity was 50.39%, the PPV was 75.33% and the accuracy was 50.56%. From these values the risk score is fair at predicting survival from those infants that did survive in the test dataset. However, the sensitivity and overall accuracy are very poor.

# Chapter 5 Discussion

## 5.1 Conclusions

The first objective of this thesis was to first determine if socioeconomic factors improved survival prediction of infants in the United States. Cox regression models and Kaplan Meier curves were used to evaluate potential predictors of survival in univariate analyses. Those that were shown to have a significant relationship with infant survival were then used in a multivariate Cox regression model with the base metabolic factors, Apgar score at 5 minutes, gestation age at birth, and infant birthweight. The SES model was compared to the Base model, consisting of metabolic factors only using time dependent ROC plots and their corresponding AUC values. The SES factors included in the final model were maternal race, age, marital status, and education level, paternal education, WIC benefit status, whether the infant was breast fed, the timing of the start of prenatal care and number of prenatal visits, as well as the type of attending health care provider. It was found that the SES model fits the data better than the Base model using goodness of fit testing, however, the Base model outperformed the SES model when predicting infant survival.

The second objective of this thesis was to develop a risk score to assign mothers based on the available birth certificate data. A multivariate Cox regression model was fit using all potential predictors on a training dataset created by randomly splitting the full dataset in half. The beta estimates for each level of the predictors were then used to assign a score to each mother in both the training and validation datasets. The risk scores were then split into “High” and “Low” risk categories using the median value from the training dataset. Kaplan Meier plots were created for both the training and validation

risk categories and overlain to examine how the risk score fit each dataset. The resulting Kaplan Meier curve showed that both levels from each dataset were very close to each other and the Brier score indicated that they were statistically similar to each other as well. The validation between training and test datasets shows promise that risk categories could be used to guide health care providers to offer potential interventions either prior to birth or to guide relevant treatment after birth.

## 5.2 Limitations

This research does have some limitations. The first limitation is that there is not a direct measure of socioeconomic status available from birth certificate data. This is generally a measure of economic resources (e.g. income, net worth, cost of living, assets). This is important as income is directly related to health outcomes. As MacDorman and Mathews note, in 2005 there were almost three times as many minority children (<18 years of age) living in families who had incomes below the federal poverty line <sup>[1]</sup>. A second limitation is that there are no geographic identifying factors in the public data produced by the CDC. This makes estimating income and related factors impossible. It is well known that income in the United States is not distributed equally throughout the country so making assumptions on a national level is difficult. Further, the lack of geography eliminates investigation potential confounding factors from known industry locations (e.g. mining operations vs corporate office buildings)

### 5.3 Further Research

Elder and Goddeeris noted in 2006 that roughly one-third of the black-white gap in IMR is attributed to characteristics available on birth certificates, but richer data could support an SES explanation for much of the gap <sup>[5]</sup>. Sociologic research looking at the experiences of women of color in the health care space should be done to investigate how discrimination, either implicit or explicit, impacts health outcomes in minority populations. Early efforts in addressing the social determinants affecting birth outcomes are underway, however, most are too new to be able to observe changes in birth outcomes. Further research is needed working with these initiatives to better understand how their efforts are working.

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## Appendix A: Summary Tables

Table 3.A1: Raw dataset by parental characteristics

n	Level	Overall	Survived		$\chi^2$ p
			Yes	No	
		14954	7477	7477	
Maternal Race (%)	Hispanic	3082 (20.6)	1688 (22.6)	1394 (18.6)	<0.001
	Non-Hisp AIAN	172 (1.2)	63 (0.8)	109 (1.5)	
	Non-Hisp Asian	752 (5.0)	471 (6.3)	281 (3.8)	
	Non-Hisp Black	3170 (21.2)	1079 (14.4)	2091 (28.0)	
	Non-Hisp More than one race	412 (2.8)	167 (2.2)	245 (3.3)	
	Non-Hisp NHOPI	45 (0.3)	23 (0.3)	22 (0.3)	
	Non-Hisp White	7166 (47.9)	3911 (52.3)	3255 (43.5)	
	Unknown	155 (1.0)	75 (1.0)	80 (1.1)	
Maternal Age (%)	< 15	13 (0.1)	5 (0.1)	8 (0.1)	<0.001
	15	32 (0.2)	8 (0.1)	24 (0.3)	
	16	96 (0.6)	36 (0.5)	60 (0.8)	
	17	148 (1.0)	53 (0.7)	95 (1.3)	
	18	303 (2.0)	128 (1.7)	175 (2.3)	
	19	482 (3.2)	192 (2.6)	290 (3.9)	
	20-24	3486 (23.3)	1519 (20.3)	1967 (26.3)	
	25-29	4194 (28.0)	2160 (28.9)	2034 (27.2)	
	30-34	3807 (25.5)	2147 (28.7)	1660 (22.2)	
	35-39	1897 (12.7)	1016 (13.6)	881 (11.8)	
	40-44	461 (3.1)	200 (2.7)	261 (3.5)	
	45-49	31 (0.2)	12 (0.2)	19 (0.3)	
	50-54	4 (0.0)	1 (0.0)	3 (0.0)	
Maternal Education (%)	< 9th grade	500 (3.3)	235 (3.1)	265 (3.5)	<0.001
	9-12 grade	1969 (13.2)	738 (9.9)	1231 (16.5)	
	HS Grad/GED	4376 (29.3)	1849 (24.7)	2527 (33.8)	
	Some college	3253 (21.8)	1580 (21.1)	1673 (22.4)	
	Associate degree	1112 (7.4)	634 (8.5)	478 (6.4)	
	Bachelor's degree	2300 (15.4)	1500 (20.1)	800 (10.7)	
	Master's degree	946 (6.3)	658 (8.8)	288 (3.9)	
	Doctorate or Professional degree	274 (1.8)	181 (2.4)	93 (1.2)	
	Unknown	224 (1.5)	102 (1.4)	122 (1.6)	
	Maternal BMI (mean (SD))		30.16 (15.59)	28.91 (14.00)	
Maternal Height (mean (SD))		64.40 (4.24)	64.44 (4.18)	64.36 (4.29)	0.25
Pre-Pregnancy Weight (mean (SD))		189.55 (159.79)	178.69 (140.07)	200.41 (176.67)	<0.001
Delivery Weight (mean (SD))		210.45 (140.75)	202.75 (120.37)	218.15 (158.17)	<0.001
Weight Gained (mean (SD))		31.68 (22.47)	32.76 (20.00)	30.60 (24.65)	<0.001

Cont.

Maternal Marriage Status (%)	Married	7178 (48.0)	4510 (60.3)	2668 (35.7)	<0.001		
	Unmarried	7159 (47.9)	2967 (39.7)	4192 (56.1)			
	Unknown	617 (4.1)	0 (0.0)	617 (8.3)			
Maternal Place of birth (%)	Born in US	12044 (80.5)	5780 (77.3)	6264 (83.8)	<0.001		
	Not born in US	2860 (19.1)	1686 (22.5)	1174 (15.7)			
	Unknown	50 (0.3)	11 (0.1)	39 (0.5)			
Maternal Residency (%)	Resident	10099 (67.5)	5291 (70.8)	4808 (64.3)	<0.001		
	Interstate Non-res	490 (3.3)	173 (2.3)	317 (4.2)			
	Intrastate Non-res	4365 (29.2)	2013 (26.9)	2352 (31.5)			
WIC (%)	No	8238 (55.1)	4441 (59.4)	3797 (50.8)	<0.001		
	Yes	6482 (43.3)	2935 (39.3)	3547 (47.4)			
	Unknown	234 (1.6)	101 (1.4)	133 (1.8)			
Breast Fed (%)	Yes	9602 (64.2)	5311 (71.0)	4291 (57.4)	<0.001		
	No	3471 (23.2)	1160 (15.5)	2311 (30.9)			
	Unknown	1881 (12.6)	1006 (13.5)	875 (11.7)			
Start Prenatal Care (%)	1st Trimester	10378 (69.4)	5658 (75.7)	4720 (63.1)	<0.001		
	2nd Trimester	2696 (18.0)	1195 (16.0)	1501 (20.1)			
	3rd Trimester	692 (4.6)	310 (4.1)	382 (5.1)			
	No prenatal care	561 (3.8)	113 (1.5)	448 (6.0)			
	Unknown	627 (4.2)	201 (2.7)	426 (5.7)			
Prenatal Visits (%)	1-2	340 (2.3)	81 (1.1)	259 (3.5)	<0.001		
	3-4	874 (5.8)	162 (2.2)	712 (9.5)			
	5-6	1281 (8.6)	355 (4.7)	926 (12.4)			
	7-8	1630 (10.9)	672 (9.0)	958 (12.8)			
	9-10	2822 (18.9)	1546 (20.7)	1276 (17.1)			
	11-12	2985 (20.0)	1898 (25.4)	1087 (14.5)			
	13-14	1985 (13.3)	1318 (17.6)	667 (8.9)			
	15-16	1054 (7.0)	684 (9.1)	370 (4.9)			
	17-18	300 (2.0)	185 (2.5)	115 (1.5)			
	19+	520 (3.5)	262 (3.5)	258 (3.5)			
	None	561 (3.8)	113 (1.5)	448 (6.0)			
	Unknown	602 (4.0)	201 (2.7)	401 (5.4)			
	Payer (%)	Private Ins	6069 (40.6)	3718 (49.7)		2351 (31.4)	<0.001
		Medicaid	7663 (51.2)	3130 (41.9)		4533 (60.6)	
		Self-pay	562 (3.8)	280 (3.7)		282 (3.8)	
Other		554 (3.7)	305 (4.1)	249 (3.3)			
Unknown		106 (0.7)	44 (0.6)	62 (0.8)			
Prior Births Living (mean (SD))		1.58 (5.71)	1.40 (5.22)	1.76 (6.16)	<0.001		
Prior Births Dead (mean (SD))		0.51 (6.90)	0.44 (6.46)	0.58 (7.31)	0.215		
Prior Termination/ Fetal Deaths (mean (SD))		1.03 (7.34)	0.97 (7.42)	1.09 (7.26)	0.339		
Paternity Acknowledged (%)	No	2481 (16.6)	813 (10.9)	1668 (22.3)	<0.001		
	Yes	4635 (31.0)	2146 (28.7)	2489 (33.3)			
	Not Applicable	7795 (52.1)	4510 (60.3)	3285 (43.9)			
	Unknown	43 (0.3)	8 (0.1)	35 (0.5)			
Paternal Age (%)	< 15	3 (0.0)	1 (0.0)	2 (0.0)	<0.001		
	15-19	337 (2.3)	142 (1.9)	195 (2.6)			
	20-24	1890 (12.6)	843 (11.3)	1047 (14.0)			
	25-29	2977 (19.9)	1590 (21.3)	1387 (18.6)			
	30-34	3275 (21.9)	1935 (25.9)	1340 (17.9)		Cont.	

	35-39	2235 (14.9)	1324 (17.7)	911 (12.2)	
	40-44	951 (6.4)	512 (6.8)	439 (5.9)	
	45-49	361 (2.4)	180 (2.4)	181 (2.4)	
	50-54	128 (0.9)	54 (0.7)	74 (1.0)	
	55+	68 (0.5)	26 (0.3)	42 (0.6)	
Paternal Race (%)	Unknown	2729 (18.2)	870 (11.6)	1859 (24.9)	<0.001
	Hispanic	2596 (17.4)	1460 (19.5)	1136 (15.2)	
	Non-Hisp AIAN	93 (0.6)	48 (0.6)	45 (0.6)	
	Non-Hisp Asian	664 (4.4)	415 (5.6)	249 (3.3)	
	Non-Hisp Black	2337 (15.6)	889 (11.9)	1448 (19.4)	
	Non-Hisp More than one race	250 (1.7)	121 (1.6)	129 (1.7)	
	Non-Hisp NHOPI	40 (0.3)	23 (0.3)	17 (0.2)	
	Non-Hisp White	5912 (39.5)	3488 (46.6)	2424 (32.4)	
	Unknown	3062 (20.5)	1033 (13.8)	2029 (27.1)	
	Paternal Education (%)	< 9th grade	480 (3.2)	231 (3.1)	
9-12 grade		1379 (9.2)	588 (7.9)	791 (10.6)	
HS Grad/GED		4023 (26.9)	1885 (25.2)	2138 (28.6)	
Some college		2290 (15.3)	1244 (16.6)	1046 (14.0)	
Associate degree		808 (5.4)	508 (6.8)	300 (4.0)	
Bachelor's degree		1889 (12.6)	1285 (17.2)	604 (8.1)	
Master's degree		696 (4.7)	497 (6.6)	199 (2.7)	
Doctorate or Professional degree		289 (1.9)	204 (2.7)	85 (1.1)	
Unknown		3100 (20.7)	1035 (13.8)	2065 (27.6)	

Table 3.A2: Raw dataset by medical risk factors

	Level	Overall	Survived		X <sup>2</sup> p
			Yes	No	
n		14954	7477	7477	
Pre-pregnancy Smoking (%)	Nonsmoker	12671 (84.7)	6734 (90.1)	5937 (79.4)	<0.001
	1-5	560 (3.7)	188 (2.5)	372 (5.0)	
	6-10	724 (4.8)	238 (3.2)	486 (6.5)	
	11-20	742 (5.0)	247 (3.3)	495 (6.6)	
	21-40	122 (0.8)	34 (0.5)	88 (1.2)	
	41+	13 (0.1)	4 (0.1)	9 (0.1)	
	Unknown	122 (0.8)	32 (0.4)	90 (1.2)	
	1st Trimester Smoking (%)	Nonsmoker	13111 (87.7)	6916 (92.5)	
1-5		554 (3.7)	171 (2.3)	383 (5.1)	
6-10		671 (4.5)	214 (2.9)	457 (6.1)	
11-20		435 (2.9)	127 (1.7)	308 (4.1)	
21-40		51 (0.3)	13 (0.2)	38 (0.5)	
41+		5 (0.0)	1 (0.0)	4 (0.1)	
Unknown		127 (0.8)	35 (0.5)	92 (1.2)	
2nd Trimester Smoking (%)		Nonsmoker	13294 (88.9)	6999 (93.6)	6295 (84.2)
	1-5	606 (4.1)	177 (2.4)	429 (5.7)	
	6-10	632 (4.2)	182 (2.4)	450 (6.0)	

Cont.

	11-20	261 (1.7)	72 (1.0)	189 (2.5)	
	21-40	31 (0.2)	11 (0.1)	20 (0.3)	
	41+	4 (0.0)	0 (0.0)	4 (0.1)	
	Unknown	126 (0.8)	36 (0.5)	90 (1.2)	
3rd Trimester Smoking (%)	Nonsmoker	13400 (89.6)	7029 (94.0)	6371 (85.2)	<0.001
	1-5	642 (4.3)	182 (2.4)	460 (6.2)	
	6-10	544 (3.6)	166 (2.2)	378 (5.1)	
	11-20	212 (1.4)	60 (0.8)	152 (2.0)	
	21-40	23 (0.2)	6 (0.1)	17 (0.2)	
	41+	5 (0.0)	0 (0.0)	5 (0.1)	
	Unknown	128 (0.9)	34 (0.5)	94 (1.3)	
Pre-pregnancy Diabetes (%)	No	14737 (98.5)	7427 (99.3)	7310 (97.8)	<0.001
	Yes	198 (1.3)	44 (0.6)	154 (2.1)	
	Unknown	19 (0.1)	6 (0.1)	13 (0.2)	
Gestational Diabetes (%)	No	14107 (94.3)	7014 (93.8)	7093 (94.9)	0.003
	Yes	828 (5.5)	457 (6.1)	371 (5.0)	
	Unknown	19 (0.1)	6 (0.1)	13 (0.2)	
Pre-pregnancy Hypertension (%)	No	13843 (92.6)	7044 (94.2)	6799 (90.9)	<0.001
	Yes	1092 (7.3)	427 (5.7)	665 (8.9)	
	Unknown	19 (0.1)	6 (0.1)	13 (0.2)	
Gestational Hypertension (%)	No	13843 (92.6)	7044 (94.2)	6799 (90.9)	<0.001
	Yes	1092 (7.3)	427 (5.7)	665 (8.9)	
	Unknown	19 (0.1)	6 (0.1)	13 (0.2)	
Hypertension Eclampsia (%)	No	14876 (99.5)	7455 (99.7)	7421 (99.3)	0.001
	Yes	59 (0.4)	16 (0.2)	43 (0.6)	
	Unknown	19 (0.1)	6 (0.1)	13 (0.2)	
Previous Pre-term Birth (%)	No	14145 (94.6)	7250 (97.0)	6895 (92.2)	<0.001
	Yes	790 (5.3)	221 (3.0)	569 (7.6)	
	Unknown	19 (0.1)	6 (0.1)	13 (0.2)	
Infertility Treatment (%)	No	14671 (98.1)	7363 (98.5)	7308 (97.7)	0.003
	Yes	264 (1.8)	108 (1.4)	156 (2.1)	
	Unknown	19 (0.1)	6 (0.1)	13 (0.2)	
Fertility Enhancing Drugs (%)	No	129 (0.9)	49 (0.7)	80 (1.1)	0.007
	Yes	123 (0.8)	54 (0.7)	69 (0.9)	
	Not Applicable	14671 (98.1)	7363 (98.5)	7308 (97.7)	
	Unknown	31 (0.2)	11 (0.1)	20 (0.3)	
Asst. Reproductive Tech (%)	No	100 (0.7)	41 (0.5)	59 (0.8)	0.011
	Yes	152 (1.0)	62 (0.8)	90 (1.2)	
	Not Applicable	14671 (98.1)	7363 (98.5)	7308 (97.7)	
	Unknown	31 (0.2)	11 (0.1)	20 (0.3)	

Cont.

Previous Cesareans (mean (SD))		0.42 (4.31)	0.31 (3.28)	0.52 (5.14)	0.003
Gonorrhea (%)	No	14827 (99.2)	7442 (99.5)	7385 (98.8)	<0.001
	Yes	72 (0.5)	22 (0.3)	50 (0.7)	
	Unknown	55 (0.4)	13 (0.2)	42 (0.6)	
Chlamydia (%)	No	14515 (97.1)	7336 (98.1)	7179 (96.0)	<0.001
	Yes	384 (2.6)	128 (1.7)	256 (3.4)	
	Unknown	55 (0.4)	13 (0.2)	42 (0.6)	
Syphilis (%)	No	14874 (99.5)	7456 (99.7)	7418 (99.2)	<0.001
	Yes	25 (0.2)	8 (0.1)	17 (0.2)	
	Unknown	55 (0.4)	13 (0.2)	42 (0.6)	
Hepatitis C (%)	No	14774 (98.8)	7437 (99.5)	7337 (98.1)	<0.001
	Yes	125 (0.8)	27 (0.4)	98 (1.3)	
	Unknown	55 (0.4)	13 (0.2)	42 (0.6)	
Hepatitis B (%)	No	14871 (99.4)	7451 (99.7)	7420 (99.2)	<0.001
	Yes	28 (0.2)	13 (0.2)	15 (0.2)	
	Unknown	55 (0.4)	13 (0.2)	42 (0.6)	

Table 3.A3: Raw dataset by labor and delivery information

	Level	Overall	Survived		X <sup>2</sup> p
			Yes	No	
n		14954	7477	7477	
Birthing Facility (%)	Hospital	14742 (98.6)	7362 (98.5)	7380 (98.7)	0.24
	Not Hospital	212 (1.4)	115 (1.5)	97 (1.3)	
Live Birth Order (mean (SD))		2.31 (1.49)	2.17 (1.36)	2.45 (1.59)	<0.001
Total Pregnancy Order (mean (SD))		2.78 (1.83)	2.58 (1.69)	2.98 (1.95)	<0.001
Interval Last Live Birth (%)	1st live birth	5327 (35.6)	2815 (37.6)	2512 (33.6)	<0.001
	0-3 months	413 (2.8)	104 (1.4)	309 (4.1)	
	4-11 months	264 (1.8)	70 (0.9)	194 (2.6)	
	12-17 months	947 (6.3)	349 (4.7)	598 (8.0)	
	18-23 months	1135 (7.6)	552 (7.4)	583 (7.8)	
	24-35 months	1869 (12.5)	997 (13.3)	872 (11.7)	
	36-47 months	1223 (8.2)	692 (9.3)	531 (7.1)	
	48-59 months	789 (5.3)	412 (5.5)	377 (5.0)	
	60-71 months	572 (3.8)	295 (3.9)	277 (3.7)	
	72+ months	1792 (12.0)	905 (12.1)	887 (11.9)	
	Unknown	623 (4.2)	286 (3.8)	337 (4.5)	
Interval Last Other Outcome (%)	1st live birth	10543 (70.5)	5459 (73.0)	5084 (68.0)	<0.001
	0-3 months	9 (0.1)	1 (0.0)	8 (0.1)	
	4-11 months	383 (2.6)	167 (2.2)	216 (2.9)	

	12-17 months	478 (3.2)	250 (3.3)	228 (3.0)	
	18-23 months	230 (1.5)	101 (1.4)	129 (1.7)	
	24-35 months	352 (2.4)	153 (2.0)	199 (2.7)	
	36-47 months	284 (1.9)	139 (1.9)	145 (1.9)	
	48-59 months	180 (1.2)	87 (1.2)	93 (1.2)	
	60-71 months	150 (1.0)	75 (1.0)	75 (1.0)	
	72+ months	604 (4.0)	286 (3.8)	318 (4.3)	
	Unknown	1741 (11.6)	759 (10.2)	982 (13.1)	
Interval Since Last Pregnancy (%)	1st live birth	4294 (28.7)	2315 (31.0)	1979 (26.5)	<0.001
	0-3 months	350 (2.3)	94 (1.3)	256 (3.4)	
	4-11 months	577 (3.9)	222 (3.0)	355 (4.7)	
	12-17 months	1283 (8.6)	550 (7.4)	733 (9.8)	
	18-23 months	1152 (7.7)	552 (7.4)	600 (8.0)	
	24-35 months	1720 (11.5)	914 (12.2)	806 (10.8)	
	36-47 months	1067 (7.1)	613 (8.2)	454 (6.1)	
	48-59 months	647 (4.3)	348 (4.7)	299 (4.0)	
	60-71 months	451 (3.0)	236 (3.2)	215 (2.9)	
	72+ months	1297 (8.7)	694 (9.3)	603 (8.1)	
	Unknown	2116 (14.2)	939 (12.6)	1177 (15.7)	
Induction of Labor (%)	No	11759 (78.6)	5623 (75.2)	6136 (82.1)	<0.001
	Yes	3188 (21.3)	1851 (24.8)	1337 (17.9)	
	Unknown	7 (0.0)	3 (0.0)	4 (0.1)	
Augmentation of Labor (%)	No	12273 (82.1)	5803 (77.6)	6470 (86.5)	<0.001
	Yes	2674 (17.9)	1671 (22.3)	1003 (13.4)	
	Unknown	7 (0.0)	3 (0.0)	4 (0.1)	
Steroids (%)	No	13420 (89.7)	7295 (97.6)	6125 (81.9)	<0.001
	Yes	1527 (10.2)	179 (2.4)	1348 (18.0)	
	Unknown	7 (0.0)	3 (0.0)	4 (0.1)	
Antibiotics (%)		10693 (71.5)	5642 (75.5)	5051 (67.6)	<0.001
	Yes	4254 (28.4)	1832 (24.5)	2422 (32.4)	
	Unknown	7 (0.0)	3 (0.0)	4 (0.1)	
Chorioamnionitis (%)	No	14709 (98.4)	7367 (98.5)	7342 (98.2)	0.272
	Yes	238 (1.6)	107 (1.4)	131 (1.8)	
	Unknown	7 (0.0)	3 (0.0)	4 (0.1)	
Anesthesia (%)	No	4094 (27.4)	1883 (25.2)	2211 (29.6)	<0.001
	Yes	10853 (72.6)	5591 (74.8)	5262 (70.4)	
	Unknown	7 (0.0)	3 (0.0)	4 (0.1)	
Presentation (%)	Cephalic	13265 (88.7)	7059 (94.4)	6206 (83.0)	<0.001
	Breech	1351 (9.0)	285 (3.8)	1066 (14.3)	
	Other	248 (1.7)	97 (1.3)	151 (2.0)	
	Unknown	90 (0.6)	36 (0.5)	54 (0.7)	

Cont.

Delivery Rout (%)	Spontaneous	8614 (57.6)	4923 (65.8)	3691 (49.4)	<0.001
	Cesarean	5957 (39.8)	2322 (31.1)	3635 (48.6)	
	Vacuum	300 (2.0)	181 (2.4)	119 (1.6)	
	Forceps	71 (0.5)	46 (0.6)	25 (0.3)	
	Unknown	12 (0.1)	5 (0.1)	7 (0.1)	
Trial of Labor Attempted (%)	No	4644 (31.1)	1702 (22.8)	2942 (39.3)	<0.001
	Yes	1227 (8.2)	596 (8.0)	631 (8.4)	
	Not applicable	8985 (60.1)	5150 (68.9)	3835 (51.3)	
	Unknown	98 (0.7)	29 (0.4)	69 (0.9)	
Successful External Cephalic Version (%)	No	14915 (99.7)	7458 (99.7)	7457 (99.7)	0.281
	Yes	26 (0.2)	15 (0.2)	11 (0.1)	
	Unknown	13 (0.1)	4 (0.1)	9 (0.1)	
Failed External Cephalic Version (%)	No	14912 (99.7)	7461 (99.8)	7451 (99.7)	0.248
	Yes	29 (0.2)	12 (0.2)	17 (0.2)	
	Unknown	13 (0.1)	4 (0.1)	9 (0.1)	
Delivery Method (%)	Vaginal	8985 (60.1)	5150 (68.9)	3835 (51.3)	<0.001
	C-Sect	5957 (39.8)	2322 (31.1)	3635 (48.6)	
	Unknown	12 (0.1)	5 (0.1)	7 (0.1)	
Maternal Transfusion (%)	No	14835 (99.2)	7434 (99.4)	7401 (99.0)	0.003
	Yes	107 (0.7)	36 (0.5)	71 (0.9)	
	Unknown	12 (0.1)	7 (0.1)	5 (0.1)	
Perineal Laceration (%)	No	14853 (99.3)	7402 (99.0)	7451 (99.7)	<0.001
	Yes	89 (0.6)	68 (0.9)	21 (0.3)	
	Unknown	12 (0.1)	7 (0.1)	5 (0.1)	
Ruptured Uterus (%)	No	14927 (99.8)	7469 (99.9)	7458 (99.7)	0.003
	Yes	15 (0.1)	1 (0.0)	14 (0.2)	
	Unknown	12 (0.1)	7 (0.1)	5 (0.1)	
Unplanned Hysterectomy (%)	No	14926 (99.8)	7468 (99.9)	7458 (99.7)	0.009
	Yes	16 (0.1)	2 (0.0)	14 (0.2)	
	Unknown	12 (0.1)	7 (0.1)	5 (0.1)	
Admit ICU (%)	No	14858 (99.4)	7458 (99.7)	7400 (99.0)	<0.001
	Yes	84 (0.6)	12 (0.2)	72 (1.0)	
	Unknown	12 (0.1)	7 (0.1)	5 (0.1)	
Attending (%)	Dr of Med	12528 (83.8)	6081 (81.3)	6447 (86.2)	<0.001
	Dr of Osteo	1112 (7.4)	582 (7.8)	530 (7.1)	
	Cert Nurse	1053 (7.0)	676 (9.0)	377 (5.0)	
	Midwife	89 (0.6)	65 (0.9)	24 (0.3)	
	Other Midwife	160 (1.1)	71 (0.9)	89 (1.2)	
	Unknown	12 (0.1)	2 (0.0)	10 (0.1)	
Mother Transferred (%)	No	14567 (97.4)	7429 (99.4)	7138 (95.5)	<0.001
	Yes	371 (2.5)	42 (0.6)	329 (4.4)	Cont.

	Unknown	16 (0.1)	6 (0.1)	10 (0.1)			
Infant Transferred (%)	No	14004 (93.6)	7402 (99.0)	6602 (88.3)	<0.001		
	Yes	939 (6.3)	69 (0.9)	870 (11.6)			
	Unknown	11 (0.1)	6 (0.1)	5 (0.1)			
Apgar 5 Minutes (%)	0-3	692 (4.6)	24 (0.3)	668 (8.9)	<0.001		
	4-6	1211 (8.1)	95 (1.3)	1116 (14.9)			
	7-8	2840 (19.0)	874 (11.7)	1966 (26.3)			
	9-10	10070 (67.3)	6453 (86.3)	3617 (48.4)			
	Unknown	141 (0.9)	31 (0.4)	110 (1.5)			
Plural (%)	Single	13924 (93.1)	7217 (96.5)	6707 (89.7)	<0.001		
	Twin	966 (6.5)	251 (3.4)	715 (9.6)			
	Triplet	59 (0.4)	7 (0.1)	52 (0.7)			
	Quadruplet	4 (0.0)	2 (0.0)	2 (0.0)			
	Quintuplet+	1 (0.0)	0 (0.0)	1 (0.0)			
	Unknown	13925 (93.1)	7217 (96.5)	6708 (89.7)			
Set Order (%)	1st	497 (3.3)	124 (1.7)	373 (5.0)	<0.001		
	2nd	509 (3.4)	133 (1.8)	376 (5.0)			
	3rd	23 (0.2)	3 (0.0)	20 (0.3)			
	Unknown	13925 (93.1)	7217 (96.5)	6708 (89.7)			
Sex (%)	Female	7032 (47.0)	3690 (49.4)	3342 (44.7)	<0.001		
	Male	7922 (53.0)	3787 (50.6)	4135 (55.3)			
Gestation Age (%)	< 20 weeks	2 (0.0)	1 (0.0)	1 (0.0)	<0.001		
	20-27 weeks	1842 (12.3)	33 (0.4)	1809 (24.2)			
	28-31 weeks	591 (4.0)	77 (1.0)	514 (6.9)			
	32-33 weeks	390 (2.6)	81 (1.1)	309 (4.1)			
	34-36 weeks	1488 (10.0)	541 (7.2)	947 (12.7)			
	37-38 weeks	3553 (23.8)	1878 (25.1)	1675 (22.4)			
	39 weeks	4186 (28.0)	2781 (37.2)	1405 (18.8)			
	40 weeks	2148 (14.4)	1525 (20.4)	623 (8.3)			
	41 weeks	689 (4.6)	525 (7.0)	164 (2.2)			
	42+ weeks	46 (0.3)	31 (0.4)	15 (0.2)			
	Unknown	19 (0.1)	4 (0.1)	15 (0.2)			
	Birth Weight (%)	227-1499 grams	2407 (16.1)	97 (1.3)		2310 (30.9)	<0.001
		1500-2499 grams	1805 (12.1)	476 (6.4)		1329 (17.8)	
2500-8165 grams		10733 (71.8)	6903 (92.3)	3830 (51.2)			
Unknown		9 (0.1)	1 (0.0)	8 (0.1)			
Unknown		9 (0.1)	1 (0.0)	8 (0.1)			

Table 3.A4: Raw dataset by infant abnormalities

n	Level	Overall	Survived		X <sup>2</sup> p
			Yes	No	
		14954	7477	7477	
Assisted Ventilation (%)	No	12598 (84.2)	7216 (96.5)	5382 (72.0)	<0.001
	Yes	2351 (15.7)	259 (3.5)	2092 (28.0)	
	Unknown	5 (0.0)	2 (0.0)	3 (0.0)	
Assisted Ventilation > 6 hours (%)	No	13639 (91.2)	7390 (98.8)	6249 (83.6)	<0.001
	Yes	1310 (8.8)	85 (1.1)	1225 (16.4)	
	Unknown	5 (0.0)	2 (0.0)	3 (0.0)	
Admit NICU (%)	No	10478 (70.1)	6864 (91.8)	3614 (48.3)	<0.001
	Yes	4471 (29.9)	611 (8.2)	3860 (51.6)	
	Unknown	5 (0.0)	2 (0.0)	3 (0.0)	
Surfactant (%)	No	14188 (94.9)	7448 (99.6)	6740 (90.1)	<0.001
	Yes	761 (5.1)	27 (0.4)	734 (9.8)	
	Unknown	5 (0.0)	2 (0.0)	3 (0.0)	
Antibiotics (%)	No	13728 (91.8)	7306 (97.7)	6422 (85.9)	<0.001
	Yes	1221 (8.2)	169 (2.3)	1052 (14.1)	
	Unknown	5 (0.0)	2 (0.0)	3 (0.0)	
Seizures (%)	No	14871 (99.4)	7470 (99.9)	7401 (99.0)	<0.001
	Yes	78 (0.5)	5 (0.1)	73 (1.0)	
	Unknown	5 (0.0)	2 (0.0)	3 (0.0)	

Table 4.A1 Univariate Analysis of Predictors

	HR	95% LCL	95% UCL	X <sup>2</sup> p	
Maternal Race					<b>0.001</b>
Black	0.95	0.90	1.00	0.068	
AIAN	0.69	0.50	0.88	<0.001	
Asian	0.97	0.85	1.09	0.613	
NHOPI	0.89	0.47	1.31	0.575	
2+ Races	0.86	0.73	0.99	0.023	
Hispanic	1.01	0.95	1.07	0.729	
Unknown	1.03	0.80	1.25	0.829	
Maternal Education					<b>&lt;0.001</b>
9-12	0.87	0.74	1.00	0.042	
HS Grad/GED	0.90	0.78	1.03	0.12	
Some College	0.92	0.79	1.04	0.182	
Associate Degree	1.00	0.85	1.15	0.953	
Bachelor's Degree	1.11	0.97	1.25	0.147	Cont.

	Master's Degree	1.07	0.90	1.24	0.436	
	PhD/Professional	0.86	0.62	1.10	0.21	
	Unknown	0.91	0.70	1.13	0.411	
Maternal Age						<b>&lt; 0.001</b>
	15	0.61	-0.20	1.41	0.219	
	16	0.56	-0.18	1.29	0.12	
	17	0.63	-0.10	1.35	0.202	
	18	0.64	-0.06	1.35	0.223	
	19	0.65	-0.06	1.35	0.225	
	20-24	0.63	-0.06	1.33	0.199	
	25-29	0.64	-0.05	1.34	0.21	
	30-34	0.72	0.03	1.42	0.357	
	35-39	0.78	0.08	1.47	0.478	
	40-44	0.76	0.06	1.47	0.448	
	45-49	0.65	-0.18	1.47	0.297	
	50-54	1.33	0.01	2.66	0.67	
Marriage Status						<b>&lt;0.001</b>
	Unmarried	0.86	0.81	0.90	<0.001	
	Unknown	0.90	0.81	0.99	0.022	
Prenatal Care Start						<b>&lt;0.001</b>
	2nd Trimester	0.93	0.87	0.99	0.013	
	3rd Trimester	0.83	0.73	0.93	<0.001	
	No Prenatal Care	1.06	0.97	1.16	0.214	
	Unknown	1.13	1.03	1.23	0.016	
Prenatal Visits						<b>&lt;0.001</b>
	1-2	1.03	0.88	1.19	0.683	
	3-4	1.16	1.04	1.28	0.016	
	5-6	1.02	0.91	1.14	0.688	
	7-8	0.96	0.85	1.07	0.479	
	9-10	0.87	0.76	0.98	0.012	
	11-12	0.79	0.68	0.90	<0.001	
	13-14	0.83	0.71	0.95	0.002	
	15-16	0.89	0.75	1.03	0.096	
	17-18	0.79	0.59	1.00	0.025	
	19+	0.95	0.79	1.10	0.497	
	Unknown	1.06	0.93	1.20	0.387	
Sex						<b>0.525</b>
	Female	1.02	0.97	1.06		
Breast Fed						<b>&lt;0.001</b>
	No	1.11	1.05	1.16	<0.001	
	Unknown	1.16	1.08	1.23	<0.001	<i>Cont.</i>

Apgar 5 Minutes						<b>&lt;0.001</b>
	4-6	0.92	0.83	1.02	0.108	
	7-8	0.63	0.54	0.72	<0.001	
	9-10	0.49	0.40	0.57	<0.001	
	Unknown	0.75	0.55	0.95	0.005	
Gestation Age (Weeks)						<b>&lt;0.001</b>
	20-27	0.16	-1.80	2.12	0.065	
	28-31	0.12	-1.85	2.08	0.031	
	32-33	0.10	-1.87	2.06	0.019	
	34-36	0.09	-1.87	2.05	0.018	
	37-38	0.08	-1.88	2.04	0.012	
	39	0.08	-1.89	2.04	0.01	
	40	0.08	-1.88	2.04	0.011	
	41	0.08	-1.89	2.04	0.011	
	42+	0.12	-1.90	2.15	0.044	
	Unknown	0.16	-1.87	2.18	0.073	
Attending						<b>&lt;0.001</b>
	Dr. of Osteopathy	1.00	0.91	1.09	0.979	
	Certified Nurse					
	Midwife	0.81	0.70	0.91	<0.001	
	Other Midwife	0.67	0.27	1.07	0.053	
	Other	1.11	0.90	1.32	0.325	
	Unknown	0.78	0.16	1.40	0.428	
Birth Weight (grams)						<b>&lt;0.001</b>
	1500-2499	0.64	0.57	0.70	<0.001	
	2500-8165	0.55	0.49	0.60	<0.001	
	Unknown	1.73	1.04	2.43	0.121	
WIC						<b>&lt;0.001</b>
	Yes	0.89	0.85	0.94	<0.001	
	Unknown	1.00	0.83	1.18	0.985	
Payer						<b>&lt;0.001</b>
	Private Insurance	1.14	1.09	1.19	<0.001	
	Self-Pay	1.05	0.93	1.17	0.465	
	Other	0.99	0.86	1.12	0.854	
	Unknown	1.24	0.99	1.49	0.098	
Paternal Education						<b>&lt;0.001</b>
	9-12	0.97	0.82	1.11	0.638	
	HS Grad/GED	0.99	0.86	1.12	0.888	
	Some College	1.04	0.90	1.18	0.551	
	Associate Degree	1.14	0.97	1.31	0.133	
	Bachelor's Degree	1.22	1.08	1.37	0.007	
	Master's Degree	1.26	1.08	1.45	0.014	<i>Cont.</i>

	PhD/Professional	1.08	0.83	1.33	0.545
	Unknown	0.97	0.83	1.10	0.606
Risk Category					<b>&lt;0.001</b>
	High	1.42	1.38	1.47	

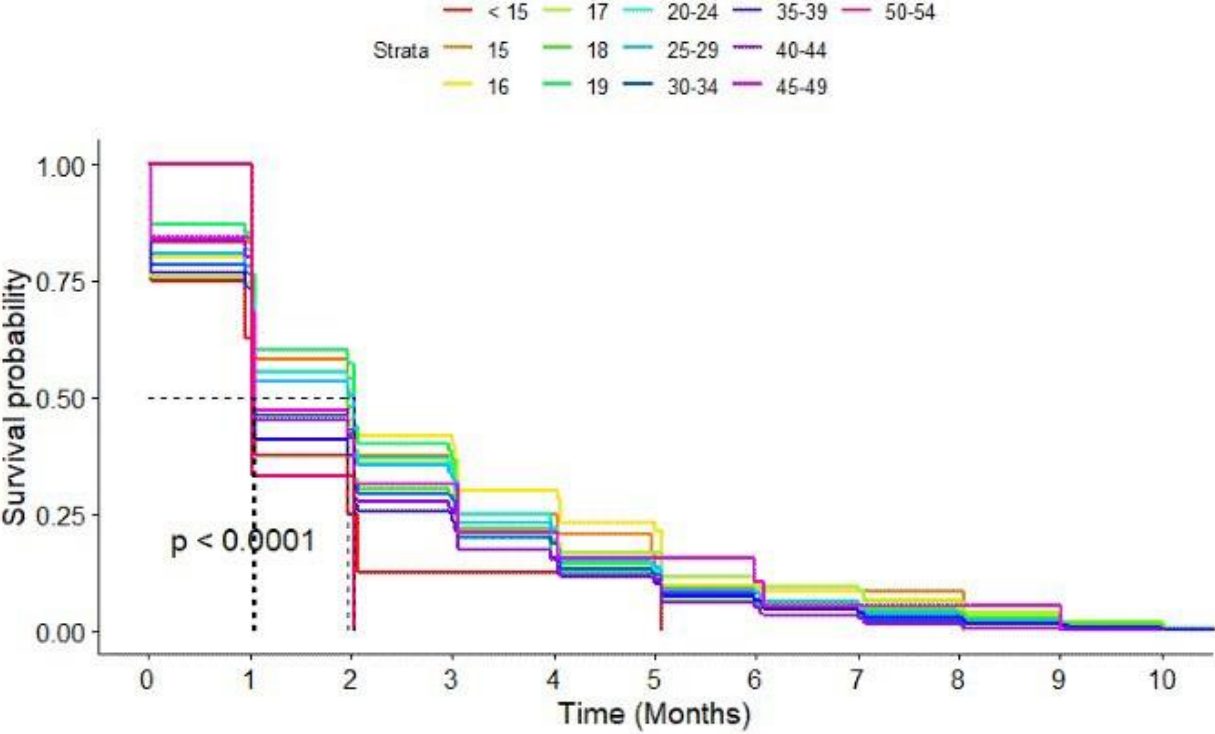


Figure 4.2.A1 Maternal Age Kaplan Meier Curve

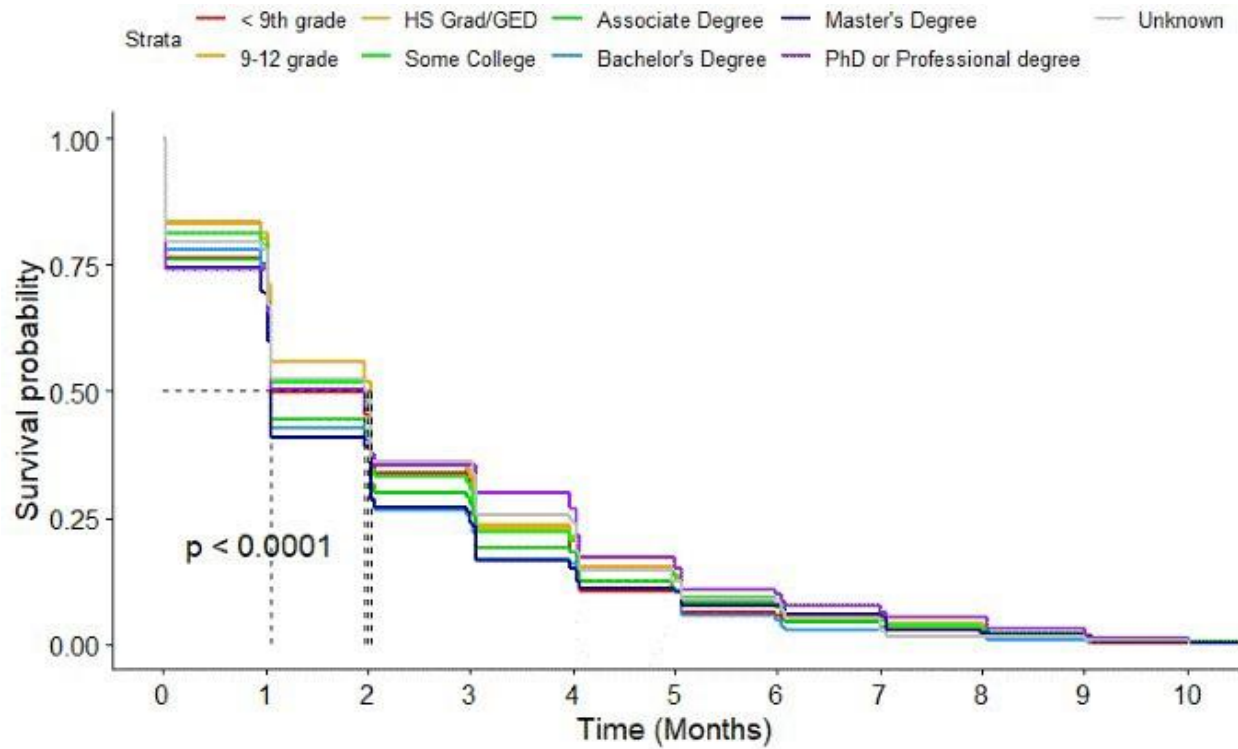


Figure 4.2.A2 Maternal Education Kaplan Meier Curve

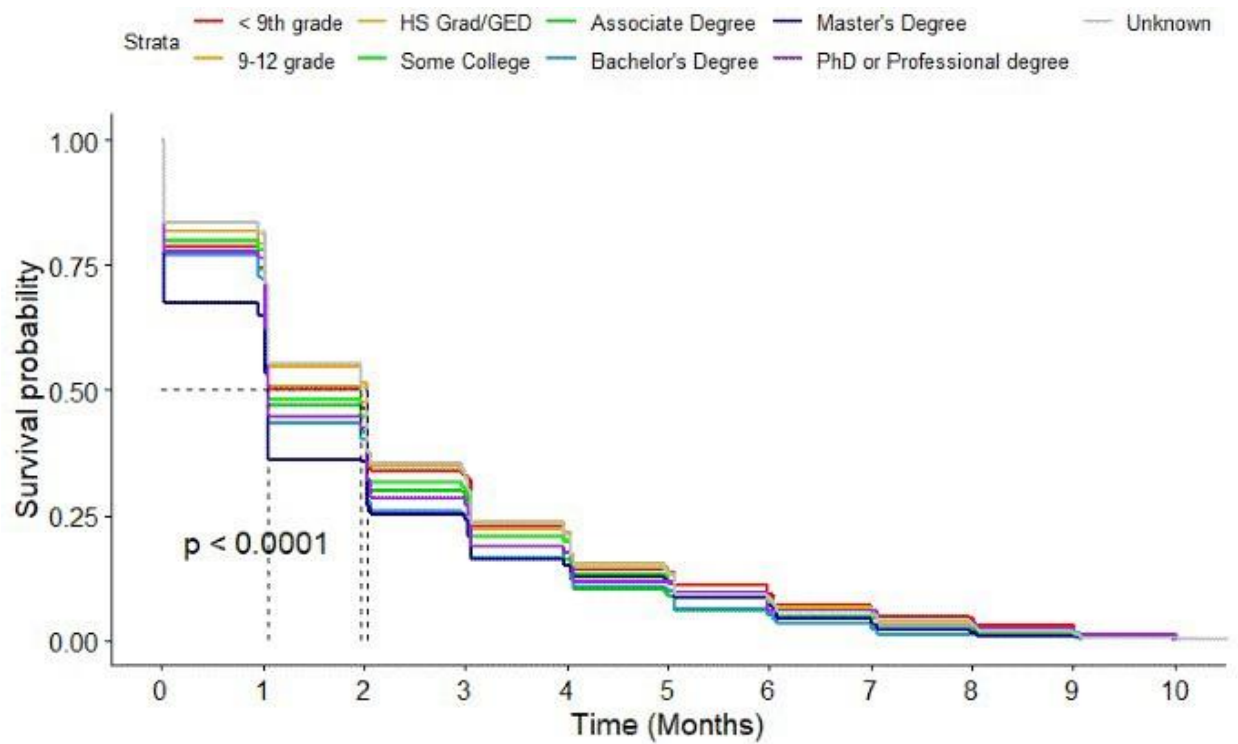


Figure 4.2.A3 Paternal Education Kaplan Meier Curve

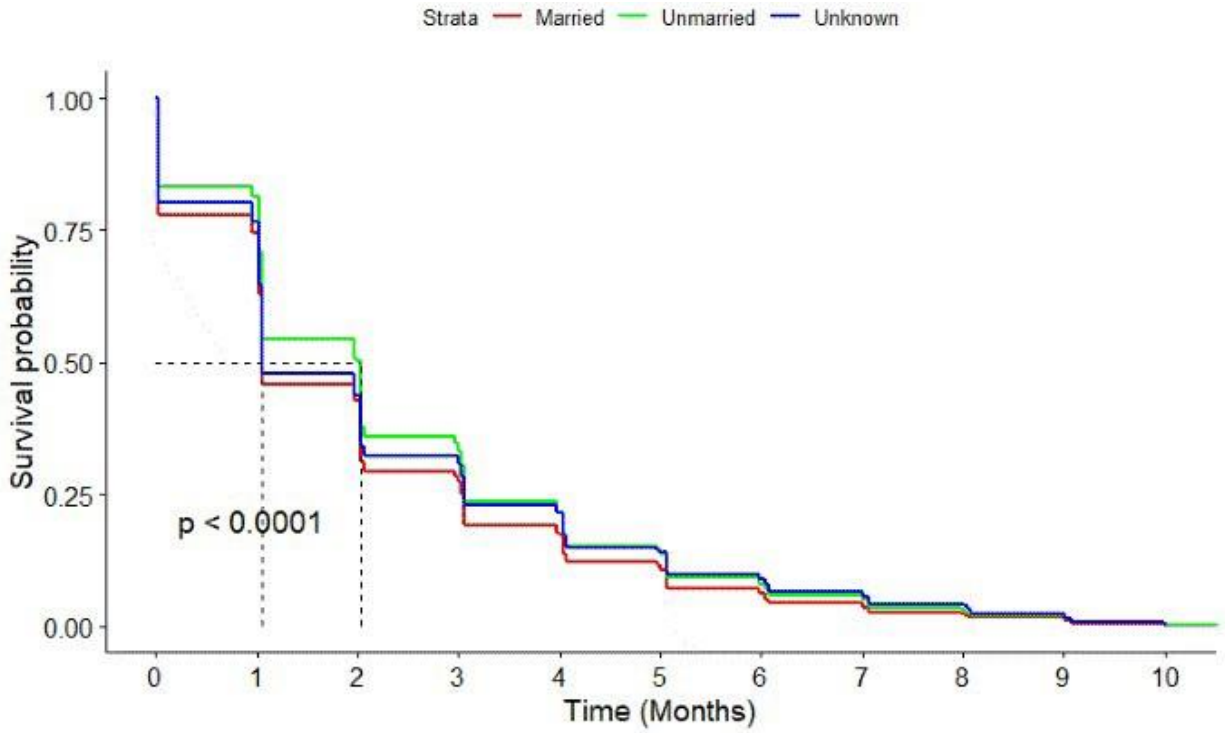


Figure 4.2.A4 Maternal Marriage Status Kaplan Meier Curve

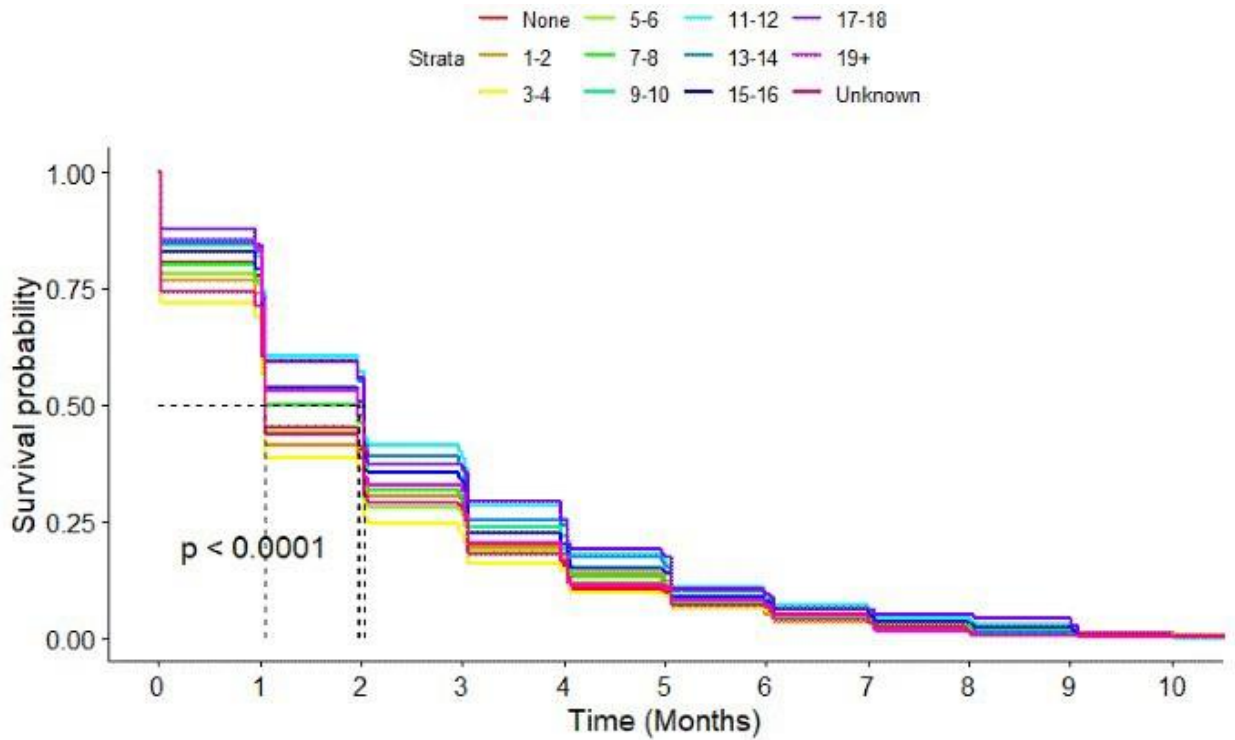


Figure 4.2.A5 Number of Prenatal Visits Kaplan Meier Curve

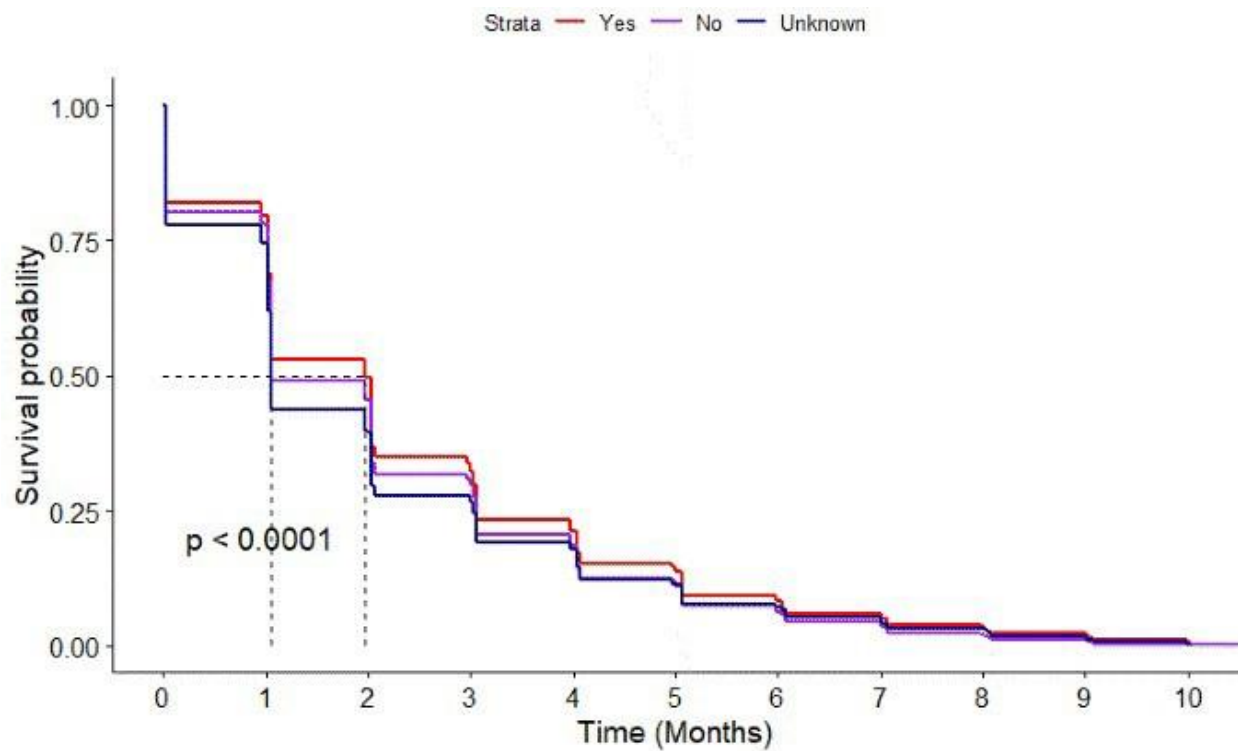


Figure 4.2.A7 WIC Benefits Status Kaplan Meier Curve

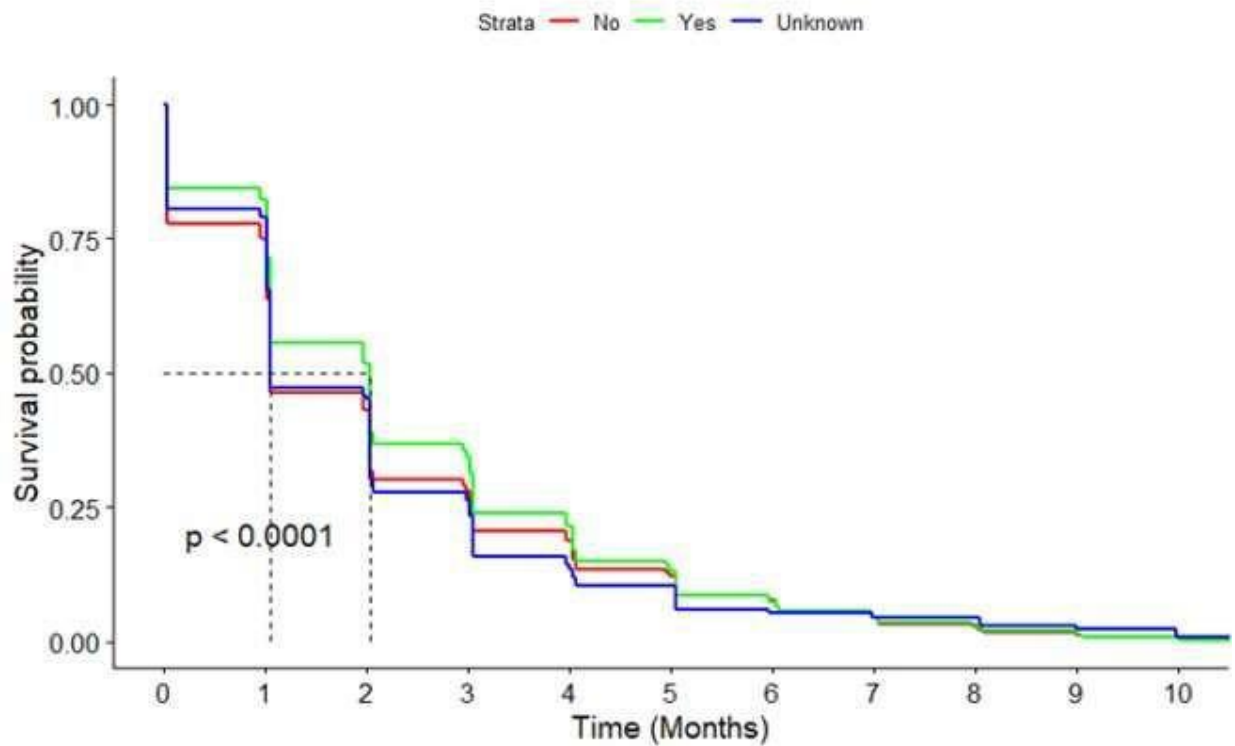


Figure 4.2.A6 Breast Feeding Status Kaplan Meier Curve

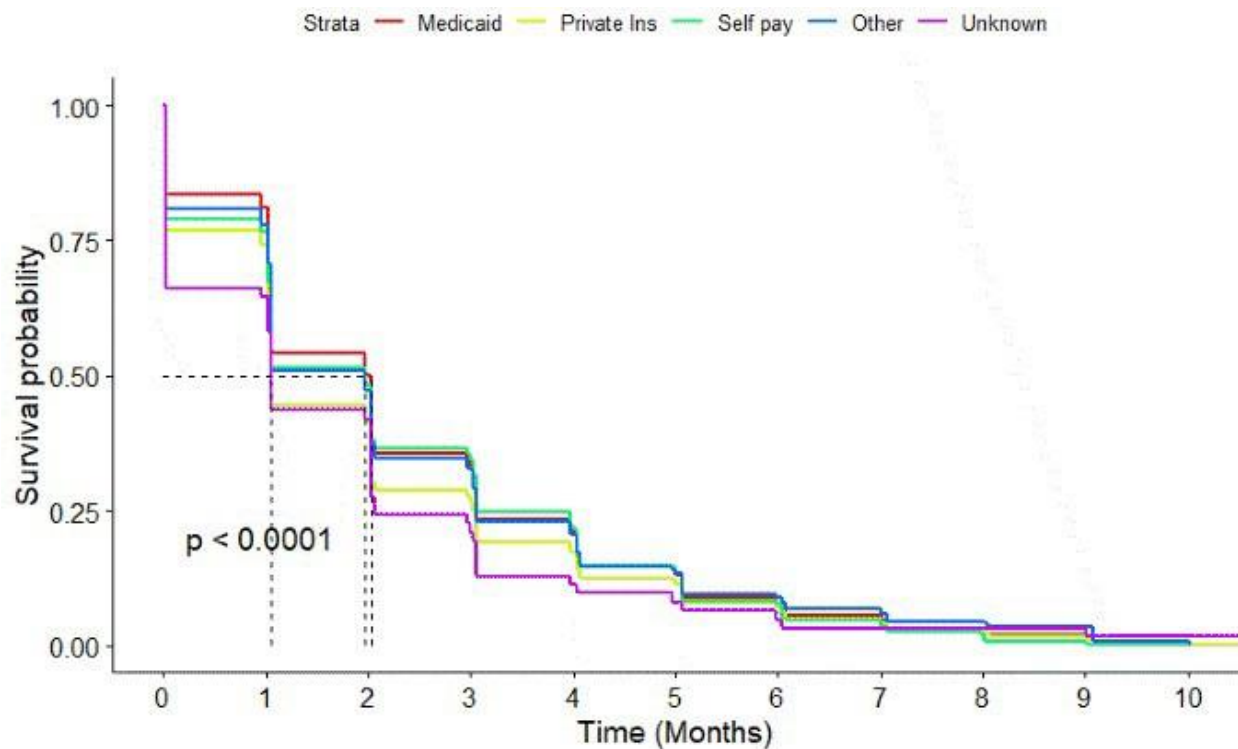


Figure 4.2.A8 Payer Kaplan Meier Curve

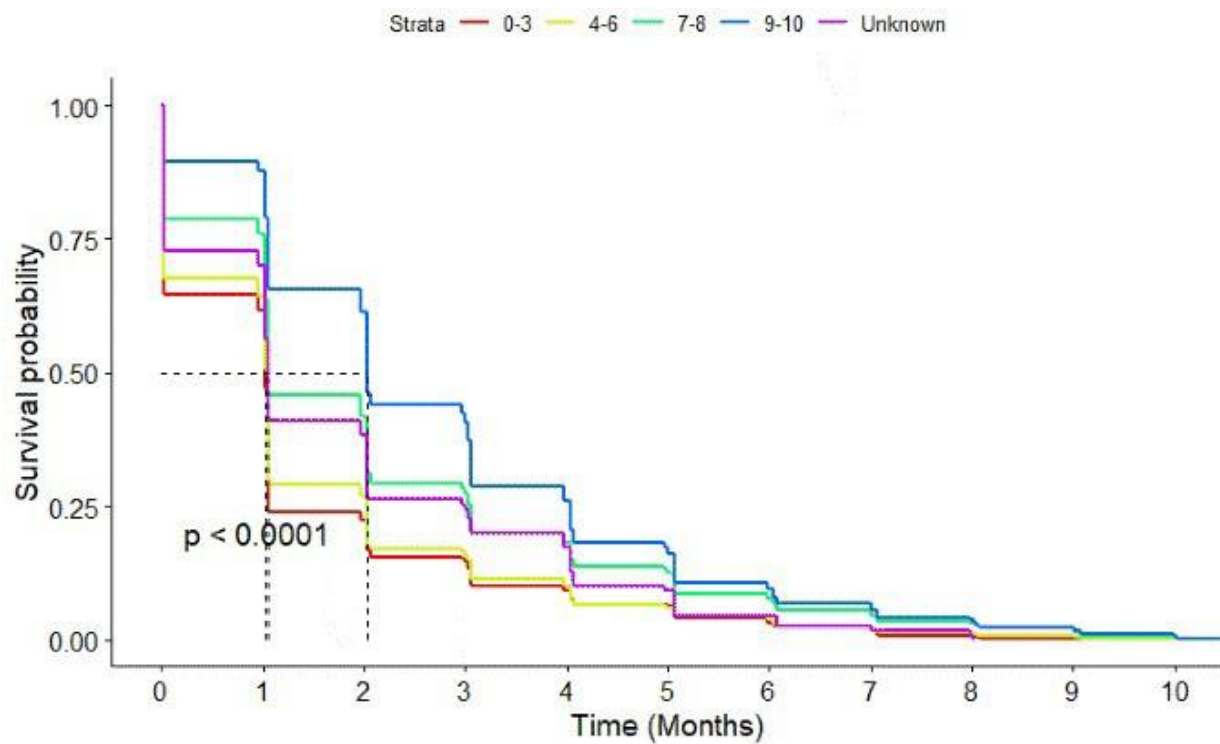


Figure 4.2.A9 5-Minute Apgar Score Kaplan Meier Curve

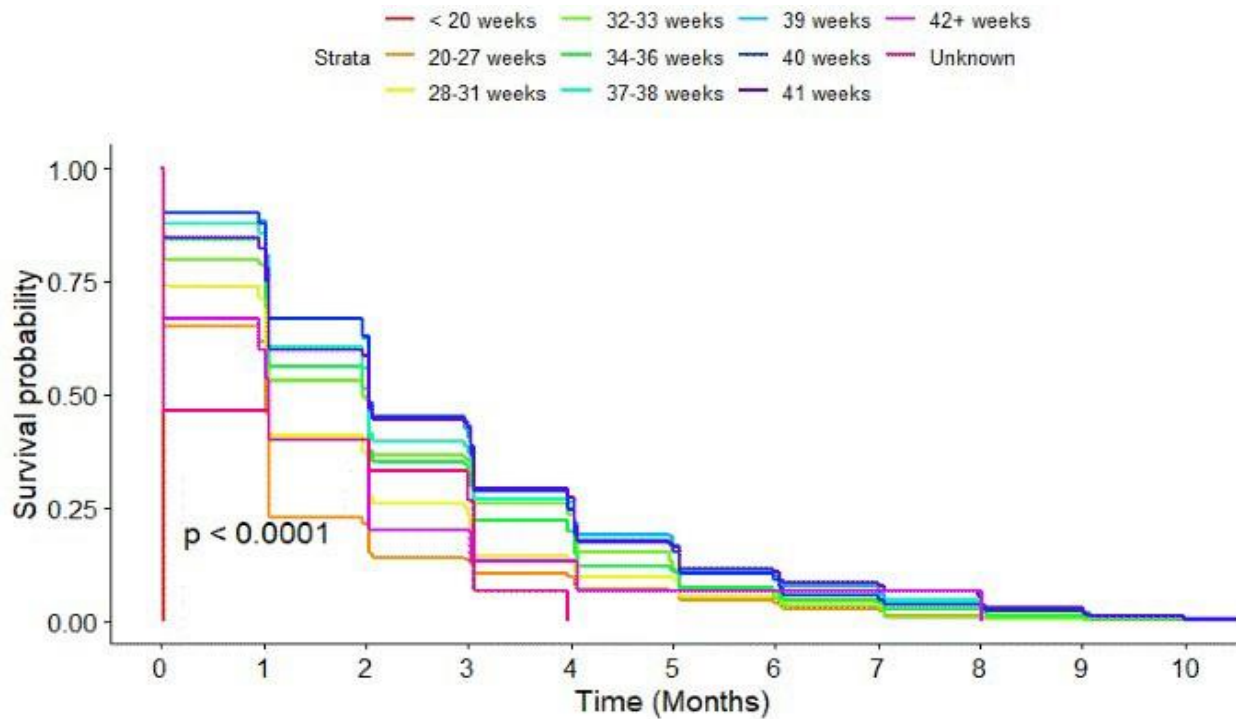


Figure 4.2.A10 Gestation Age Kaplan Meier Curve

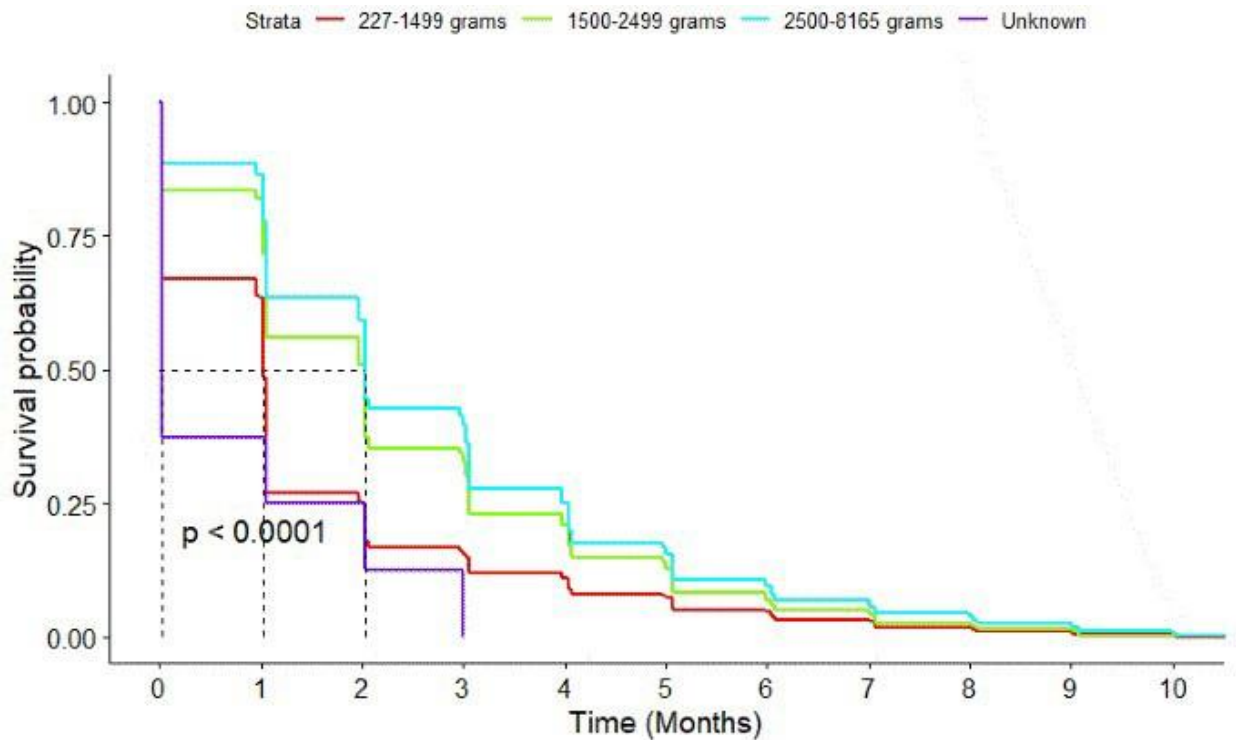


Figure 4.2.A11 Birthweight Kaplan Meier Curve

Table 4.3.A2 Multivariate Cox Regression SES Model

	<u>HR</u>	<u>95% LCL</u>	<u>95% UCL</u>	<u>p</u>
Apgar 5 mins.				
4-6	0.93	0.85	1.03	0.17
7-8	0.73	0.67	0.80	< 0.001
9-10	0.66	0.61	0.73	< 0.001
Unknown	0.83	0.67	1.04	0.10
Gestation Age (weeks)				
20-27	0.27	0.04	1.97	0.20
28-31	0.22	0.03	1.58	0.13
32-33	0.19	0.03	1.37	0.10
34-36	0.20	0.03	1.42	0.11
37-38	0.18	0.02	1.31	0.09
39	0.18	0.02	1.28	0.09
40	0.18	0.02	1.32	0.09
41	0.18	0.03	1.34	0.09
42+	0.24	0.03	1.89	0.18
Unknown	0.28	0.03	2.36	0.24
Birthweight (grams)				
1500-2499	0.97	0.85	1.10	0.61
2500-8165	0.94	0.81	1.09	0.42
Unknown	1.63	0.55	4.81	0.38
Maternal Race				
Black	0.91	0.86	0.96	< 0.001
AIAN	0.69	0.57	0.84	< 0.001
Asian	0.86	0.76	0.97	0.02
NHOPI	0.88	0.58	1.35	0.56
2+ Races	0.88	0.78	1.01	0.07
Hispanic	1.01	0.94	1.08	0.78
Unknown	0.88	0.68	1.13	0.32
Maternal Education				
9-12	0.84	0.72	0.98	0.03
HS Grad/GED	0.86	0.74	1.00	0.05
Some College	0.87	0.74	1.01	0.07
Associate degree	0.89	0.75	1.06	0.20
Bachelor's degree	0.91	0.76	1.08	0.26
Master's degree	0.82	0.67	1.00	0.05
PhD/Professional degree	0.68	0.52	0.90	0.01
Unknown	0.84	0.65	1.08	0.17
Maternal Age				
15	0.55	0.25	1.24	0.15
16	0.55	0.26	1.17	0.12
17	0.62	0.30	1.29	0.20
				<i>Cont.</i>

	18	0.65	0.32	1.33	0.24
	19	0.61	0.30	1.23	0.17
	20-24	0.59	0.29	1.20	0.15
	25-29	0.56	0.28	1.13	0.11
	30-34	0.60	0.30	1.22	0.16
	35-39	0.63	0.31	1.28	0.20
	40-44	0.60	0.30	1.23	0.16
	45-49	0.51	0.22	1.18	0.12
	50-54	0.69	0.18	2.62	0.58
Marriage Status					
	Unmarried	0.93	0.88	0.99	0.02
	Unknown	0.72	0.62	0.85	< 0.001
WIC					
	Yes	0.99	0.94	1.04	0.60
	Unknown	0.98	0.82	1.18	0.87
Breast Fed					
	No	1.12	1.06	1.18	< 0.001
	Unknown	1.33	1.17	1.52	< 0.001
Payer					
	Private Insurance	1.01	0.95	1.08	0.77
	Self-Pay	0.93	0.82	1.06	0.29
	Other	0.94	0.83	1.07	0.36
	Unknown	1.01	0.77	1.32	0.96
Prenatal Care Start					
	2nd Trimester	0.99	0.93	1.06	0.87
	3rd Trimester	0.95	0.85	1.07	0.42
	None	0.98	0.80	1.20	0.84
	Unknown	1.00	0.84	1.18	0.96
Prenatal Visits					
	1-2	1.09	0.87	1.35	0.46
	3-4	1.10	0.91	1.33	0.34
	5-6	0.99	0.83	1.20	0.95
	7-8	1.06	0.88	1.27	0.57
	9-10	1.00	0.84	1.21	0.96
	11-12	0.95	0.79	1.14	0.58
	13-14	0.99	0.81	1.20	0.89
	15-16	1.05	0.86	1.29	0.63
	17-18	0.93	0.72	1.19	0.55
	19+	1.08	0.88	1.34	0.46
	Unknown	*	*	*	*
Attending					
	Dr. of Osteo	1.02	0.93	1.12	0.62
	Certified Nurse Midwife	0.97	0.87	1.08	0.54
	Other Midwife	0.72	0.48	1.09	0.12

	Other	1.01	0.80	1.27	0.93
	Unknown	0.68	0.36	1.29	0.24
Paternal Education					
	9-12	1.01	0.86	1.19	0.90
	HS Grad/GED	1.01	0.87	1.18	0.90
	Some College	1.04	0.89	1.23	0.61
	Associate degree	1.15	0.95	1.39	0.16
	Bachelor's degree	1.16	0.97	1.38	0.11
	Master's degree	1.16	0.93	1.44	0.18
	PhD/Professional degree	1.11	0.84	1.46	0.46
	Unknown	1.03	0.88	1.21	0.70

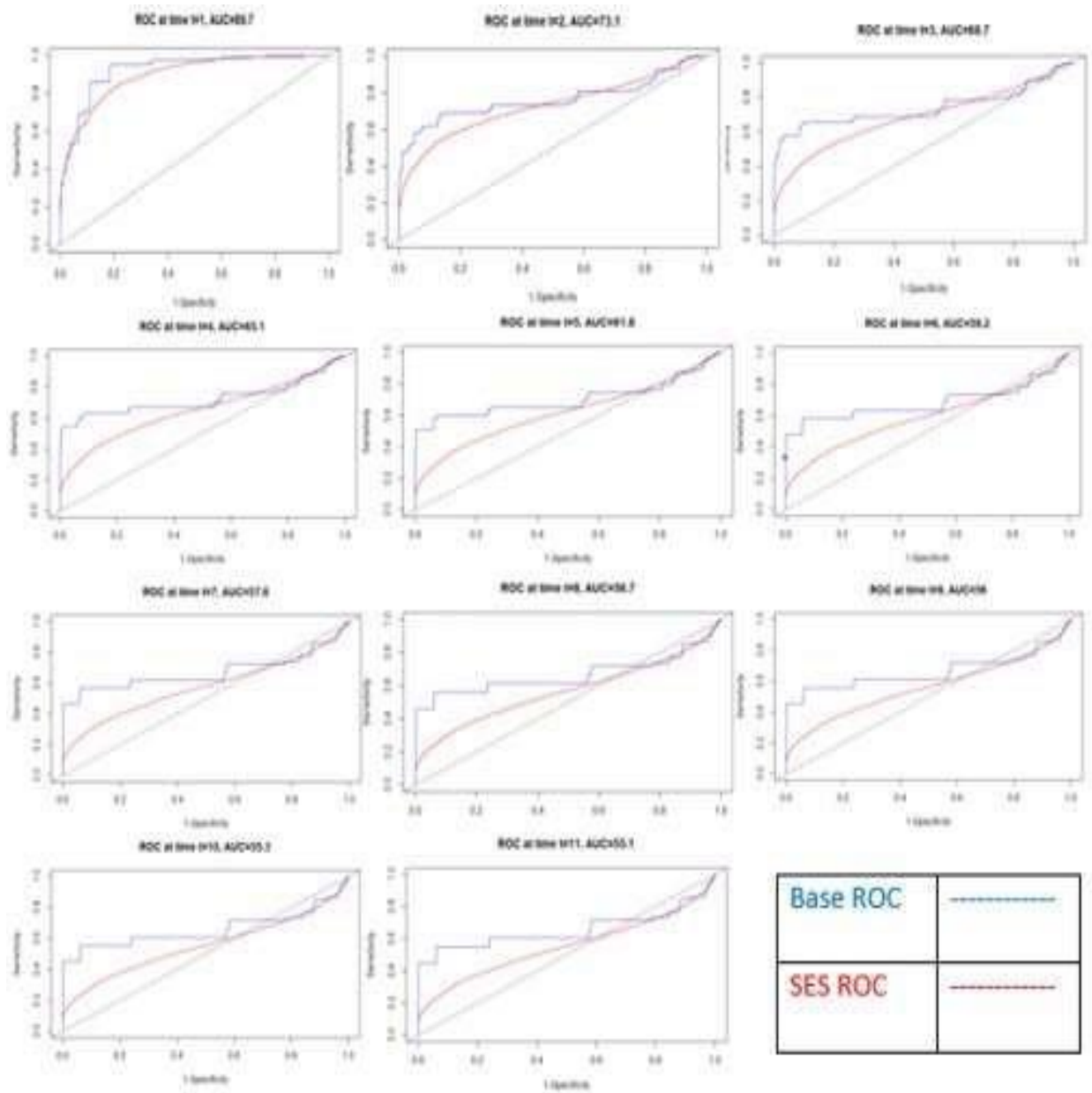


Figure 4.3.A1 Model Comparison of Time Dependent ROCs

## APPENDIX B: SAS and R Programming Code

```

FILENAME born16 '\VS16LINK.Public.USDENPUB_2019_08_29';
DATA b16;
INFILE born16 LRECL = 20000 ;
attrib dob_yy    length=4    label="Birth Year";
attrib dob_mm    length=3    label="Birth Month 01 January";
attrib dob_tt    length=4    label="Time of Birth 0000-2359 Time of Birth";
attrib dob_wk    length=3    label="Birth Day of Week 1 Sunday";
attrib bfacil    length=3    label="Birth Place 1 Hospital";
attrib f_bfacil  length=3    label="Reporting Flag for Birth Place 0 Non-Reporting";
attrib bfacil3   length=3    label="Facility Recode 1 In Hospital";
attrib mageimp   length=3    label="Mother's Age Imputed Blank Age not imputed";
attrib magerep   length=3    label="Reported Age of Mother Used Flag Blank
Reported age not used";
attrib mager     length=3    label="Mother's Single Years of Age 12 10 -- 12 years";
attrib mager14   length=3    label="Mother's Age Recode 14 01 Under 15 Years";
attrib mager9    length=3    label="Mother's Age Recode 9 1 Under 15 years";
attrib mbstate_rec length=3    label="Mother's Nativity 1 Born in the U.S. (50 US
States)";
attrib restatus  length=3    label="Residence Status";
attrib mrace31   length=3    label="Mother's Race Recode 31";
attrib mrace6    length=3    label="Mother's Race Recode 6";
attrib mrace15   length=3    label="Mother's Race Recode 15";
attrib mbrace    length=3    label="Bridged Race Mother";
attrib mraceimp  length=$1    label="Mother's Race Imputed Flag Blank Mother's race
not imputed";
attrib mhisp_r   length=3    label="Mother's Hispanic Origin Recode 0 Non-Hispanic";
attrib f_mhisp   length=3    label="Reporting Flag for Mother's Origin 0 Non-
Reporting";
attrib mracehisp length=3    label="Mother's Race/Hispanic Origin 1 Non-Hispanic
White (only)";
attrib mar_p     length=$1    label="Paternity Acknowledged Y Yes";
attrib dmar      length=3    label="Marital Status";
attrib mar_imp   length=3    label="Mother's Marital Status Imputed Blank Marital
Status not imputed";
attrib f_mar_p   length=3    label="Reporting Flag for Paternity Acknowledged 0 Non-
Reporting";
attrib meduc     length=3    label="Mother's Education 1 8th grade or less";
attrib f_meduc   length=3    label="Reporting Flag for Education of Mother 0 Non-
Reporting";
attrib fagerpt_flg length=3    label="Father's Reported Age Used Blank Father's
reported age not u";

```

attrib fagecomb length=3 label="Father's Combined Age (Revised) 09-98 Father's  
 combined age in ye";  
 attrib fage11 length=3 label="Father's Age Recode 11 01 Under 15 years";  
 attrib frace31 length=3 label="Father's Race Recode 31 01 White (only) [only one  
 race";  
 attrib frace6 length=3 label="Father's Race Recode 6 1 White (only)";  
 attrib frace15 length=3 label="Father's Race Recode 15 01 White (only)";  
 attrib fbrace length=3 label="Bridged Race Father 1 White";  
 attrib fhispr length=3 label="Father's Hispanic Origin Recode 0 Non-Hispanic";  
 attrib f\_fhispr length=3 label="Reporting Flag for Father's Origin 0 Non-Reporting";  
 attrib fracehisp length=3 label="Father's Race/Hispanic Origin 1 Non-Hispanic  
 White (only)";  
 attrib feduc length=3 label="Father's Education 1 8th grade or less";  
 attrib f\_feduc length=3 label="Reporting Flag for Father's Education";  
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 still li";  
 attrib priordead length=3 label="Prior Births Now Dead 00-30 Number of children  
 dead";  
 attrib priorterm length=3 label="Prior Other Terminations 00-30 Number other  
 terminations";  
 attrib lbo\_rec length=3 label="Live Birth Order Recode 1-7 Number of live birth  
 order.";  
 attrib tpo\_rec length=3 label="Total Birth Order Recode 1-7 Number of total birth  
 order";  
 attrib illb\_r length=3 label="Interval Since Last Live Birth Recode 000-003 Plural  
 delivery";  
 attrib illb\_r11 length=3 label="Interval Since Last Live Birth Recode 11 00 Zero to  
 3 months (plural de";  
 attrib iloo\_r length=3 label="Interval Since Last Other Pregnancy Recode 000-  
 003 Plural delivery";  
 attrib iloo\_r11 length=3 label="Interval Since Last Other Pregnancy Recode 11 00  
 Zero to 3 months (plural de";  
 attrib ilp\_r length=3 label="Interval Since Last Pregnancy Recode 000-003 Plural  
 delivery";  
 attrib ilp\_r11 length=3 label="Interval Since Last Pregnancy Recode 11 00 Zero to  
 3 months (plural de";  
 attrib precare length=3 label="Month Prenatal Care Began 00 No prenatal care";  
 attrib f\_mpcb length=3 label="Reporting Flag for Month Prenatal Care Began 0  
 Non-Reporting";  
 attrib precare5 length=3 label="Month Prenatal Care Began Recode 1 1st to 3rd  
 month";  
 attrib previs length=3 label="Number of Prenatal Visits (Revised only) 00-98  
 Number of prenatal visits";

attrib previs\_rec length=3 label="Number of Prenatal Visits Recode 01 No visits";  
 attrib f\_tpcv length=3 label="Reporting Flag for Total Prenatal Care Visits 0 Non-Reporting";  
 attrib wic length=\$1 label="WIC Y Yes";  
 attrib f\_wic length=3 label="Reporting Flag for WIC 0 Non-Reporting";  
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 attrib cig\_1 length=3 label="Cigarettes 1st Trimester 00-97 Number of cigarettes daily";  
 attrib cig\_2 length=3 label="Cigarettes 2nd Trimester 00-97 Number of cigarettes daily";  
 attrib cig\_3 length=3 label="Cigarettes 3rd Trimester 00-97 Number of cigarettes daily";  
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 attrib cig1\_r length=3 label="Cigarettes 1st Trimester Recode 0 Nonsmoker";  
 attrib cig2\_r length=3 label="Cigarettes 2nd Trimester Recode 0 Nonsmoker";  
 attrib cig3\_r length=3 label="Cigarettes 3rd Trimester Recode 0 Nonsmoker";  
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 attrib f\_cigs\_1 length=3 label="Reporting Flag for Cigarettes 1st Trimester 0 Non-Reporting";  
 attrib f\_cigs\_2 length=3 label="Reporting Flag for Cigarettes 2nd Trimester 0 Non-Reporting";  
 attrib f\_cigs\_3 length=3 label="Reporting Flag for Cigarettes 3rd Trimester 0 Non-Reporting";  
 attrib cig\_rec length=\$1 label="Cigarette Recode (Revised) Y Yes";  
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 attrib mhtr length=3 label="Mother's Height in Total Inches 30-78 Height in inches";  
 attrib f\_m\_ht length=3 label="Reporting Flag for Mother's Height 0 Non-Reporting";  
 attrib bmi length=8 label="Body Mass Index 13.0-69.9 Body Mass Index";  
 attrib bmi\_r length=3 label="Body Mass Index Recode 1 Underweight <18.5";  
 attrib pwgt\_r length=3 label="Pre-pregnancy Weight Recode 075-375 Weight in pounds";  
 attrib f\_pwgt length=3 label="Reporting Flag for Pre-pregnancy Weight 0 Non-Reporting";  
 attrib dwgt\_r length=3 label="Delivery Weight Recode 100-400 Weight in pounds";  
 attrib f\_dwgt length=3 label="Reporting Flag for Delivery Weight 0 Non-Reporting";  
 attrib wtgain length=3 label="Weight Gain 00-97 Weight gain in pounds";

attrib wtgain\_rec length=3 label="Weight Gain Recode 1 Less than 11 pounds";  
 attrib f\_wtgain length=3 label="Reporting Flag for Weight Gain 0 Non-Reporting";  
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 attrib rf\_gdiab length=\$1 label="Gestational Diabetes Y Yes";  
 attrib rf\_phype length=\$1 label="Pre-pregnancy Hypertension Y Yes";  
 attrib rf\_ghype length=\$1 label="Gestational Hypertension Y Yes";  
 attrib rf\_ehype length=\$1 label="Hypertension Eclampsia Y Yes";  
 attrib rf\_ppb length=\$1 label="Previous Preterm Birth Y Yes";  
 attrib f\_rf\_pdiab length=3 label="Reporting Flag for Pre-pregnancy Diabetes 0 Non-Reporting";  
 attrib f\_rf\_gdiab length=3 label="Reporting Flag for Gestational Diabetes 0 Non-Reporting";  
 attrib f\_rf\_phype length=3 label="Reporting Flag for Pre-pregnancy Hypertension 0 Non-Reporting";  
 attrib f\_rf\_ghype length=3 label="Reporting Flag for Gestational Hypertension 0 Non-Reporting";  
 attrib f\_rf\_ehype length=3 label="Reporting Flag for Hypertension Eclampsia 0 Non-Reporting";  
 attrib f\_rf\_ppb length=3 label="Reporting Flag for Previous Preterm Birth 0 Non-Reporting";  
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 attrib rf\_drg length=\$1 label="Fertility Enhancing Drugs Y Yes";  
 attrib rf\_art length=\$1 label="Asst. Reproductive Technology Y Yes";  
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 attrib f\_rf\_art length=3 label="Reporting Flag for Reproductive Technology 0 Non-Reporting";  
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 attrib rf\_cesarn length=3 label="Number of Previous Cesareans 00 None";  
 attrib f\_rf\_cesar length=3 label="Reporting Flag for Previous Cesarean 0 Non-Reporting";  
 attrib f\_rf\_ncesar length=3 label="Reporting Flag for Number of Previous Cesareans 0 Non-Reporting";  
 attrib no\_risks length=3 label="No Risk Factors Reported 1 True";  
 attrib ip\_gon length=\$1 label="Gonorrhoea Y Yes";  
 attrib ip\_syph length=\$1 label="Syphilis Y Yes";  
 attrib ip\_chlam length=\$1 label="Chlamydia Y Yes";  
 attrib ip\_hepb length=\$1 label="Hepatitis B Y Yes";  
 attrib ip\_hepc length=\$1 label="Hepatitis C Y Yes";  
 attrib f\_ip\_gon length=3 label="Reporting Flag for Gonorrhoea 0 Non-Reporting";  
 attrib f\_ip\_syph length=3 label="Reporting Flag for Syphilis 0 Non-Reporting";  
 attrib f\_ip\_chlam length=3 label="Reporting Flag for Chlamydia 0 Non-Reporting";  
 attrib f\_ip\_hepb length=3 label="Reporting Flag for Hepatitis B 0 Non-Reporting";

attrib f\_ip\_hepc length=3 label="Reporting Flag for Hepatitis C 0 Non-Reporting";  
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 attrib ob\_succ length=\$1 label="Successful External Cephalic Version Y Yes";  
 attrib ob\_fail length=\$1 label="Failed External Cephalic Version Y Yes";  
 attrib f\_ob\_succ length=3 label="Reporting Flag for Successful External Cephalic  
 Version 0 Non-Reporting";  
 attrib f\_ob\_fail length=3 label="Reporting Flag for Failed External Cephalic Version  
 0 Non-Reporting";  
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 attrib co\_dodyy length=4 label="Cohort Year of Death";  
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 attrib ld\_augm length=\$1 label="Augmentation of Labor Y Yes";  
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 attrib ld\_antb length=\$1 label="Antibiotics Y Yes";  
 attrib ld\_chor length=\$1 label="Chorioamnionitis Y Yes";  
 attrib ld\_anes length=\$1 label="Anesthesia Y Yes";  
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 Reporting";  
 attrib f\_ld\_augm length=3 label="Reporting Flag for Augmentation of Labor 0 Non-  
 Reporting";  
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 attrib f\_ld\_antb length=3 label="Reporting Flag for Antibiotics 0 Non-Reporting";  
 attrib f\_ld\_chor length=3 label="Reporting Flag for Chorioamnionitis 0 Non-  
 Reporting";  
 attrib f\_ld\_anes length=3 label="Reporting Flag for Anesthesia 0 Non-Reporting";  
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 attrib me\_pres length=\$1 label="Fetal Presentation at Delivery 1 Cephalic";  
 attrib me\_rout length=\$1 label="Final Route and Method of Delivery 1  
 Spontaneous";  
 attrib me\_trial length=\$1 label="Trial of Labor Attempted (if cesarean) Y Yes";  
 attrib f\_me\_pres length=3 label="Reporting Flag for Fetal Presentation 0 Non-  
 Reporting";  
 attrib f\_me\_rout length=3 label="Reporting Flag for Final Route and Method of  
 Deliver 0 Non-Reporting";  
 attrib f\_me\_trial length=3 label="Reporting Flag for Trial of Labor Attempted 0 Non-  
 Reporting";  
 attrib rdmeth\_rec length=3 label="Delivery Method Recode (revised only) 1 Vaginal  
 (excludes vaginal a";  
 attrib dmeth\_rec length=3 label="Delivery Method Recode Combined 1 Vaginal";  
 attrib f\_dmeth\_rec length=3 label="Reporting Flag for Method of Delivery Recode 0  
 Non-Reporting";  
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 attrib mm\_plac length=\$1 label="Perineal Laceration Y Yes";

attrib mm\_rupt length=\$1 label="Ruptured Uterus Y Yes";  
 attrib mm\_uhyst length=\$1 label="Unplanned Hysterectomy Y Yes";  
 attrib mm\_aicu length=\$1 label="Admit to Intensive Care Y Yes";  
 attrib f\_mm\_mtr length=3 label="Reporting Flag for Maternal Transfusion 0 Non-Reporting";  
 attrib f\_mm\_plac length=3 label="PLAC Reporting Flag for Perineal Laceration 0 Non-Reporting";  
 attrib f\_mm\_rupt length=3 label="Reporting Flag for Ruptured Uterus 0 Non-Reporting";  
 attrib f\_mm\_uhyst length=3 label="Reporting Flag for Unplanned Hysterectomy 0 Non-Reporting";  
 attrib f\_mm\_aicu length=3 label="Reporting Flag for Admission to Intensive Care 0 Non-Reporting";  
 attrib no\_mmorb length=3 label="No Maternal Morbidity Reported 1 True";  
 attrib attend length=3 label="Attendant at Birth 1 Doctor of Medicine (MD)";  
 attrib mtran length=\$1 label="Mother Transferred Y Yes";  
 attrib pay length=3 label="Payment Source for Delivery 1 Medicaid";  
 attrib pay\_rec length=3 label="Payment Recode 1 Medicaid";  
 attrib f\_pay length=3 label="Reporting Flag for Source of Payment 0 Non-Reporting";  
 attrib f\_pay\_rec length=3 label="Reporting Flag for Payment Recode 0 Non-Reporting";  
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 attrib apgar5r length=3 label="Five Minute APGAR Recode 1 A score of 0-3";  
 attrib f\_apgar5 length=3 label="Reporting Flag for Five minute APGAR 0 Non-Reporting";  
 attrib apgar10 length=3 label="Ten Minute APGAR Score 00-10 A score of 0-10";  
 attrib apgar10r length=3 label="Ten Minute APGAR Recode 1 A score of 0-3";  
 attrib dplural length=3 label="Plurality Recode 1 Single";  
 attrib imp\_plur length=3 label="Plurality Imputed Blank Plurality is imputed";  
 attrib setorder\_r length=3 label="Set Order Recode 1 1st";  
 attrib sex length=\$1 label="Sex of Infant M Male";  
 attrib imp\_sex length=3 label="Imputed Sex Blank Infant Sex not Imputed";  
 attrib dlmp\_mm length=3 label="Last Normal Menses Month 01 January";  
 attrib dlmp\_yy length=4 label="Last Normal Menses Year nnnn Year of last normal menses";  
 attrib compgst\_imp length=3 label="Combined Gestation Imputation Flag Blank Combined Gestation is not i";  
 attrib combgst\_imp length=3 label="Combined Gestation Imputed";  
 attrib obgest\_flg length=3 label="Obstetric Estimate of Gestation Used Flag Blank Obstetric Estimate is not u";  
 attrib combgest length=3 label="Combined Gestation -- Detail in Weeks 17-47 17th through 47th week of";

attrib gestrec10 length=3 label="Combined Gestation Recode 10 01 Under 20 weeks";  
 attrib gestrec3 length=3 label="Combined Gestation Recode 3 1 Under 37 weeks";  
 attrib Impused length=3 label="Combined Gestation Used Flag Blank Combined gestation not used";  
 attrib oegest\_comb length=3 label="Obstetric Estimate Edited 17-47 Weeks of gestation";  
 attrib oegest\_r10 length=3 label="Obstetric Estimate Recode10 01 Under 20 weeks";  
 attrib oegest\_r3 length=3 label="Obstetric Estimate Recode 3 1 Under 37 weeks";  
 attrib bwtr14 length=3 label="Birth Weight Recode 14 01 0227 - 0499 grams";  
 attrib bwtr4 length=3 label="Birth Weight Recode 4 1 0227 - 1499 grams";  
 attrib brthwgt length=4 label="Imputed Birth Weight";  
 attrib bwtmp length=3 label="Birth Weight Imputed Flag";  
 attrib ab\_aven1 length=\$1 label="Assisted Ventilation (immediately) Y Yes";  
 attrib ab\_aven6 length=\$1 label="Assisted Ventilation > 6 hrs Y Yes";  
 attrib ab\_nicu length=\$1 label="Admission to NICU Y Yes";  
 attrib ab\_surf length=\$1 label="Surfactant Y Yes";  
 attrib ab\_anti length=\$1 label="Antibiotics for Newborn Y Yes";  
 attrib ab\_seiz length=\$1 label="Seizures Y Yes";  
 attrib f\_ab\_aven1 length=3 label="Reporting Flag for Assisted Ventilation (immediately) 0 Non-Reporting";  
 attrib f\_ab\_aven6 length=3 label="Reporting Flag for Assisted Ventilation >6 hrs 0 Non-Reporting";  
 attrib f\_ab\_nicu length=3 label="Reporting Flag for Admission to NICU 0 Non-Reporting";  
 attrib f\_ab\_surf length=3 label="Reporting Flag for Surfactant 0 Non-Reporting";  
 attrib f\_ab\_anti length=3 label="Reporting Flag for Antibiotics 0 Non-Reporting";  
 attrib f\_ab\_seiz length=3 label="Reporting Flag for Seizures 0 Non-Reporting";  
 attrib no\_abnorm length=3 label="No Abnormal Conditions Checked 1 True";  
 attrib ca\_anen length=\$1 label="Anencephaly Y Yes";  
 attrib ca\_mnsb length=\$1 label="Meningomyelocele / Spina Bifida Y Yes";  
 attrib ca\_cchd length=\$1 label="Cyanotic Congenital Heart Disease Y Yes";  
 attrib ca\_cdh length=\$1 label="Congenital Diaphragmatic Hernia Y Yes";  
 attrib ca\_omph length=\$1 label="Omphalocele Y Yes";  
 attrib ca\_gast length=\$1 label="Gastroschisis Y Yes";  
 attrib f\_ca\_anen length=3 label="Reporting Flag for Anencephaly 0 Non-Reporting";  
 attrib f\_ca\_mnsb length=3 label="Reporting Flag for Meningomyelocele/Spina Bifida 0 Non-Reporting";  
 attrib f\_ca\_cchd length=3 label="Reporting Flag for Cyanotic Congenital Heart Disease 0 Non-Reporting";

attrib f\_ca\_cdh length=3 label="Reporting Flag for Congenital Diaphragmatic Hernia 0 Non-Reporting";  
 attrib f\_ca\_omph length=3 label="Reporting Flag for Omphalocele 0 Non-Reporting";  
 attrib f\_ca\_gast length=3 label="Reporting Flag for Gastroschisis 0 Non-Reporting";  
 attrib ca\_limb length=\$1 label="Limb Reduction Defect Y Yes";  
 attrib ca\_cleft length=\$1 label="Cleft Lip w/ or w/o Cleft Palate Y Yes";  
 attrib ca\_clpal length=\$1 label="Cleft Palate alone Y Yes";  
 attrib ca\_down length=\$1 label="Down Syndrome C Confirmed";  
 attrib ca\_disor length=\$1 label="Suspected Chromosomal Disorder C Confirmed";  
 attrib ca\_hypo length=\$1 label="Hypospadias Y Yes";  
 attrib f\_ca\_limb length=3 label="Reporting Flag for Limb Reduction Defect 0 Non-Reporting";  
 attrib f\_ca\_cleft length=3 label="Reporting Flag for Cleft Lip with or without Cleft Palate 0 Non-Reporting";  
 attrib f\_ca\_clpal length=3 label="Reporting Flag for Cleft Palate Alone 0 Non-Reporting";  
 attrib f\_ca\_down length=3 label="Reporting Flag for Down Syndrome 0 Non-Reporting";  
 attrib f\_ca\_disor length=3 label="Reporting Flag for Suspected Chromosomal Disorder 0 Non-Reporting";  
 attrib f\_ca\_hypo length=3 label="Reporting Flag for Hypospadias 0 Non-Reporting";  
 attrib no\_congen length=3 label="No Congenital Anomalies Checked 1 True";  
 attrib itran length=\$1 label="Infant Transferred Y Yes";  
 attrib ilive length=\$1 label="Infant Living at Time of Report Y Yes";  
 attrib bfed length=\$1 label="Infant Breastfed at Discharge Y Yes";  
 attrib f\_bfed length=3 label="Reporting Flag for Breastfed at Discharge 0 Non-Reporting";  
 attrib ubfacil length=3 label="Birth Place 1 Hospital";  
 attrib urf\_diab length=3 label="Diabetes 1 Yes";  
 attrib urf\_chype length=3 label="Chronic Hypertension 1 Yes";  
 attrib urf\_phype length=3 label="Pregnancy Associated Hypertension 1 Yes";  
 attrib urf\_ehype length=3 label="Eclampsia 1 Yes";  
 attrib ume\_forc length=3 label="Forceps 1 Yes";  
 attrib ume\_vacu length=3 label="Vacuum 1 Yes";  
 attrib uop\_indu length=3 label="Induction of Labor 1 Yes";  
 attrib uld\_bree length=3 label="Breech 1 Yes";  
 attrib uca\_anen length=3 label="Anencephalus 1 Anomaly reported";  
 attrib uca\_spina length=3 label="Spina Bifida / Meningocele 1 Anomaly reported";  
 attrib uca\_omph length=3 label="Omphalocele / Gastroschisis 1 Anomaly reported";

```

attrib uca_clip    length=3    label="Cleft Lip / Palate 1 Anomaly reported";
attrib uca_hern    length=3    label="Diaphragmatic Hernia 1 Anomaly reported";
attrib uca_down    length=3    label="Down Syndrome 1 Anomaly reported";
attrib flgnd      length=3    label="Match Status 1 Both";

```

## INPUT

```

@9  dob_yy        4.
@13 dob_mm        2.
@19 dob_tt        4.
@23 dob_wk        1.
@32 bfacil        1.
@33 f_bfacil      1.
@50 bfacil3       1.
@73 mageimp       1.
@74 magerep       1.
@75 mager         2.
@77 mager14       2.
@79 mager9        1.
@84 mbstate_rec   1.
@104 restatus     1.
@105 mrace31      2.
@107 mrace6       1.
@108 mrace15     2.
@110 mbrace       1.
@111 mraceimp     $1.
@115 mhispr       1.
@116 f_mhispr     1.
@117 mracehisp    1.
@119 mar_p        $1.
@120 dmar         1.
@121 mar_imp      1.
@123 f_mar_p      1.
@124 meduc        1.
@126 f_meduc      1.
@142 fagerpt_flg  1.
@147 fagecomb     2.
@149 fage11       2.
@151 frace31      2.
@153 frace6       1.
@154 frace15     2.
@156 fbrace       1.
@160 fhispr       1.

```

@161	f_fhisp	1.	
@162	fracehisp	1.	
@163	feduc	1.	
@165	f_feduc		1.
@171	priorlive	2.	
@173	priordead	2.	
@175	priorterm	2.	
@179	lbo_rec	1.	
@182	tpo_rec	1.	
@198	illb_r	3.	
@201	illb_r11	2.	
@206	iloo_r	3.	
@209	iloo_r11	2.	
@214	ilp_r	3.	
@217	ilp_r11	2.	
@224	precare	2.	
@226	f_mpcb	1.	
@227	precare5	1.	
@238	previs	2.	
@242	previs_rec	2.	
@244	f_tpcv	1.	
@251	wic	\$1.	
@252	f_wic	1.	
@253	cig_0	2.	
@255	cig_1	2.	
@257	cig_2	2.	
@259	cig_3	2.	
@261	cig0_r	1.	
@262	cig1_r	1.	
@263	cig2_r	1.	
@264	cig3_r	1.	
@265	f_cigs_0	1.	
@266	f_cigs_1	1.	
@267	f_cigs_2	1.	
@268	f_cigs_3	1.	
@269	cig_rec	\$1.	
@270	f_tobaco	1.	
@280	mhtr	2.	
@282	f_m_ht	1.	
@283	bmi	4.1	
@287	bmi_r	1.	
@292	pwgt_r	3.	
@295	f_pwgt	1.	

@299	dwgt_r	3.
@303	f_dwgt	1.
@304	wtgain	2.
@306	wtgain_rec	1.
@307	f_wtgain	1.
@313	rf_pdiab	\$1.
@314	rf_gdiab	\$1.
@315	rf_phype	\$1.
@316	rf_ghype	\$1.
@317	rf_ehype	\$1.
@318	rf_ppb	\$1.
@319	f_rf_pdiab	1.
@320	f_rf_gdiab	1.
@321	f_rf_phype	1.
@322	f_rf_ghype	1.
@323	f_rf_ehype	1.
@324	f_rf_ppb	1.
@325	rf_inft	\$1.
@326	rf_drg	\$1.
@327	rf_art	\$1.
@329	f_rf_drg	1.
@330	f_rf_art	1.
@331	rf_cesar	\$1.
@332	rf_cesarn	2.
@335	f_rf_cesar	1.
@336	f_rf_ncesar	1.
@337	no_risks	1.
@343	ip_gon	\$1.
@344	ip_syph	\$1.
@345	ip_chlam	\$1.
@346	ip_hepb	\$1.
@347	ip_hepc	\$1.
@348	f_ip_gon	1.
@349	f_ip_syph	1.
@350	f_ip_chlam	1.
@351	f_ip_hepb	1.
@352	f_ip_hepc	1.
@353	no_infec	1.
@360	ob_succ	\$1.
@361	ob_fail	\$1.
@363	f_ob_succ	1.
@364	f_ob_fail	1.
@365	co_seqnum	7.

@372	co_dodyy		4.
@383	ld_indl	\$1.	
@384	ld_augm	\$1.	
@385	ld_ster	\$1.	
@386	ld_antb	\$1.	
@387	ld_chor	\$1.	
@388	ld_anes	\$1.	
@389	f_ld_indl	1.	
@390	f_ld_augm	1.	
@391	f_ld_ster	1.	
@392	f_ld_antb	1.	
@393	f_ld_chor	1.	
@394	f_ld_anes	1.	
@395	no_lbrdlv	1.	
@401	me_pres	\$1.	
@402	me_rout	\$1.	
@403	me_trial	\$1.	
@404	f_me_pres	1.	
@405	f_me_rout	1.	
@406	f_me_trial	1.	
@407	rdmeth_rec	1.	
@408	dmeth_rec	1.	
@409	f_dmeth_rec	1.	
@415	mm_mtr	\$1.	
@416	mm_plac	\$1.	
@417	mm_rupt	\$1.	
@418	mm_uhyst	\$1.	
@419	mm_aicu	\$1.	
@421	f_mm_mtr	1.	
@422	f_mm_plac	1.	
@423	f_mm_rupt	1.	
@424	f_mm_uhyst	1.	
@425	f_mm_aicu	1.	
@427	no_mmorb	1.	
@433	attend	1.	
@434	mtran	\$1.	
@435	pay	1.	
@436	pay_rec	1.	
@437	f_pay	1.	
@438	f_pay_rec	1.	
@444	apgar5	2.	
@446	apgar5r	1.	
@447	f_apgar5	1.	

@448	apgar10	2.
@450	apgar10r	1.
@454	dplural	1.
@456	imp_plur	1.
@459	setorder_r	1.
@475	sex	\$1.
@476	imp_sex	1.
@477	dimp_mm	2.
@481	dimp_yy	4.
@487	compgst_imp	1.
@488	combgst_imp	1.
@489	obgest_flg	1.
@490	combgest	2.
@492	gestrec10	2.
@494	gestrec3	1.
@498	Impused	1.
@499	oegest_comb	2.
@501	oegest_r10	2.
@503	oegest_r3	1.
@509	bwtr14	2.
@511	bwtr4	1.
@512	brthwgt	4.
@516	bwtimp	1.
@517	ab_aven1	\$1.
@518	ab_aven6	\$1.
@519	ab_nicu	\$1.
@520	ab_surf	\$1.
@521	ab_anti	\$1.
@522	ab_seiz	\$1.
@524	f_ab_aven1	1.
@525	f_ab_aven6	1.
@526	f_ab_nicu	1.
@527	f_ab_surf	1.
@528	f_ab_anti	1.
@529	f_ab_seiz	1.
@531	no_abnorm	1.
@537	ca_anen	\$1.
@538	ca_mnsb	\$1.
@539	ca_cchd	\$1.
@540	ca_cdh	\$1.
@541	ca_omph	\$1.
@542	ca_gast	\$1.
@543	f_ca_anen	1.

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@544 f_ca_mnsb      1.
@545 f_ca_cchd     1.
@546 f_ca_cdh      1.
@547 f_ca_omph     1.
@548 f_ca_gast     1.
@549 ca_limb       $1.
@550 ca_cleft      $1.
@551 ca_clpal      $1.
@552 ca_down       $1.
@553 ca_disor      $1.
@554 ca_hypo       $1.
@555 f_ca_limb     1.
@556 f_ca_cleft    1.
@557 f_ca_clpal    1.
@558 f_ca_down     1.
@559 f_ca_disor    1.
@560 f_ca_hypo     1.
@561 no_congen     1.
@567 itran         $1.
@568 ilive         $1.
@569 bfed          $1.
@570 f_bfed        1.
@1330 ubfacil      1.
@1331 urf_diab     1.
@1332 urf_chype    1.
@1333 urf_phype    1.
@1334 urf_ehype    1.
@1335 ume_forc     1.
@1336 ume_vacu     1.
@1337 uop_indu     1.
@1338 uld_bree     1.
@1340 uca_anen     1.
@1341 uca_spina    1.
@1342 uca_omph     1.
@1343 uca_clip     1.
@1344 uca_hern     1.
@1345 uca_down     1.
@1346 flgnd       1.;
IF RESTATUS < 4 and dob_yy=2016;
PROC SORT; BY co_seqnum; RUN;

```

FILENAME died16 'VS16LINK.Public.USNUMPUB\_2019\_08\_26';

```

DATA d16;
INFILE died16 LRECL = 20000 ;
attrib dob_yy    length=4    label="Birth Year";
attrib dob_mm    length=3    label="Birth Month 01 January";
attrib dob_tt    length=4    label="Time of Birth 0000-2359 Time of Birth";
attrib dob_wk    length=3    label="Birth Day of Week 1 Sunday";
attrib bfacil    length=3    label="Birth Place 1 Hospital";
attrib f_bfacil  length=3    label="Reporting Flag for Birth Place 0 Non-Reporting";
attrib bfacil3   length=3    label="Facility Recode 1 In Hospital";
attrib mageimp   length=3    label="Mother's Age Imputed Blank Age not imputed";
attrib magerep   length=3    label="Reported Age of Mother Used Flag Blank
Reported age not used";
attrib mager     length=3    label="Mother's Single Years of Age 12 10 -- 12 years";
attrib mager14  length=3    label="Mother's Age Recode 14 01 Under 15 Years";
attrib mager9   length=3    label="Mother's Age Recode 9 1 Under 15 years";
attrib mbstate_rec length=3    label="Mother's Nativity 1 Born in the U.S. (50 US
States)";
attrib restatus  length=3    label="Residence Status";
attrib mrace31   length=3    label="Mother's Race Recode 31";
attrib mrace6    length=3    label="Mother's Race Recode 6";
attrib mrace15   length=3    label="Mother's Race Recode 15";
attrib mbrace    length=3    label="Bridged Race Mother";
attrib mraceimp  length=$1    label="Mother's Race Imputed Flag Blank Mother's race
not imputed";
attrib mhisp_r   length=3    label="Mother's Hispanic Origin Recode 0 Non-Hispanic";
attrib f_mhisp   length=3    label="Reporting Flag for Mother's Origin 0 Non-
Reporting";
attrib mracehisp length=3    label="Mother's Race/Hispanic Origin 1 Non-Hispanic
White (only)";
attrib mar_p     length=$1    label="Paternity Acknowledged Y Yes";
attrib dmar      length=3    label="Marital Status";
attrib mar_imp   length=3    label="Mother's Marital Status Imputed Blank Marital
Status not imputed";
attrib f_mar_p   length=3    label="Reporting Flag for Paternity Acknowledged 0 Non-
Reporting";
attrib meduc     length=3    label="Mother's Education 1 8th grade or less";
attrib f_meduc   length=3    label="Reporting Flag for Education of Mother 0 Non-
Reporting";
attrib fagerpt_flg length=3    label="Father's Reported Age Used Blank Father's
reported age not u";
attrib fagecomb  length=3    label="Father's Combined Age (Revised) 09-98 Father's
combined age in ye";

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attrib fage11 length=3 label="Father's Age Recode 11 01 Under 15 years";  
 attrib frace31 length=3 label="Father's Race Recode 31 01 White (only) [only one  
 race";  
 attrib frace6 length=3 label="Father's Race Recode 6 1 White (only)";  
 attrib frace15 length=3 label="Father's Race Recode 15 01 White (only)";  
 attrib fbrace length=3 label="Bridged Race Father 1 White";  
 attrib fhispc\_r length=3 label="Father's Hispanic Origin Recode 0 Non-Hispanic";  
 attrib f\_fhispc length=3 label="Reporting Flag for Father's Origin 0 Non-Reporting";  
 attrib fracehisp length=3 label="Father's Race/Hispanic Origin 1 Non-Hispanic  
 White (only)";  
 attrib feduc length=3 label="Father's Education 1 8th grade or less";  
 attrib f\_feduc length=3 label="Reporting Flag for Father's Education";  
 attrib priorlive length=3 label="Prior Births Now Living 00-30 Number of children  
 still li";  
 attrib priordead length=3 label="Prior Births Now Dead 00-30 Number of children  
 dead";  
 attrib priorterm length=3 label="Prior Other Terminations 00-30 Number other  
 terminations";  
 attrib lbo\_rec length=3 label="Live Birth Order Recode 1-7 Number of live birth  
 order.";  
 attrib tpo\_rec length=3 label="Total Birth Order Recode 1-7 Number of total birth  
 order";  
 attrib illb\_r length=3 label="Interval Since Last Live Birth Recode 000-003 Plural  
 delivery";  
 attrib illb\_r11 length=3 label="Interval Since Last Live Birth Recode 11 00 Zero to  
 3 months (plural de";  
 attrib iloo\_r length=3 label="Interval Since Last Other Pregnancy Recode 000-  
 003 Plural delivery";  
 attrib iloo\_r11 length=3 label="Interval Since Last Other Pregnancy Recode 11 00  
 Zero to 3 months (plural de";  
 attrib ilp\_r length=3 label="Interval Since Last Pregnancy Recode 000-003 Plural  
 delivery";  
 attrib ilp\_r11 length=3 label="Interval Since Last Pregnancy Recode 11 00 Zero to  
 3 months (plural de";  
 attrib precare length=3 label="Month Prenatal Care Began 00 No prenatal care";  
 attrib f\_mpcb length=3 label="Reporting Flag for Month Prenatal Care Began 0  
 Non-Reporting";  
 attrib precare5 length=3 label="Month Prenatal Care Began Recode 1 1st to 3rd  
 month";  
 attrib previs length=3 label="Number of Prenatal Visits (Revised only) 00-98  
 Number of prenatal visits";  
 attrib previs\_rec length=3 label="Number of Prenatal Visits Recode 01 No visits";

attrib f_tpcv	length=3	label="Reporting Flag for Total Prenatal Care Visits 0 Non-Reporting";
attrib wic	length=\$1	label="WIC Y Yes";
attrib f_wic	length=3	label="Reporting Flag for WIC 0 Non-Reporting";
attrib cig_0	length=3	label="Cigarettes Before Pregnancy 00-97 Number of cigarettes daily";
attrib cig_1	length=3	label="Cigarettes 1st Trimester 00-97 Number of cigarettes daily";
attrib cig_2	length=3	label="Cigarettes 2nd Trimester 00-97 Number of cigarettes daily";
attrib cig_3	length=3	label="Cigarettes 3rd Trimester 00-97 Number of cigarettes daily";
attrib cig0_r	length=3	label="Cigarettes Before Pregnancy Recode 0 Nonsmoker";
attrib cig1_r	length=3	label="Cigarettes 1st Trimester Recode 0 Nonsmoker";
attrib cig2_r	length=3	label="Cigarettes 2nd Trimester Recode 0 Nonsmoker";
attrib cig3_r	length=3	label="Cigarettes 3rd Trimester Recode 0 Nonsmoker";
attrib f_cigs_0	length=3	label="Reporting Flag for Cigarettes before Pregnancy 0 Non-Reporting";
attrib f_cigs_1	length=3	label="Reporting Flag for Cigarettes 1st Trimester 0 Non-Reporting";
attrib f_cigs_2	length=3	label="Reporting Flag for Cigarettes 2nd Trimester 0 Non-Reporting";
attrib f_cigs_3	length=3	label="Reporting Flag for Cigarettes 3rd Trimester 0 Non-Reporting";
attrib cig_rec	length=\$1	label="Cigarette Recode (Revised) Y Yes";
attrib f_tobaco	length=3	label="Reporting Flag for Tobacco use 0 Non-Reporting";
attrib mhtr	length=3	label="Mother's Height in Total Inches 30-78 Height in inches";
attrib f_m_ht	length=3	label="Reporting Flag for Mother's Height 0 Non-Reporting";
attrib bmi	length=8	label="Body Mass Index 13.0-69.9 Body Mass Index";
attrib bmi_r	length=3	label="Body Mass Index Recode 1 Underweight <18.5";
attrib pwgt_r	length=3	label="Pre-pregnancy Weight Recode 075-375 Weight in pounds";
attrib f_pwgt	length=3	label="Reporting Flag for Pre-pregnancy Weight 0 Non-Reporting";
attrib dwgt_r	length=3	label="Delivery Weight Recode 100-400 Weight in pounds";
attrib f_dwgt	length=3	label="Reporting Flag for Delivery Weight 0 Non-Reporting";
attrib wtgain	length=3	label="Weight Gain 00-97 Weight gain in pounds";
attrib wtgain_rec	length=3	label="Weight Gain Recode 1 Less than 11 pounds";

attrib f\_wtgain length=3 label="Reporting Flag for Weight Gain 0 Non-Reporting";  
 attrib rf\_pdiab length=\$1 label="Pre-pregnancy Diabetes Y Yes";  
 attrib rf\_gdiab length=\$1 label="Gestational Diabetes Y Yes";  
 attrib rf\_phype length=\$1 label="Pre-pregnancy Hypertension Y Yes";  
 attrib rf\_ghype length=\$1 label="Gestational Hypertension Y Yes";  
 attrib rf\_ehype length=\$1 label="Hypertension Eclampsia Y Yes";  
 attrib rf\_ppb length=\$1 label="Previous Preterm Birth Y Yes";  
 attrib f\_rf\_pdiab length=3 label="Reporting Flag for Pre-pregnancy Diabetes 0 Non-Reporting";  
 attrib f\_rf\_gdiab length=3 label="Reporting Flag for Gestational Diabetes 0 Non-Reporting";  
 attrib f\_rf\_phype length=3 label="Reporting Flag for Pre-pregnancy Hypertension 0 Non-Reporting";  
 attrib f\_rf\_ghype length=3 label="Reporting Flag for Gestational Hypertension 0 Non-Reporting";  
 attrib f\_rf\_ehype length=3 label="Reporting Flag for Hypertension Eclampsia 0 Non-Reporting";  
 attrib f\_rf\_ppb length=3 label="Reporting Flag for Previous Preterm Birth 0 Non-Reporting";  
 attrib rf\_inft length=\$1 label="Infertility Treatment Used Y Yes";  
 attrib rf\_drg length=\$1 label="Fertility Enhancing Drugs Y Yes";  
 attrib rf\_art length=\$1 label="Asst. Reproductive Technology Y Yes";  
 attrib f\_rf\_drg length=3 label="Reporting Flag for Fertility Enhance Drugs 0 Non-Reporting";  
 attrib f\_rf\_art length=3 label="Reporting Flag for Reproductive Technology 0 Non-Reporting";  
 attrib rf\_cesar length=\$1 label="Previous Cesarean Y Yes";  
 attrib rf\_cesarn length=3 label="Number of Previous Cesareans 00 None";  
 attrib f\_rf\_cesar length=3 label="Reporting Flag for Previous Cesarean 0 Non-Reporting";  
 attrib f\_rf\_ncesar length=3 label="Reporting Flag for Number of Previous Cesareans 0 Non-Reporting";  
 attrib no\_risks length=3 label="No Risk Factors Reported 1 True";  
 attrib ip\_gon length=\$1 label="Gonorrhea Y Yes";  
 attrib ip\_syph length=\$1 label="Syphilis Y Yes";  
 attrib ip\_chlam length=\$1 label="Chlamydia Y Yes";  
 attrib ip\_hepb length=\$1 label="Hepatitis B Y Yes";  
 attrib ip\_hepc length=\$1 label="Hepatitis C Y Yes";  
 attrib f\_ip\_gon length=3 label="Reporting Flag for Gonorrhea 0 Non-Reporting";  
 attrib f\_ip\_syph length=3 label="Reporting Flag for Syphilis 0 Non-Reporting";  
 attrib f\_ip\_chlam length=3 label="Reporting Flag for Chlamydia 0 Non-Reporting";  
 attrib f\_ip\_hepb length=3 label="Reporting Flag for Hepatitis B 0 Non-Reporting";  
 attrib f\_ip\_hepc length=3 label="Reporting Flag for Hepatitis C 0 Non-Reporting";

attrib no\_infec length=3 label="No Infections Reported 1 True";  
 attrib ob\_succ length=\$1 label="Successful External Cephalic Version Y Yes";  
 attrib ob\_fail length=\$1 label="Failed External Cephalic Version Y Yes";  
 attrib f\_ob\_succ length=3 label="Reporting Flag for Successful External Cephalic  
 Version 0 Non-Reporting";  
 attrib f\_ob\_fail length=3 label="Reporting Flag for Failed External Cephalic Version  
 0 Non-Reporting";  
 attrib co\_seqnum length=7 label="Cohort Sequence Number";  
 attrib co\_dodyy length=4 label="Cohort Year of Death";  
 attrib ld\_indl length=\$1 label="Induction of Labor Y Yes";  
 attrib ld\_augm length=\$1 label="Augmentation of Labor Y Yes";  
 attrib ld\_ster length=\$1 label="Steroids Y Yes";  
 attrib ld\_antb length=\$1 label="Antibiotics Y Yes";  
 attrib ld\_chor length=\$1 label="Chorioamnionitis Y Yes";  
 attrib ld\_anes length=\$1 label="Anesthesia Y Yes";  
 attrib f\_ld\_indl length=3 label="Reporting Flag for Induction of Labor 0 Non-  
 Reporting";  
 attrib f\_ld\_augm length=3 label="Reporting Flag for Augmentation of Labor 0 Non-  
 Reporting";  
 attrib f\_ld\_ster length=3 label="Reporting Flag for Steroids 0 Non-Reporting";  
 attrib f\_ld\_antb length=3 label="Reporting Flag for Antibiotics 0 Non-Reporting";  
 attrib f\_ld\_chor length=3 label="Reporting Flag for Chorioamnionitis 0 Non-  
 Reporting";  
 attrib f\_ld\_anes length=3 label="Reporting Flag for Anesthesia 0 Non-Reporting";  
 attrib no\_lbrdlv length=3 label="No Characteristics of Labor Reported 1 True";  
 attrib me\_pres length=\$1 label="Fetal Presentation at Delivery 1 Cephalic";  
 attrib me\_rout length=\$1 label="Final Route and Method of Delivery 1  
 Spontaneous";  
 attrib me\_trial length=\$1 label="Trial of Labor Attempted (if cesarean) Y Yes";  
 attrib f\_me\_pres length=3 label="Reporting Flag for Fetal Presentation 0 Non-  
 Reporting";  
 attrib f\_me\_rout length=3 label="Reporting Flag for Final Route and Method of  
 Deliver 0 Non-Reporting";  
 attrib f\_me\_trial length=3 label="Reporting Flag for Trial of Labor Attempted 0 Non-  
 Reporting";  
 attrib rdmeth\_rec length=3 label="Delivery Method Recode (revised only) 1 Vaginal  
 (excludes vaginal a";  
 attrib dmeth\_rec length=3 label="Delivery Method Recode Combined 1 Vaginal";  
 attrib f\_dmeth\_rec length=3 label="Reporting Flag for Method of Delivery Recode 0  
 Non-Reporting";  
 attrib mm\_mtr length=\$1 label="Maternal Transfusion Y Yes";  
 attrib mm\_plac length=\$1 label="Perineal Laceration Y Yes";  
 attrib mm\_rupt length=\$1 label="Ruptured Uterus Y Yes";

attrib mm\_uhyst length=\$1 label="Unplanned Hysterectomy Y Yes";  
 attrib mm\_aicu length=\$1 label="Admit to Intensive Care Y Yes";  
 attrib f\_mm\_mtr length=3 label="Reporting Flag for Maternal Transfusion 0 Non-Reporting";  
 attrib f\_mm\_plac length=3 label="PLAC Reporting Flag for Perineal Laceration 0 Non-Reporting";  
 attrib f\_mm\_rupt length=3 label="Reporting Flag for Ruptured Uterus 0 Non-Reporting";  
 attrib f\_mm\_uhyst length=3 label="Reporting Flag for Unplanned Hysterectomy 0 Non-Reporting";  
 attrib f\_mm\_aicu length=3 label="Reporting Flag for Admission to Intensive Care 0 Non-Reporting";  
 attrib no\_mmorb length=3 label="No Maternal Morbidity Reported 1 True";  
 attrib attend length=3 label="Attendant at Birth 1 Doctor of Medicine (MD)";  
 attrib mtran length=\$1 label="Mother Transferred Y Yes";  
 attrib pay length=3 label="Payment Source for Delivery 1 Medicaid";  
 attrib pay\_rec length=3 label="Payment Recode 1 Medicaid";  
 attrib f\_pay length=3 label="Reporting Flag for Source of Payment 0 Non-Reporting";  
 attrib f\_pay\_rec length=3 label="Reporting Flag for Payment Recode 0 Non-Reporting";  
 attrib apgar5 length=3 label="Five Minute APGAR Score 00-10 A score of 0-10";  
 attrib apgar5r length=3 label="Five Minute APGAR Recode 1 A score of 0-3";  
 attrib f\_apgar5 length=3 label="Reporting Flag for Five minute APGAR 0 Non-Reporting";  
 attrib apgar10 length=3 label="Ten Minute APGAR Score 00-10 A score of 0-10";  
 attrib apgar10r length=3 label="Ten Minute APGAR Recode 1 A score of 0-3";  
 attrib dplural length=3 label="Plurality Recode 1 Single";  
 attrib imp\_plur length=3 label="Plurality Imputed Blank Plurality is imputed";  
 attrib setorder\_r length=3 label="Set Order Recode 1 1st";  
 attrib sex length=\$1 label="Sex of Infant M Male";  
 attrib imp\_sex length=3 label="Imputed Sex Blank Infant Sex not Imputed";  
 attrib dlmp\_mm length=3 label="Last Normal Menses Month 01 January";  
 attrib dlmp\_yy length=4 label="Last Normal Menses Year nnnn Year of last normal menses";  
 attrib compgst\_imp length=3 label="Combined Gestation Imputation Flag Blank Combined Gestation is not i";  
 attrib combgst\_imp length=3 label="Combined Gestation Imputed";  
 attrib obgest\_flg length=3 label="Obstetric Estimate of Gestation Used Flag Blank Obstetric Estimate is not u";  
 attrib combgest length=3 label="Combined Gestation -- Detail in Weeks 17-47 17th through 47th week of";

attrib gestrec10 length=3 label="Combined Gestation Recode 10 01 Under 20 weeks";  
 attrib gestrec3 length=3 label="Combined Gestation Recode 3 1 Under 37 weeks";  
 attrib Impused length=3 label="Combined Gestation Used Flag Blank Combined gestation not used";  
 attrib oegest\_comb length=3 label="Obstetric Estimate Edited 17-47 Weeks of gestation";  
 attrib oegest\_r10 length=3 label="Obstetric Estimate Recode10 01 Under 20 weeks";  
 attrib oegest\_r3 length=3 label="Obstetric Estimate Recode 3 1 Under 37 weeks";  
 attrib bwtr14 length=3 label="Birth Weight Recode 14 01 0227 - 0499 grams";  
 attrib bwtr4 length=3 label="Birth Weight Recode 4 1 0227 - 1499 grams";  
 attrib brthwgt length=4 label="Imputed Birth Weight";  
 attrib bwtmp length=3 label="Birth Weight Imputed Flag";  
 attrib ab\_aven1 length=\$1 label="Assisted Ventilation (immediately) Y Yes";  
 attrib ab\_aven6 length=\$1 label="Assisted Ventilation > 6 hrs Y Yes";  
 attrib ab\_nicu length=\$1 label="Admission to NICU Y Yes";  
 attrib ab\_surf length=\$1 label="Surfactant Y Yes";  
 attrib ab\_anti length=\$1 label="Antibiotics for Newborn Y Yes";  
 attrib ab\_seiz length=\$1 label="Seizures Y Yes";  
 attrib f\_ab\_aven1 length=3 label="Reporting Flag for Assisted Ventilation (immediately) 0 Non-Reporting";  
 attrib f\_ab\_aven6 length=3 label="Reporting Flag for Assisted Ventilation >6 hrs 0 Non-Reporting";  
 attrib f\_ab\_nicu length=3 label="Reporting Flag for Admission to NICU 0 Non-Reporting";  
 attrib f\_ab\_surf length=3 label="Reporting Flag for Surfactant 0 Non-Reporting";  
 attrib f\_ab\_anti length=3 label="Reporting Flag for Antibiotics 0 Non-Reporting";  
 attrib f\_ab\_seiz length=3 label="Reporting Flag for Seizures 0 Non-Reporting";  
 attrib no\_abnorm length=3 label="No Abnormal Conditions Checked 1 True";  
 attrib ca\_anen length=\$1 label="Anencephaly Y Yes";  
 attrib ca\_mnsb length=\$1 label="Meningomyelocele / Spina Bifida Y Yes";  
 attrib ca\_cchd length=\$1 label="Cyanotic Congenital Heart Disease Y Yes";  
 attrib ca\_cdh length=\$1 label="Congenital Diaphragmatic Hernia Y Yes";  
 attrib ca\_omph length=\$1 label="Omphalocele Y Yes";  
 attrib ca\_gast length=\$1 label="Gastroschisis Y Yes";  
 attrib f\_ca\_anen length=3 label="Reporting Flag for Anencephaly 0 Non-Reporting";  
 attrib f\_ca\_mnsb length=3 label="Reporting Flag for Meningomyelocele/Spina Bifida 0 Non-Reporting";  
 attrib f\_ca\_cchd length=3 label="Reporting Flag for Cyanotic Congenital Heart Disease 0 Non-Reporting";

attrib f\_ca\_cdh length=3 label="Reporting Flag for Congenital Diaphragmatic Hernia 0 Non-Reporting";  
 attrib f\_ca\_omph length=3 label="Reporting Flag for Omphalocele 0 Non-Reporting";  
 attrib f\_ca\_gast length=3 label="Reporting Flag for Gastroschisis 0 Non-Reporting";  
 attrib ca\_limb length=\$1 label="Limb Reduction Defect Y Yes";  
 attrib ca\_cleft length=\$1 label="Cleft Lip w/ or w/o Cleft Palate Y Yes";  
 attrib ca\_clpal length=\$1 label="Cleft Palate alone Y Yes";  
 attrib ca\_down length=\$1 label="Down Syndrome C Confirmed";  
 attrib ca\_disor length=\$1 label="Suspected Chromosomal Disorder C Confirmed";  
 attrib ca\_hypo length=\$1 label="Hypospadias Y Yes";  
 attrib f\_ca\_limb length=3 label="Reporting Flag for Limb Reduction Defect 0 Non-Reporting";  
 attrib f\_ca\_cleft length=3 label="Reporting Flag for Cleft Lip with or without Cleft Palate 0 Non-Reporting";  
 attrib f\_ca\_clpal length=3 label="Reporting Flag for Cleft Palate Alone 0 Non-Reporting";  
 attrib f\_ca\_down length=3 label="Reporting Flag for Down Syndrome 0 Non-Reporting";  
 attrib f\_ca\_disor length=3 label="Reporting Flag for Suspected Chromosomal Disorder 0 Non-Reporting";  
 attrib f\_ca\_hypo length=3 label="Reporting Flag for Hypospadias 0 Non-Reporting";  
 attrib no\_congen length=3 label="No Congenital Anomalies Checked 1 True";  
 attrib itran length=\$1 label="Infant Transferred Y Yes";  
 attrib ilive length=\$1 label="Infant Living at Time of Report Y Yes";  
 attrib bfed length=\$1 label="Infant Breastfed at Discharge Y Yes";  
 attrib f\_bfed length=3 label="Reporting Flag for Breastfed at Discharge 0 Non-Reporting";  
 attrib ubfacil length=3 label="Birth Place 1 Hospital";  
 attrib urf\_diab length=3 label="Diabetes 1 Yes";  
 attrib urf\_chype length=3 label="Chronic Hypertension 1 Yes";  
 attrib urf\_phype length=3 label="Pregnancy Associated Hypertension 1 Yes";  
 attrib urf\_ehype length=3 label="Eclampsia 1 Yes";  
 attrib ume\_forc length=3 label="Forceps 1 Yes";  
 attrib ume\_vacu length=3 label="Vacuum 1 Yes";  
 attrib uop\_indu length=3 label="Induction of Labor 1 Yes";  
 attrib uld\_bree length=3 label="Breech 1 Yes";  
 attrib uca\_anen length=3 label="Anencephalus 1 Anomaly reported";  
 attrib uca\_spina length=3 label="Spina Bifida / Meningocele 1 Anomaly reported";  
 attrib uca\_omph length=3 label="Omphalocele / Gastroschisis 1 Anomaly reported";

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attrib uca_clip    length=3    label="Cleft Lip / Palate 1 Anomaly reported";
attrib uca_hern    length=3    label="Diaphragmatic Hernia 1 Anomaly reported";
attrib uca_down    length=3    label="Down Syndrome 1 Anomaly reported";
attrib flgnd      length=3    label="Match Status 1 Both";
attrib aged       length=3    label="Age at Death in Days";
attrib ager5      length=3    label="Infant Age Recode 5 1 Under 1 Hour";
attrib ager22     length=3    label="Infant Age Recode 22 1 Under 1 Hour";
attrib manner     length=3    label="Manner of Death 1 Accident";
attrib dispo      length=$1    label="Method of Disposition B Burial";
attrib autopsy    length=$1    label="Autopsy Y Yes";
attrib place      length=3    label="Place of Injury for Causes W00-Y34, except Y06.-
and Y07.- 0 Home";
attrib ucodr130   length=3    label="130 Infant Cause Recode";
attrib recwt      length=8    label="Record Weight for Period File";
attrib hospd      length=3    label="Place of Death and Decendent's Status 1 Hospital,
Clinic, Med Center- Inpatient";
attrib dweekday   length=3    label="Day of Week of Death";
attrib dod_yy     length=3    label="Data year 2017";
attrib dod_mm     length=3    label="Month of Death";

```

## INPUT

```

@9  dob_yy      4.
@13 dob_mm     2.
@19 dob_tt     4.
@23 dob_wk     1.
@32 bfacil     1.
@33 f_bfacil   1.
@50 bfacil3    1.
@73 mageimp    1.
@74 magerep    1.
@75 mager      2.
@77 mager14    2.
@79 mager9     1.
@84 mbstate_rec 1.
@104 restatus  1.
@105 mrace31   2.
@107 mrace6    1.
@108 mrace15   2.
@110 mbrace    1.
@111 mraceimp  $1.
@115 mhisp_r   1.
@116 f_mhisp   1.

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@117	mracehisp	1.
@119	mar_p	\$1.
@120	dmar	1.
@121	mar_imp	1.
@123	f_mar_p	1.
@124	meduc	1.
@126	f_meduc	1.
@142	fagerpt_flg	1.
@147	fagecomb	2.
@149	fage11	2.
@151	frace31	2.
@153	frace6	1.
@154	frace15	2.
@156	fbrace	1.
@160	fhispr	1.
@161	f_fhispr	1.
@162	fracehisp	1.
@163	feduc	1.
@165	f_feduc	1.
@171	priorlive	2.
@173	priordead	2.
@175	priorterm	2.
@179	lbo_rec	1.
@182	tpo_rec	1.
@198	illb_r	3.
@201	illb_r11	2.
@206	iloo_r	3.
@209	iloo_r11	2.
@214	ilp_r	3.
@217	ilp_r11	2.
@224	precare	2.
@226	f_mpcb	1.
@227	precare5	1.
@238	previs	2.
@242	previs_rec	2.
@244	f_tpcv	1.
@251	wic	\$1.
@252	f_wic	1.
@253	cig_0	2.
@255	cig_1	2.
@257	cig_2	2.
@259	cig_3	2.
@261	cig0_r	1.

@262	cig1_r	1.
@263	cig2_r	1.
@264	cig3_r	1.
@265	f_cigs_0	1.
@266	f_cigs_1	1.
@267	f_cigs_2	1.
@268	f_cigs_3	1.
@269	cig_rec	\$1.
@270	f_tobaco	1.
@280	mhtr	2.
@282	f_m_ht	1.
@283	bmi	4.1
@287	bmi_r	1.
@292	pwgt_r	3.
@295	f_pwgt	1.
@299	dwgt_r	3.
@303	f_dwgt	1.
@304	wtgain	2.
@306	wtgain_rec	1.
@307	f_wtgain	1.
@313	rf_pdiab	\$1.
@314	rf_gdiab	\$1.
@315	rf_phype	\$1.
@316	rf_ghype	\$1.
@317	rf_ehype	\$1.
@318	rf_ppb	\$1.
@319	f_rf_pdiab	1.
@320	f_rf_gdiab	1.
@321	f_rf_phype	1.
@322	f_rf_ghype	1.
@323	f_rf_ehype	1.
@324	f_rf_ppb	1.
@325	rf_inft	\$1.
@326	rf_drg	\$1.
@327	rf_art	\$1.
@329	f_rf_drg	1.
@330	f_rf_art	1.
@331	rf_cesar	\$1.
@332	rf_cesarn	2.
@335	f_rf_cesar	1.
@336	f_rf_ncesar	1.
@337	no_risks	1.
@343	ip_gon	\$1.

@344	ip_syph	\$1.	
@345	ip_chlam	\$1.	
@346	ip_hepb	\$1.	
@347	ip_hepc	\$1.	
@348	f_ip_gon	1.	
@349	f_ip_syph	1.	
@350	f_ip_chlam	1.	
@351	f_ip_hepb	1.	
@352	f_ip_hepc	1.	
@353	no_infec	1.	
@360	ob_succ	\$1.	
@361	ob_fail	\$1.	
@363	f_ob_succ	1.	
@364	f_ob_fail	1.	
@365	co_seqnum		7.
@372	co_dodyy		4.
@383	ld_indl	\$1.	
@384	ld_augm	\$1.	
@385	ld_ster	\$1.	
@386	ld_antb	\$1.	
@387	ld_chor	\$1.	
@388	ld_anes	\$1.	
@389	f_ld_indl	1.	
@390	f_ld_augm	1.	
@391	f_ld_ster	1.	
@392	f_ld_antb	1.	
@393	f_ld_chor	1.	
@394	f_ld_anes	1.	
@395	no_lbrdlv	1.	
@401	me_pres	\$1.	
@402	me_rout	\$1.	
@403	me_trial	\$1.	
@404	f_me_pres	1.	
@405	f_me_rout	1.	
@406	f_me_trial	1.	
@407	rdmeth_rec	1.	
@408	dmeth_rec	1.	
@409	f_dmeth_rec	1.	
@415	mm_mtr	\$1.	
@416	mm_plac	\$1.	
@417	mm_rupt	\$1.	
@418	mm_uhyst	\$1.	
@419	mm_aicu	\$1.	

@421	f_mm_mtr	1.
@422	f_mm_plac	1.
@423	f_mm_rupt	1.
@424	f_mm_uhyst	1.
@425	f_mm_aicu	1.
@427	no_mmorb	1.
@433	attend	1.
@434	mtran	\$1.
@435	pay	1.
@436	pay_rec	1.
@437	f_pay	1.
@438	f_pay_rec	1.
@444	apgar5	2.
@446	apgar5r	1.
@447	f_apgar5	1.
@448	apgar10	2.
@450	apgar10r	1.
@454	dplural	1.
@456	imp_plur	1.
@459	setorder_r	1.
@475	sex	\$1.
@476	imp_sex	1.
@477	dimp_mm	2.
@481	dimp_yy	4.
@487	compgst_imp	1.
@488	combgst_imp	1.
@489	obgest_flg	1.
@490	combgest	2.
@492	gestrec10	2.
@494	gestrec3	1.
@498	Impused	1.
@499	oegest_comb	2.
@501	oegest_r10	2.
@503	oegest_r3	1.
@509	bwtr14	2.
@511	bwtr4	1.
@512	brthwgt	4.
@516	bwtimp	1.
@517	ab_aven1	\$1.
@518	ab_aven6	\$1.
@519	ab_nicu	\$1.
@520	ab_surf	\$1.
@521	ab_anti	\$1.

@522	ab_seiz	\$1.
@524	f_ab_aven1	1.
@525	f_ab_aven6	1.
@526	f_ab_nicu	1.
@527	f_ab_surf	1.
@528	f_ab_anti	1.
@529	f_ab_seiz	1.
@531	no_abnorm	1.
@537	ca_anen	\$1.
@538	ca_mnsb	\$1.
@539	ca_cchd	\$1.
@540	ca_cdh	\$1.
@541	ca_omph	\$1.
@542	ca_gast	\$1.
@543	f_ca_anen	1.
@544	f_ca_mnsb	1.
@545	f_ca_cchd	1.
@546	f_ca_cdh	1.
@547	f_ca_omph	1.
@548	f_ca_gast	1.
@549	ca_limb	\$1.
@550	ca_cleft	\$1.
@551	ca_clpal	\$1.
@552	ca_down	\$1.
@553	ca_disor	\$1.
@554	ca_hypo	\$1.
@555	f_ca_limb	1.
@556	f_ca_cleft	1.
@557	f_ca_clpal	1.
@558	f_ca_down	1.
@559	f_ca_disor	1.
@560	f_ca_hypo	1.
@561	no_congen	1.
@567	itrn	\$1.
@568	ilive	\$1.
@569	bfed	\$1.
@570	f_bfed	1.
@1330	ubfacil	1.
@1331	urf_diab	1.
@1332	urf_chype	1.
@1333	urf_phype	1.
@1334	urf_ehype	1.
@1335	ume_forc	1.

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@1336 ume_vacu      1.
@1337 uop_indu      1.
@1338 uld_bree      1.
@1340 uca_anen      1.
@1341 uca_spina     1.
@1342 uca_omph      1.
@1343 uca_clip      1.
@1344 uca_hern      1.
@1345 uca_down      1.
@1346 flgnd         1.
@1356 aged          3.
@1359 ager5         1.
@1360 ager22        2.
@1362 manner        1.
@1363 dispo         $1.
@1364 autopsy       $1.
@1366 place         1.
@1373 ucodr130      3.
@1377 recwt         1.7
@1670 hospd         1.
@1671 dweekday      1.
@1672 dod_yy        4.
@1742 dod_mm        2.;

```

```

IF RESTATUS < 4 and dob_yy >2015;
PROC SORT; BY co_seqnum; RUN;

```

```

FILENAME died17 'VS17LINK.Public.USNUMPUB_R2019_05_20';

```

```

DATA d17;
INFILE died17 LRECL = 20000 ;
attrib dob_yy      length=4   label="Birth Year";
attrib dob_mm      length=3   label="Birth Month 01 January";
attrib dob_tt      length=4   label="Time of Birth 0000-2359 Time of Birth";
attrib dob_wk      length=3   label="Birth Day of Week 1 Sunday";
attrib bfacil      length=3   label="Birth Place 1 Hospital";
attrib f_bfacil    length=3   label="Reporting Flag for Birth Place 0 Non-Reporting";
attrib bfacil3     length=3   label="Facility Recode 1 In Hospital";
attrib mageimp     length=3   label="Mother's Age Imputed Blank Age not imputed";
attrib magerep     length=3   label="Reported Age of Mother Used Flag Blank
Reported age not used";
attrib mager       length=3   label="Mother's Single Years of Age 12 10 -- 12 years";
attrib mager14    length=3   label="Mother's Age Recode 14 01 Under 15 Years";
attrib mager9      length=3   label="Mother's Age Recode 9 1 Under 15 years";

```

attrib mbstate\_rec length=3 label="Mother's Nativity 1 Born in the U.S. (50 US States)";  
 attrib restatus length=3 label="Residence Status";  
 attrib mrace31 length=3 label="Mother's Race Recode 31";  
 attrib mrace6 length=3 label="Mother's Race Recode 6";  
 attrib mrace15 length=3 label="Mother's Race Recode 15";  
 attrib mbrace length=3 label="Bridged Race Mother";  
 attrib mraceimp length=\$1 label="Mother's Race Imputed Flag Blank Mother's race not imputed";  
 attrib mhispanic\_r length=3 label="Mother's Hispanic Origin Recode 0 Non-Hispanic";  
 attrib f\_mhispanic length=3 label="Reporting Flag for Mother's Origin 0 Non-Reporting";  
 attrib mracehispanic length=3 label="Mother's Race/Hispanic Origin 1 Non-Hispanic White (only)";  
 attrib mar\_p length=\$1 label="Paternity Acknowledged Y Yes";  
 attrib dmar length=3 label="Marital Status";  
 attrib mar\_imp length=3 label="Mother's Marital Status Imputed Blank Marital Status not imputed";  
 attrib f\_mar\_p length=3 label="Reporting Flag for Paternity Acknowledged 0 Non-Reporting";  
 attrib meduc length=3 label="Mother's Education 1 8th grade or less";  
 attrib f\_meduc length=3 label="Reporting Flag for Education of Mother 0 Non-Reporting";  
 attrib fagerpt\_flg length=3 label="Father's Reported Age Used Blank Father's reported age not u";  
 attrib fagecomb length=3 label="Father's Combined Age (Revised) 09-98 Father's combined age in ye";  
 attrib fage11 length=3 label="Father's Age Recode 11 01 Under 15 years";  
 attrib frace31 length=3 label="Father's Race Recode 31 01 White (only) [only one race]";  
 attrib frace6 length=3 label="Father's Race Recode 6 1 White (only)";  
 attrib frace15 length=3 label="Father's Race Recode 15 01 White (only)";  
 attrib fbrace length=3 label="Bridged Race Father 1 White";  
 attrib fhispanic\_r length=3 label="Father's Hispanic Origin Recode 0 Non-Hispanic";  
 attrib f\_fhispanic length=3 label="Reporting Flag for Father's Origin 0 Non-Reporting";  
 attrib fracehispanic length=3 label="Father's Race/Hispanic Origin 1 Non-Hispanic White (only)";  
 attrib feduc length=3 label="Father's Education 1 8th grade or less";  
 attrib f\_feduc length=3 label="Reporting Flag for Father's Education";  
 attrib priorlive length=3 label="Prior Births Now Living 00-30 Number of children still li";  
 attrib priordead length=3 label="Prior Births Now Dead 00-30 Number of children dead";

attrib priorterm length=3 label="Prior Other Terminations 00-30 Number other terminations";  
 attrib lbo\_rec length=3 label="Live Birth Order Recode 1-7 Number of live birth order.";  
 attrib tpo\_rec length=3 label="Total Birth Order Recode 1-7 Number of total birth order";  
 attrib illb\_r length=3 label="Interval Since Last Live Birth Recode 000-003 Plural delivery";  
 attrib illb\_r11 length=3 label="Interval Since Last Live Birth Recode 11 00 Zero to 3 months (plural de";  
 attrib iloo\_r length=3 label="Interval Since Last Other Pregnancy Recode 000-003 Plural delivery";  
 attrib iloo\_r11 length=3 label="Interval Since Last Other Pregnancy Recode 11 00 Zero to 3 months (plural de";  
 attrib ilp\_r length=3 label="Interval Since Last Pregnancy Recode 000-003 Plural delivery";  
 attrib ilp\_r11 length=3 label="Interval Since Last Pregnancy Recode 11 00 Zero to 3 months (plural de";  
 attrib precare length=3 label="Month Prenatal Care Began 00 No prenatal care";  
 attrib f\_mpcb length=3 label="Reporting Flag for Month Prenatal Care Began 0 Non-Reporting";  
 attrib precare5 length=3 label="Month Prenatal Care Began Recode 1 1st to 3rd month";  
 attrib previs length=3 label="Number of Prenatal Visits (Revised only) 00-98 Number of prenatal visits";  
 attrib previs\_rec length=3 label="Number of Prenatal Visits Recode 01 No visits";  
 attrib f\_tpcv length=3 label="Reporting Flag for Total Prenatal Care Visits 0 Non-Reporting";  
 attrib wic length=\$1 label="WIC Y Yes";  
 attrib f\_wic length=3 label="Reporting Flag for WIC 0 Non-Reporting";  
 attrib cig\_0 length=3 label="Cigarettes Before Pregnancy 00-97 Number of cigarettes daily";  
 attrib cig\_1 length=3 label="Cigarettes 1st Trimester 00-97 Number of cigarettes daily";  
 attrib cig\_2 length=3 label="Cigarettes 2nd Trimester 00-97 Number of cigarettes daily";  
 attrib cig\_3 length=3 label="Cigarettes 3rd Trimester 00-97 Number of cigarettes daily";  
 attrib cig0\_r length=3 label="Cigarettes Before Pregnancy Recode 0 Nonsmoker";  
 attrib cig1\_r length=3 label="Cigarettes 1st Trimester Recode 0 Nonsmoker";  
 attrib cig2\_r length=3 label="Cigarettes 2nd Trimester Recode 0 Nonsmoker";  
 attrib cig3\_r length=3 label="Cigarettes 3rd Trimester Recode 0 Nonsmoker";

attrib f\_cigs\_0 length=3 label="Reporting Flag for Cigarettes before Pregnancy 0 Non-Reporting";  
 attrib f\_cigs\_1 length=3 label="Reporting Flag for Cigarettes 1st Trimester 0 Non-Reporting";  
 attrib f\_cigs\_2 length=3 label="Reporting Flag for Cigarettes 2nd Trimester 0 Non-Reporting";  
 attrib f\_cigs\_3 length=3 label="Reporting Flag for Cigarettes 3rd Trimester 0 Non-Reporting";  
 attrib cig\_rec length=\$1 label="Cigarette Recode (Revised) Y Yes";  
 attrib f\_tobaco length=3 label="Reporting Flag for Tobacco use 0 Non-Reporting";  
 attrib mhtr length=3 label="Mother's Height in Total Inches 30-78 Height in inches";  
 attrib f\_m\_ht length=3 label="Reporting Flag for Mother's Height 0 Non-Reporting";  
 attrib bmi length=8 label="Body Mass Index 13.0-69.9 Body Mass Index";  
 attrib bmi\_r length=3 label="Body Mass Index Recode 1 Underweight <18.5";  
 attrib pwgt\_r length=3 label="Pre-pregnancy Weight Recode 075-375 Weight in pounds";  
 attrib f\_pwgt length=3 label="Reporting Flag for Pre-pregnancy Weight 0 Non-Reporting";  
 attrib dwgt\_r length=3 label="Delivery Weight Recode 100-400 Weight in pounds";  
 attrib f\_dwgt length=3 label="Reporting Flag for Delivery Weight 0 Non-Reporting";  
 attrib wtgain length=3 label="Weight Gain 00-97 Weight gain in pounds";  
 attrib wtgain\_rec length=3 label="Weight Gain Recode 1 Less than 11 pounds";  
 attrib f\_wtgain length=3 label="Reporting Flag for Weight Gain 0 Non-Reporting";  
 attrib rf\_pdiab length=\$1 label="Pre-pregnancy Diabetes Y Yes";  
 attrib rf\_gdiab length=\$1 label="Gestational Diabetes Y Yes";  
 attrib rf\_phype length=\$1 label="Pre-pregnancy Hypertension Y Yes";  
 attrib rf\_ghype length=\$1 label="Gestational Hypertension Y Yes";  
 attrib rf\_ehype length=\$1 label="Hypertension Eclampsia Y Yes";  
 attrib rf\_ppb length=\$1 label="Previous Preterm Birth Y Yes";  
 attrib f\_rf\_pdiab length=3 label="Reporting Flag for Pre-pregnancy Diabetes 0 Non-Reporting";  
 attrib f\_rf\_gdiab length=3 label="Reporting Flag for Gestational Diabetes 0 Non-Reporting";  
 attrib f\_rf\_phype length=3 label="Reporting Flag for Pre-pregnancy Hypertension 0 Non-Reporting";  
 attrib f\_rf\_ghype length=3 label="Reporting Flag for Gestational Hypertension 0 Non-Reporting";  
 attrib f\_rf\_ehype length=3 label="Reporting Flag for Hypertension Eclampsia 0 Non-Reporting";

attrib f\_rf\_ppb length=3 label="Reporting Flag for Previous Preterm Birth 0 Non-Reporting";  
 attrib rf\_inft length=\$1 label="Infertility Treatment Used Y Yes";  
 attrib rf\_drg length=\$1 label="Fertility Enhancing Drugs Y Yes";  
 attrib rf\_art length=\$1 label="Asst. Reproductive Technology Y Yes";  
 attrib f\_rf\_drg length=3 label="Reporting Flag for Fertility Enhance Drugs 0 Non-Reporting";  
 attrib f\_rf\_art length=3 label="Reporting Flag for Reproductive Technology 0 Non-Reporting";  
 attrib rf\_cesar length=\$1 label="Previous Cesarean Y Yes";  
 attrib rf\_cesarn length=3 label="Number of Previous Cesareans 00 None";  
 attrib f\_rf\_cesar length=3 label="Reporting Flag for Previous Cesarean 0 Non-Reporting";  
 attrib f\_rf\_ncesar length=3 label="Reporting Flag for Number of Previous Cesareans 0 Non-Reporting";  
 attrib no\_risks length=3 label="No Risk Factors Reported 1 True";  
 attrib ip\_gon length=\$1 label="Gonorrhea Y Yes";  
 attrib ip\_syph length=\$1 label="Syphilis Y Yes";  
 attrib ip\_chlam length=\$1 label="Chlamydia Y Yes";  
 attrib ip\_hepb length=\$1 label="Hepatitis B Y Yes";  
 attrib ip\_hepc length=\$1 label="Hepatitis C Y Yes";  
 attrib f\_ip\_gon length=3 label="Reporting Flag for Gonorrhea 0 Non-Reporting";  
 attrib f\_ip\_syph length=3 label="Reporting Flag for Syphilis 0 Non-Reporting";  
 attrib f\_ip\_chlam length=3 label="Reporting Flag for Chlamydia 0 Non-Reporting";  
 attrib f\_ip\_hepb length=3 label="Reporting Flag for Hepatitis B 0 Non-Reporting";  
 attrib f\_ip\_hepc length=3 label="Reporting Flag for Hepatitis C 0 Non-Reporting";  
 attrib no\_infec length=3 label="No Infections Reported 1 True";  
 attrib ob\_succ length=\$1 label="Successful External Cephalic Version Y Yes";  
 attrib ob\_fail length=\$1 label="Failed External Cephalic Version Y Yes";  
 attrib f\_ob\_succ length=3 label="Reporting Flag for Successful External Cephalic Version 0 Non-Reporting";  
 attrib f\_ob\_fail length=3 label="Reporting Flag for Failed External Cephalic Version 0 Non-Reporting";  
 attrib co\_seqnum length=7 label="Cohort Sequence Number";  
 attrib co\_dodyy length=4 label="Cohort Year of Death";  
 attrib ld\_indl length=\$1 label="Induction of Labor Y Yes";  
 attrib ld\_augm length=\$1 label="Augmentation of Labor Y Yes";  
 attrib ld\_ster length=\$1 label="Steroids Y Yes";  
 attrib ld\_antb length=\$1 label="Antibiotics Y Yes";  
 attrib ld\_chor length=\$1 label="Chorioamnionitis Y Yes";  
 attrib ld\_anes length=\$1 label="Anesthesia Y Yes";  
 attrib f\_ld\_indl length=3 label="Reporting Flag for Induction of Labor 0 Non-Reporting";

attrib f\_id\_augm length=3 label="Reporting Flag for Augmentation of Labor 0 Non-Reporting";  
 attrib f\_id\_ster length=3 label="Reporting Flag for Steroids 0 Non-Reporting";  
 attrib f\_id\_antb length=3 label="Reporting Flag for Antibiotics 0 Non-Reporting";  
 attrib f\_id\_chor length=3 label="Reporting Flag for Chorioamnionitis 0 Non-Reporting";  
 attrib f\_id\_anes length=3 label="Reporting Flag for Anesthesia 0 Non-Reporting";  
 attrib no\_lbrdlv length=3 label="No Characteristics of Labor Reported 1 True";  
 attrib me\_pres length=\$1 label="Fetal Presentation at Delivery 1 Cephalic";  
 attrib me\_rout length=\$1 label="Final Route and Method of Delivery 1 Spontaneous";  
 attrib me\_trial length=\$1 label="Trial of Labor Attempted (if cesarean) Y Yes";  
 attrib f\_me\_pres length=3 label="Reporting Flag for Fetal Presentation 0 Non-Reporting";  
 attrib f\_me\_rout length=3 label="Reporting Flag for Final Route and Method of Deliver 0 Non-Reporting";  
 attrib f\_me\_trial length=3 label="Reporting Flag for Trial of Labor Attempted 0 Non-Reporting";  
 attrib rdmeth\_rec length=3 label="Delivery Method Recode (revised only) 1 Vaginal (excludes vaginal a";  
 attrib dmeth\_rec length=3 label="Delivery Method Recode Combined 1 Vaginal";  
 attrib f\_dmeth\_rec length=3 label="Reporting Flag for Method of Delivery Recode 0 Non-Reporting";  
 attrib mm\_mtr length=\$1 label="Maternal Transfusion Y Yes";  
 attrib mm\_plac length=\$1 label="Perineal Laceration Y Yes";  
 attrib mm\_rupt length=\$1 label="Ruptured Uterus Y Yes";  
 attrib mm\_uhyst length=\$1 label="Unplanned Hysterectomy Y Yes";  
 attrib mm\_aicu length=\$1 label="Admit to Intensive Care Y Yes";  
 attrib f\_mm\_mtr length=3 label="Reporting Flag for Maternal Transfusion 0 Non-Reporting";  
 attrib f\_mm\_plac length=3 label="PLAC Reporting Flag for Perineal Laceration 0 Non-Reporting";  
 attrib f\_mm\_rupt length=3 label="Reporting Flag for Ruptured Uterus 0 Non-Reporting";  
 attrib f\_mm\_uhyst length=3 label="Reporting Flag for Unplanned Hysterectomy 0 Non-Reporting";  
 attrib f\_mm\_aicu length=3 label="Reporting Flag for Admission to Intensive Care 0 Non-Reporting";  
 attrib no\_mmorb length=3 label="No Maternal Morbidity Reported 1 True";  
 attrib attend length=3 label="Attendant at Birth 1 Doctor of Medicine (MD)";  
 attrib mtran length=\$1 label="Mother Transferred Y Yes";  
 attrib pay length=3 label="Payment Source for Delivery 1 Medicaid";  
 attrib pay\_rec length=3 label="Payment Recode 1 Medicaid";

attrib f\_pay length=3 label="Reporting Flag for Source of Payment 0 Non-Reporting";  
 attrib f\_pay\_rec length=3 label="Reporting Flag for Payment Recode 0 Non-Reporting";  
 attrib apgar5 length=3 label="Five Minute APGAR Score 00-10 A score of 0-10";  
 attrib apgar5r length=3 label="Five Minute APGAR Recode 1 A score of 0-3";  
 attrib f\_apgar5 length=3 label="Reporting Flag for Five minute APGAR 0 Non-Reporting";  
 attrib apgar10 length=3 label="Ten Minute APGAR Score 00-10 A score of 0-10";  
 attrib apgar10r length=3 label="Ten Minute APGAR Recode 1 A score of 0-3";  
 attrib dplural length=3 label="Plurality Recode 1 Single";  
 attrib imp\_plur length=3 label="Plurality Imputed Blank Plurality is imputed";  
 attrib setorder\_r length=3 label="Set Order Recode 1 1st";  
 attrib sex length=\$1 label="Sex of Infant M Male";  
 attrib imp\_sex length=3 label="Imputed Sex Blank Infant Sex not Imputed";  
 attrib dlmp\_mm length=3 label="Last Normal Menses Month 01 January";  
 attrib dlmp\_yy length=4 label="Last Normal Menses Year nnnn Year of last normal menses";  
 attrib compgst\_imp length=3 label="Combined Gestation Imputation Flag Blank Combined Gestation is not i";  
 attrib combgst\_imp length=3 label="Combined Gestation Imputed";  
 attrib obgest\_flg length=3 label="Obstetric Estimate of Gestation Used Flag Blank Obstetric Estimate is not u";  
 attrib combgest length=3 label="Combined Gestation -- Detail in Weeks 17-47 17th through 47th week of";  
 attrib gestrec10 length=3 label="Combined Gestation Recode 10 01 Under 20 weeks";  
 attrib gestrec3 length=3 label="Combined Gestation Recode 3 1 Under 37 weeks";  
 attrib Impused length=3 label="Combined Gestation Used Flag Blank Combined gestation not used";  
 attrib oegest\_comb length=3 label="Obstetric Estimate Edited 17-47 Weeks of gestation";  
 attrib oegest\_r10 length=3 label="Obstetric Estimate Recode10 01 Under 20 weeks";  
 attrib oegest\_r3 length=3 label="Obstetric Estimate Recode 3 1 Under 37 weeks";  
 attrib bwtr14 length=3 label="Birth Weight Recode 14 01 0227 - 0499 grams";  
 attrib bwtr4 length=3 label="Birth Weight Recode 4 1 0227 - 1499 grams";  
 attrib brthwgt length=4 label="Imputed Birth Weight";  
 attrib bwtemp length=3 label="Birth Weight Imputed Flag";  
 attrib ab\_aven1 length=\$1 label="Assisted Ventilation (immediately) Y Yes";  
 attrib ab\_aven6 length=\$1 label="Assisted Ventilation > 6 hrs Y Yes";  
 attrib ab\_nicu length=\$1 label="Admission to NICU Y Yes";  
 attrib ab\_surf length=\$1 label="Surfactant Y Yes";

attrib ab\_anti length=\$1 label="Antibiotics for Newborn Y Yes";  
 attrib ab\_seiz length=\$1 label="Seizures Y Yes";  
 attrib f\_ab\_aven1 length=3 label="Reporting Flag for Assisted Ventilation  
 (immediately) 0 Non-Reporting";  
 attrib f\_ab\_aven6 length=3 label="Reporting Flag for Assisted Ventilation >6 hrs 0  
 Non-Reporting";  
 attrib f\_ab\_nicu length=3 label="Reporting Flag for Admission to NICU 0 Non-  
 Reporting";  
 attrib f\_ab\_surf length=3 label="Reporting Flag for Surfactant 0 Non-Reporting";  
 attrib f\_ab\_anti length=3 label="Reporting Flag for Antibiotics 0 Non-Reporting";  
 attrib f\_ab\_seiz length=3 label="Reporting Flag for Seizures 0 Non-Reporting";  
 attrib no\_abnorm length=3 label="No Abnormal Conditions Checked 1 True";  
 attrib ca\_anen length=\$1 label="Anencephaly Y Yes";  
 attrib ca\_mnsb length=\$1 label="Meningomyelocele / Spina Bifida Y Yes";  
 attrib ca\_cchd length=\$1 label="Cyanotic Congenital Heart Disease Y Yes";  
 attrib ca\_cdh length=\$1 label="Congenital Diaphragmatic Hernia Y Yes";  
 attrib ca\_omph length=\$1 label="Omphalocele Y Yes";  
 attrib ca\_gast length=\$1 label="Gastroschisis Y Yes";  
 attrib f\_ca\_anen length=3 label="Reporting Flag for Anencephaly 0 Non-  
 Reporting";  
 attrib f\_ca\_mnsb length=3 label="Reporting Flag for Meningomyelocele/Spina  
 Bifida 0 Non-Reporting";  
 attrib f\_ca\_cchd length=3 label="Reporting Flag for Cyanotic Congenital Heart  
 Disease 0 Non-Reporting";  
 attrib f\_ca\_cdh length=3 label="Reporting Flag for Congenital Diaphragmatic  
 Hernia 0 Non-Reporting";  
 attrib f\_ca\_omph length=3 label="Reporting Flag for Omphalocele 0 Non-  
 Reporting";  
 attrib f\_ca\_gast length=3 label="Reporting Flag for Gastroschisis 0 Non-  
 Reporting";  
 attrib ca\_limb length=\$1 label="Limb Reduction Defect Y Yes";  
 attrib ca\_cleft length=\$1 label="Cleft Lip w/ or w/o Cleft Palate Y Yes";  
 attrib ca\_clpal length=\$1 label="Cleft Palate alone Y Yes";  
 attrib ca\_down length=\$1 label="Down Syndrome C Confirmed";  
 attrib ca\_disor length=\$1 label="Suspected Chromosomal Disorder C Confirmed";  
 attrib ca\_hypo length=\$1 label="Hypospadias Y Yes";  
 attrib f\_ca\_limb length=3 label="Reporting Flag for Limb Reduction Defect 0 Non-  
 Reporting";  
 attrib f\_ca\_cleft length=3 label="Reporting Flag for Cleft Lip with or without Cleft  
 Palate 0 Non-Reporting";  
 attrib f\_ca\_clpal length=3 label="Reporting Flag for Cleft Palate Alone 0 Non-  
 Reporting";

attrib f\_ca\_down length=3 label="Reporting Flag for Down Syndrome 0 Non-Reporting";  
 attrib f\_ca\_disor length=3 label="Reporting Flag for Suspected Chromosomal Disorder 0 Non-Reporting";  
 attrib f\_ca\_hypo length=3 label="Reporting Flag for Hypospadias 0 Non-Reporting";  
 attrib no\_congen length=3 label="No Congenital Anomalies Checked 1 True";  
 attrib itran length=\$1 label="Infant Transferred Y Yes";  
 attrib ilive length=\$1 label="Infant Living at Time of Report Y Yes";  
 attrib bfed length=\$1 label="Infant Breastfed at Discharge Y Yes";  
 attrib f\_bfed length=3 label="Reporting Flag for Breastfed at Discharge 0 Non-Reporting";  
 attrib ubfacil length=3 label="Birth Place 1 Hospital";  
 attrib urf\_diab length=3 label="Diabetes 1 Yes";  
 attrib urf\_chype length=3 label="Chronic Hypertension 1 Yes";  
 attrib urf\_phype length=3 label="Pregnancy Associated Hypertension 1 Yes";  
 attrib urf\_ehype length=3 label="Eclampsia 1 Yes";  
 attrib ume\_forc length=3 label="Forceps 1 Yes";  
 attrib ume\_vacu length=3 label="Vacuum 1 Yes";  
 attrib uop\_indu length=3 label="Induction of Labor 1 Yes";  
 attrib uld\_bree length=3 label="Breech 1 Yes";  
 attrib uca\_anen length=3 label="Anencephalus 1 Anomaly reported";  
 attrib uca\_spina length=3 label="Spina Bifida / Meningocele 1 Anomaly reported";  
 attrib uca\_omph length=3 label="Omphalocele / Gastroschisis 1 Anomaly reported";  
 attrib uca\_clip length=3 label="Cleft Lip / Palate 1 Anomaly reported";  
 attrib uca\_hern length=3 label="Diaphragmatic Hernia 1 Anomaly reported";  
 attrib uca\_down length=3 label="Down Syndrome 1 Anomaly reported";  
 attrib flgnd length=3 label="Match Status 1 Both";  
 attrib aged length=3 label="Age at Death in Days";  
 attrib ager5 length=3 label="Infant Age Recode 5 1 Under 1 Hour";  
 attrib ager22 length=3 label="Infant Age Recode 22 1 Under 1 Hour";  
 attrib manner length=3 label="Manner of Death 1 Accident";  
 attrib dispo length=\$1 label="Method of Disposition B Burial";  
 attrib autopsy length=\$1 label="Autopsy Y Yes";  
 attrib place length=3 label="Place of Injury for Causes W00-Y34, except Y06.- and Y07.- 0 Home";  
 attrib ucodr130 length=3 label="130 Infant Cause Recode";  
 attrib recwt length=8 label="Record Weight for Period File";  
 attrib hospd length=3 label="Place of Death and Decendent's Status 1 Hospital, Clinic, Med Center- Inpatient";  
 attrib dweekday length=3 label="Day of Week of Death";  
 attrib dod\_yy length=3 label="Data year 2017";

attrib dod\_mm            length=3    label="Month of Death";

## INPUT

@9    dob\_yy            4.  
@13   dob\_mm            2.  
@19   dob\_tt            4.  
@23   dob\_wk            1.  
@32   bfacil            1.  
@33   f\_bfacil          1.  
@50   bfacil3           1.  
@73   mageimp           1.  
@74   magerep           1.  
@75   mager            2.  
@77   mager14           2.  
@79   mager9            1.  
@84   mbstate\_rec       1.  
@104   restatus          1.  
@105   mrace31           2.  
@107   mrace6            1.  
@108   mrace15           2.  
@110   mbrace            1.  
@111   mraceimp          \$1.  
@115   mhispr            1.  
@116   f\_mhispr          1.  
@117   mracehispr        1.  
@119   mar\_p            \$1.  
@120   dmar              1.  
@121   mar\_imp           1.  
@123   f\_mar\_p           1.  
@124   meduc            1.  
@126   f\_meduc           1.  
@142   fagerpt\_flg       1.  
@147   fagecomb          2.  
@149   fage11            2.  
@151   frace31           2.  
@153   frace6            1.  
@154   frace15           2.  
@156   fbrace            1.  
@160   fhispr            1.  
@161   f\_fhispr          1.  
@162   fracehispr        1.  
@163   feduc             1.

@165	f_feduc	1.
@171	priorlive	2.
@173	priordead	2.
@175	priorterm	2.
@179	lbo_rec	1.
@182	tpo_rec	1.
@198	illb_r	3.
@201	illb_r11	2.
@206	iloo_r	3.
@209	iloo_r11	2.
@214	ilp_r	3.
@217	ilp_r11	2.
@224	precare	2.
@226	f_mpcb	1.
@227	precare5	1.
@238	previs	2.
@242	previs_rec	2.
@244	f_tpcv	1.
@251	wic	\$1.
@252	f_wic	1.
@253	cig_0	2.
@255	cig_1	2.
@257	cig_2	2.
@259	cig_3	2.
@261	cig0_r	1.
@262	cig1_r	1.
@263	cig2_r	1.
@264	cig3_r	1.
@265	f_cigs_0	1.
@266	f_cigs_1	1.
@267	f_cigs_2	1.
@268	f_cigs_3	1.
@269	cig_rec	\$1.
@270	f_tobaco	1.
@280	mhtr	2.
@282	f_m_ht	1.
@283	bmi	4.1
@287	bmi_r	1.
@292	pwgt_r	3.
@295	f_pwgt	1.
@299	dwgt_r	3.
@303	f_dwgt	1.
@304	wtgain	2.

@306	wtgain_rec	1.
@307	f_wtgain	1.
@313	rf_pdiab	\$1.
@314	rf_gdiab	\$1.
@315	rf_phype	\$1.
@316	rf_ghype	\$1.
@317	rf_ehype	\$1.
@318	rf_ppb	\$1.
@319	f_rf_pdiab	1.
@320	f_rf_gdiab	1.
@321	f_rf_phype	1.
@322	f_rf_ghype	1.
@323	f_rf_ehype	1.
@324	f_rf_ppb	1.
@325	rf_inft	\$1.
@326	rf_drg	\$1.
@327	rf_art	\$1.
@329	f_rf_drg	1.
@330	f_rf_art	1.
@331	rf_cesar	\$1.
@332	rf_cesarn	2.
@335	f_rf_cesar	1.
@336	f_rf_ncesar	1.
@337	no_risks	1.
@343	ip_gon	\$1.
@344	ip_syph	\$1.
@345	ip_chlam	\$1.
@346	ip_hepb	\$1.
@347	ip_hepc	\$1.
@348	f_ip_gon	1.
@349	f_ip_syph	1.
@350	f_ip_chlam	1.
@351	f_ip_hepb	1.
@352	f_ip_hepc	1.
@353	no_infec	1.
@360	ob_succ	\$1.
@361	ob_fail	\$1.
@363	f_ob_succ	1.
@364	f_ob_fail	1.
@365	co_seqnum	7.
@372	co_dodyy	4.
@383	ld_incl	\$1.
@384	ld_augm	\$1.

@385	ld_ster	\$1.
@386	ld_antb	\$1.
@387	ld_chor	\$1.
@388	ld_anes	\$1.
@389	f_ld_indl	1.
@390	f_ld_augm	1.
@391	f_ld_ster	1.
@392	f_ld_antb	1.
@393	f_ld_chor	1.
@394	f_ld_anes	1.
@395	no_lbrdlv	1.
@401	me_pres	\$1.
@402	me_rout	\$1.
@403	me_trial	\$1.
@404	f_me_pres	1.
@405	f_me_rout	1.
@406	f_me_trial	1.
@407	rdmeth_rec	1.
@408	dmeth_rec	1.
@409	f_dmeth_rec	1.
@415	mm_mtr	\$1.
@416	mm_plac	\$1.
@417	mm_rupt	\$1.
@418	mm_uhyst	\$1.
@419	mm_aicu	\$1.
@421	f_mm_mtr	1.
@422	f_mm_plac	1.
@423	f_mm_rupt	1.
@424	f_mm_uhyst	1.
@425	f_mm_aicu	1.
@427	no_mmorb	1.
@433	attend	1.
@434	mtran	\$1.
@435	pay	1.
@436	pay_rec	1.
@437	f_pay	1.
@438	f_pay_rec	1.
@444	apgar5	2.
@446	apgar5r	1.
@447	f_apgar5	1.
@448	apgar10	2.
@450	apgar10r	1.
@454	dplural	1.

@456	imp_plur	1.
@459	setorder_r	1.
@475	sex	\$1.
@476	imp_sex	1.
@477	dimp_mm	2.
@481	dimp_yy	4.
@487	compgst_imp	1.
@488	combgst_imp	1.
@489	obgest_flg	1.
@490	combgest	2.
@492	gestrec10	2.
@494	gestrec3	1.
@498	lmpused	1.
@499	oegest_comb	2.
@501	oegest_r10	2.
@503	oegest_r3	1.
@509	bwtr14	2.
@511	bwtr4	1.
@512	brthwgt	4.
@516	bwtmp	1.
@517	ab_aven1	\$1.
@518	ab_aven6	\$1.
@519	ab_nicu	\$1.
@520	ab_surf	\$1.
@521	ab_anti	\$1.
@522	ab_seiz	\$1.
@524	f_ab_aven1	1.
@525	f_ab_aven6	1.
@526	f_ab_nicu	1.
@527	f_ab_surf	1.
@528	f_ab_anti	1.
@529	f_ab_seiz	1.
@531	no_abnorm	1.
@537	ca_anen	\$1.
@538	ca_mnsb	\$1.
@539	ca_cchd	\$1.
@540	ca_cdh	\$1.
@541	ca_omph	\$1.
@542	ca_gast	\$1.
@543	f_ca_anen	1.
@544	f_ca_mnsb	1.
@545	f_ca_cchd	1.
@546	f_ca_cdh	1.

@547 f_ca_omph	1.
@548 f_ca_gast	1.
@549 ca_limb	\$1.
@550 ca_cleft	\$1.
@551 ca_clpal	\$1.
@552 ca_down	\$1.
@553 ca_disor	\$1.
@554 ca_hypo	\$1.
@555 f_ca_limb	1.
@556 f_ca_cleft	1.
@557 f_ca_clpal	1.
@558 f_ca_down	1.
@559 f_ca_disor	1.
@560 f_ca_hypo	1.
@561 no_congen	1.
@567 itran	\$1.
@568 ilive	\$1.
@569 bfed	\$1.
@570 f_bfed	1.
@1330 ubfacil	1.
@1331 urf_diab	1.
@1332 urf_chype	1.
@1333 urf_phype	1.
@1334 urf_ehype	1.
@1335 ume_forc	1.
@1336 ume_vacu	1.
@1337 uop_indu	1.
@1338 uld_bree	1.
@1340 uca_anen	1.
@1341 uca_spina	1.
@1342 uca_omph	1.
@1343 uca_clip	1.
@1344 uca_hern	1.
@1345 uca_down	1.
@1346 flgnd	1.
@1356 aged	3.
@1359 ager5	1.
@1360 ager22	2.
@1362 manner	1.
@1363 dispo	\$1.
@1364 autopsy	\$1.
@1366 place	1.
@1373 ucodr130	3.

```

@1377 recwt      1.7
@1670 hospd      1.
@1671 dweekday   1.
@1672 dod_yy     4.
@1742 dod_mm     2.;
IF restatus <4 and dob_yy >2016;
PROC SORT; BY co_seqnum; RUN;

```

```

DATA B16D16;
MERGE b16 d16; BY co_seqnum;
run;

```

```

DATA thesis;
MERGE B16D16 d17; BY co_seqnum;
RUN;
#
## Missing as 0 or 9
#

```

```

thesis$mar_p<- thesis$mar_p %>% fct_collapse(X = c("", "X"), group_other = FALSE)
thesis$dmar[is.na(thesis$dmar)]<-9
thesis$mageimp[is.na(thesis$mageimp)]<-0
thesis$magerep[is.na(thesis$magerep)]<-0
thesis$mraceimp[is.na(thesis$mraceimp)]<-0
thesis$mar_imp[is.na(thesis$mar_imp)]<-0
thesis$imp_plur[is.na(thesis$imp_plur)]<-0
thesis$imp_sex[is.na(thesis$imp_sex)]<-0
thesis$combgst_imp[is.na(thesis$combgst_imp)]<-0
thesis$obgest_flg[is.na(thesis$obgest_flg)]<-0
thesis$Impused[is.na(thesis$Impused)]<-0
thesis$bwtimp[is.na(thesis$bwtimp)]<-0
thesis$flgnd[is.na(thesis$flgnd)]<-0
thesis$ager22[is.na(thesis$ager22)]<-99
thesis$manner[is.na(thesis$manner)]<-9
thesis$place[is.na(thesis$place)]<-99

```

```

#
## Factor variables
#
thesis1$bfacil3 <- factor(thesis1$bfacil3, #levels = c("1", "2", "9"),
                        levels = c("Hospital", "Not Hospital", "Unknown"))
thesis1$mager14 <- factor(thesis1$mager14, # levels =
c("1", "3", "4", "5", "6", "7", "8", "9", "10", "11", "12", "13", "14"),

```

```

levels = c("< 15", "15", "16", "17", "18", "19", "20-24", "25-29", "30-34", "35-39", "40-44", "45-49", "50-54"))
thesis1$mbstate_rec <- factor(thesis1$mbstate_rec, #levels = c("1", "2", "3"),
levels = c("Born in US", "Not born in US", "Unknown"))
thesis1$restatus <- factor(thesis1$restatus, #levels = c("1", "2", "3"),
levels = c("Resident", "Intrastate Non-res", "Interstate Non-res"))
thesis1$mracehisp <- factor(thesis1$mracehisp, #levels =
c("1", "2", "3", "4", "5", "6", "7", "8"),
levels = c("Non-Hisp White", "Non-Hisp Black", "Non-Hisp AIAN", "Non-
Hisp Asian", "Non-Hisp NHOPI", "Non-Hisp More than one race", "Hispanic", "Unknown"))
thesis1$mar_p <- factor(thesis1$mar_p, #levels = c("Y", "N", "U", "X"),
levels = c("Yes", "No", "Unknown", "Not_Applicable"))
thesis1$dmar <- factor(thesis1$dmar, #levels = c("1", "2", "9"),
levels = c("Married", "Unmarried", "Unknown"))
thesis1$meduc <- factor(thesis1$meduc, # levels = c("1", "2", "3", "4", "5", "6", "7", "8", "9"),
levels = c("< 9th grade", "9-12 grade", "HS Grad/GED", "Some
college", "Associate degree", "Bachelor's degree", "Master's degree", "Doctorate or
Professional degree", "Unknown"))
thesis1$fage11 <- factor(thesis1$fage11, # levels =
c("1", "2", "3", "4", "5", "6", "7", "8", "9", "10", "11"),
levels = c("< 15", "15-19", "20-24", "25-29", "30-34", "35-39", "40-44", "45-
49", "50-54", "55+", "Unknown"))
thesis1$fracehisp <- factor(thesis1$fracehisp, #levels =
c("1", "2", "3", "4", "5", "6", "7", "8", "9"),
levels = c("Non-Hisp White", "Non-Hisp Black", "Non-Hisp AIAN", "Non-
Hisp Asian", "Non-Hisp NHOPI", "Non-Hisp More than one race", "Hispanic", "Unknown"))
thesis1$feduc <- factor(thesis1$feduc, #levels = c("1", "2", "3", "4", "5", "6", "7", "8", "9"),
levels = c("< 9th grade", "9-12 grade", "HS Grad/GED", "Some
college", "Associate degree", "Bachelor's degree", "Master's degree", "Doctorate or
Professional degree", "Unknown"))
thesis1$illb_r11 <- factor(thesis1$illb_r11, #levels =
c("0", "1", "2", "3", "4", "5", "6", "7", "8", "88", "99"),
levels = c("0-3 months", "4-11 months", "12-17 months", "18-23
months", "24-35 months", "36-47 months", "48-59 months", "60-71 months", "72+
months", "1st live birth", "Unknown"))
thesis1$iloo_r11 <- factor(thesis1$iloo_r11, #levels =
c("0", "1", "2", "3", "4", "5", "6", "7", "8", "88", "99"),
levels = c("0-3 months", "4-11 months", "12-17 months", "18-23
months", "24-35 months", "36-47 months", "48-59 months", "60-71 months", "72+
months", "1st live birth", "Unknown"))
thesis1$ilp_r11 <- factor(thesis1$ilp_r11, #levels =
c("0", "1", "2", "3", "4", "5", "6", "7", "8", "88", "99"),

```

```

      levels = c("0-3 months", "4-11 months", "12-17 months", "18-23
months", "24-35 months", "36-47 months", "48-59 months", "60-71 months", "72+
months", "1st live birth", "Unknown"))
thesis1$precare5 <- factor(thesis1$precare5, # levels = c("1", "2", "3", "4", "5"),
      levels = c("1st Trimester", "2nd Trimester", "3rd Trimester", "No prenatal
care", "Unknown"))
thesis1$previs_rec <- factor(thesis1$previs_rec, # levels =
c("1", "2", "3", "4", "5", "6", "7", "8", "9", "10", "11", "12"),
      levels = c("None", "1-2", "3-4", "5-6", "7-8", "9-10", "11-12", "13-14", "15-
16", "17-18", "19+", "Unknown"))
thesis1$wic <- factor(thesis1$wic, #levels = c("Y", "N", "U"),
      levels = c("No", "Yes", "Unknown"))
thesis1$scig0_r <- factor(thesis1$scig0_r, # levels = c("0", "1", "2", "3", "4", "5", "6"),
      levels = c("Nonsmoker", "1-5", "6-10", "11-20", "21-40", "41+", "Unknown"))
thesis1$scig1_r <- factor(thesis1$scig1_r, #levels = c("0", "1", "2", "3", "4", "5", "6"),
      levels = c("Nonsmoker", "1-5", "6-10", "11-20", "21-40", "41+", "Unknown"))
thesis1$scig2_r <- factor(thesis1$scig2_r, #levels = c("0", "1", "2", "3", "4", "5", "6"),
      levels = c("Nonsmoker", "1-5", "6-10", "11-20", "21-40", "41+", "Unknown"))
thesis1$scig3_r <- factor(thesis1$scig3_r, #levels = c("0", "1", "2", "3", "4", "5", "6"),
      levels = c("Nonsmoker", "1-5", "6-10", "11-20", "21-40", "41+", "Unknown"))
thesis1$rf_pdiab <- factor(thesis1$rf_pdiab, # levels = c("Y", "N", "U"),
      levels = c("No", "Yes", "Unknown"))
thesis1$rf_gdiab <- factor(thesis1$rf_gdiab, #levels = c("Y", "N", "U"),
      levels = c("No", "Yes", "Unknown"))
thesis1$rf_ghype <- factor(thesis1$rf_ghype, #levels = c("Y", "N", "U"),
      levels = c("No", "Yes", "Unknown"))
thesis1$rf_ehype <- factor(thesis1$rf_ehype, #levels = c("Y", "N", "U"),
      levels = c("No", "Yes", "Unknown"))
thesis1$rf_ppb <- factor(thesis1$rf_ppb, #levels = c("Y", "N", "U"),
      levels = c("No", "Yes", "Unknown"))
thesis1$rf_inft <- factor(thesis1$rf_inft, # levels = c("Y", "N", "U"),
      levels = c("No", "Yes", "Unknown"))
thesis1$rf_drg <- factor(thesis1$rf_drg, #levels = c("Y", "N", "X", "U"),
      levels = c("No", "Yes", "Not Applicable", "Unknown"))
thesis1$rf_art <- factor(thesis1$rf_art, #levels = c("Y", "N", "X", "U"),
      levels = c("No", "Yes", "Not Applicable", "Unknown"))
thesis1$ip_gon <- factor(thesis1$ip_gon, #levels = c("Y", "N", "U"),
      levels = c("No", "Yes", "Unknown"))
thesis1$ip_syph <- factor(thesis1$ip_syph, # levels = c("Y", "N", "U"),
      levels = c("No", "Yes", "Unknown"))
thesis1$ip_chlam <- factor(thesis1$ip_chlam, # levels = c("Y", "N", "U"),
      levels = c("No", "Yes", "Unknown"))
thesis1$ip_hepb <- factor(thesis1$ip_hepb, #levels = c("Y", "N", "U"),

```

```

      levels = c("No", "Yes", "Unknown"))
thesis1$ip_hepc <- factor(thesis1$ip_hepc, #levels = c("Y", "N", "U"),
      levels = c("No", "Yes", "Unknown"))
thesis1$ob_succ <- factor(thesis1$ob_succ, #levels = c("Y", "N", "U"),
      levels = c("Yes", "No", "Unknown"))
thesis1$ob_fail <- factor(thesis1$ob_fail, #levels = c("Y", "N", "U"),
      levels = c("No", "Yes", "Unknown"))
thesis1$id_incl <- factor(thesis1$id_incl, #levels = c("Y", "N", "U"),
      levels = c("No", "Yes", "Unknown"))
thesis1$id_augm <- factor(thesis1$id_augm, #levels = c("Y", "N", "U"),
      levels = c("No", "Yes", "Unknown"))
thesis1$id_ster <- factor(thesis1$id_ster, #levels = c("Y", "N", "U"),
      levels = c("No", "Yes", "Unknown"))
thesis1$id_antb <- factor(thesis1$id_antb, #levels = c("Y", "N", "U"),
      levels = c("No", "Yes", "Unknown"))
thesis1$id_chor <- factor(thesis1$id_chor, #levels = c("Y", "N", "U"),
      levels = c("No", "Yes", "Unknown"))
thesis1$id_anes <- factor(thesis1$id_anes, #levels = c("Y", "N", "U"),
      levels = c("No", "Yes", "Unknown"))
thesis1$me_pres <- factor(thesis1$me_pres, #levels = c("1", "2", "3", "9"),
      levels = c("Cephalic", "Breech", "Other", "Unknown"))
thesis1$me_rout <- factor(thesis1$me_rout, #levels = c("1", "2", "3", "4", "9"),
      levels = c("Spontaneous", "Cesarean", "Forceps", "Vacuum", "Unknown"))
thesis1$me_trial <- factor(thesis1$me_trial, # levels = c("Y", "N", "X", "U"),
      levels = c("Yes", "No", "Not applicable", "Unknown"))
thesis1$dmeth_rec <- factor(thesis1$dmeth_rec, # levels = c("1", "2", "9"),
      levels = c("Vaginal", "C-Sect", "Unknown"))
thesis1$mm_mtr <- factor(thesis1$mm_mtr, #levels = c("Y", "N", "U"),
      levels = c("No", "Yes", "Unknown"))
thesis1$mm_plac <- factor(thesis1$mm_plac, # levels = c("Y", "N", "U"),
      levels = c("No", "Yes", "Unknown"))
thesis1$mm_rupt <- factor(thesis1$mm_rupt, #levels = c("Y", "N", "U"),
      levels = c("No", "Yes", "Unknown"))
thesis1$mm_uhyst <- factor(thesis1$mm_uhyst, # levels = c("Y", "N", "U"),
      levels = c("No", "Yes", "Unknown"))
thesis1$mm_aicu <- factor(thesis1$mm_aicu, #levels = c("Y", "N", "U"),
      levels = c("No", "Yes", "Unknown"))
thesis1$attend <- factor(thesis1$attend, #levels = c("1", "2", "3", "4", "5", "9"),
      levels = c("Dr of Med", "Dr of Osteo", "Cert Nurse Midwife", "Other
Midwife", "Other", "Unknown"))
thesis1$mtran <- factor(thesis1$mtran, # levels = c("Y", "N", "U"),
      levels = c("No", "Yes", "Unknown"))
thesis1$pay_rec <- factor(thesis1$pay_rec, # levels = c("1", "2", "3", "4", "9"),

```

```

      levels = c("Medicaid", "Private Ins", "Self-pay", "Other", "Unknown"))
thesis1$apgar5r <- factor(thesis1$apgar5r, #levels = c("1", "2", "3", "4", "5"),
      levels = c("0-3", "4-6", "7-8", "9-10", "Unknown"))
thesis1$dplural <- factor(thesis1$dplural, #levels = c("1", "2", "3", "4", "5"),
      levels = c("Single", "Twin", "Triplet", "Quadruplet", "Quintuplet+"))
thesis1$setorder_r <- factor(thesis1$setorder_r, # levels = c("1", "2", "3", "4", "5", "9"),
      levels = c("1st", "2nd", "3rd", "4th", "5th+", "Unknown"))
thesis1$sex <- factor(thesis1$sex, #levels = c("M", "F"),
      levels = c("Male", "Female"))
thesis1$ogest_r10 <- factor(thesis1$ogest_r10, # levels =
c("1", "2", "3", "4", "5", "6", "7", "8", "9", "10", "99"),
      levels = c("< 20 weeks", "20-27 weeks", "28-31 weeks", "32-33
weeks", "34-36 weeks", "37-38 weeks", "39 weeks", "40 weeks", "41 weeks", "42+
weeks", "Unknown"))
thesis1$bwtr4 <- factor(thesis1$bwtr4, #levels = c("1", "2", "3", "4"),
      levels = c("227-1499 grams", "1500-2499 grams", "2500-8165
grams", "Unknown"))
thesis1$ab_aven1 <- factor(thesis1$ab_aven1, #levels = c("Y", "N", "U"),
      levels = c("No", "Yes", "Unknown"))
thesis1$ab_aven6 <- factor(thesis1$ab_aven6, # levels = c("Y", "N", "U"),
      levels = c("No", "Yes", "Unknown"))
thesis1$ab_nicu <- factor(thesis1$ab_nicu, # levels = c("Y", "N", "U"),
      levels = c("No", "Yes", "Unknown"))
thesis1$ab_surf <- factor(thesis1$ab_surf, # levels = c("Y", "N", "U"),
      levels = c("No", "Yes", "Unknown"))
thesis1$ab_anti <- factor(thesis1$ab_anti, # levels = c("Y", "N", "U"),
      levels = c("No", "Yes", "Unknown"))
thesis1$ab_seiz <- factor(thesis1$ab_seiz, # levels = c("Y", "N", "U"),
      levels = c("No", "Yes", "Unknown"))
thesis1$ca_anen <- factor(thesis1$ca_anen, # levels = c("Y", "N", "U"),
      levels = c("No", "Yes", "Unknown"))
thesis1$ca_mnsb <- factor(thesis1$ca_mnsb, # levels = c("Y", "N", "U"),
      levels = c("No", "Yes", "Unknown"))
thesis1$ca_cchd <- factor(thesis1$ca_cchd, # levels = c("Y", "N", "U"),
      levels = c("No", "Yes", "Unknown"))
thesis1$ca_cdh <- factor(thesis1$ca_cdh, #levels = c("Y", "N", "U"),
      levels = c("No", "Yes", "Unknown"))
thesis1$ca_omph <- factor(thesis1$ca_omph, #levels = c("Y", "N", "U"),
      levels = c("No", "Yes", "Unknown"))
thesis1$ca_gast <- factor(thesis1$ca_gast, #levels = c("Y", "N", "U"),
      levels = c("No", "Yes", "Unknown"))
thesis1$ca_limb <- factor(thesis1$ca_limb, #levels = c("Y", "N", "U"),
      levels = c("No", "Yes", "Unknown"))

```

```

thesis1$ca_hypo <- factor(thesis1$ca_hypo,# levels = c("Y","N","U"),
  levels = c("No","Yes","Unknown"))
thesis1$itrn <- factor(thesis1$itrn,# levels = c("Y","N","U"),
  levels = c("No","Yes","Unknown"))
thesis1$bfed <- factor(thesis1$bfed, #levels = c("Y","N","U"),
  levels = c("No","Yes","Unknown"))
thesis1$surf_phype <- factor(thesis1$surf_phype, #levels = c("1","2","9"),
  levels = c("No","Yes","Unknown"))
thesis1$surf_ehype <- factor(thesis1$surf_ehype,# levels = c("1","2","9"),
  levels = c("No","Yes","Unknown"))
thesis1$uca_clip <- factor(thesis1$uca_clip, #levels = c("1","2","9"),
  levels = c("No","Yes","Unknown"))
thesis1$uca_down <- factor(thesis1$uca_down, #levels = c("1","2","9"),
  levels = c("No","Yes","Unknown"))

# Create time variable
#
# Right
# thesis$dod_mm + thesis$dod_yy

thesis$DOB <- paste(thesis$dob_mm, "01", thesis$dob_yy)
thesis$DOD <- paste(thesis$dod_mm, "02", thesis$dod_yy)

thesis$DOB <- as.Date(thesis$DOB, "%b %d %Y")
thesis$DOD <- as.Date(thesis$DOD, "%b %d %Y")

thesis<- thesis %>%
  mutate(os_mon = as.numeric(difftime(DOD, DOB, units = "days"))/ 30.44)

thesis<- thesis[
  with(thesis, order(os_mon)),]

# event indicator
# thesis$flgnd

thesis$flgnd<- as.numeric(thesis$flgnd)

#
# Subset data to exclude recoded and flags
#

thesis2 <- subset(thesis1, select = c(bfacil3, mager14, mracehisp, meduc, dmar, mar_p,

```

```

mbstate_rec, restatus, fage11, fracehisp, feduc,
priorlive, priordead, priorterm, lbo_rec, tpo_rec,
wic, bfed, bmi, mhtr, precare5, previs_rec, pwgt_r,
dwgt_r, wtgain, pay_rec, cig0_r, cig1_r, cig2_r,
cig3_r, rf_pdiab, rf_gdiab, urf_phype, rf_ghype,
urf_ehype, rf_ppb, rf_inft, rf_drg, rf_art, rf_cesarn,
ip_gon, ip_chlam, ip_syph, ip_hepb, ip_hepc, illb_r11,
iloo_r11, ilp_r11, ld_indl, ld_augm, ld_ster, ld_antb,
ld_chor, ld_anes, me_pres, me_rout, me_trial, ob_succ,
ob_fail, dmeth_rec, mm_mtr, mm_plac, mm_rupt, mm_uhyst,
mm_aicu, attend, mtran, itran, apgar5r, dplural,
setorder_r, sex, oegest_r10, bwtr4, ab_aven1, ab_aven6,
ab_nicu, ab_surf, ab_anti, ab_seiz, os_mon, flgnd))

```

```

#
# Frequency tables (TableOne)
#

```

```

parental_vars <- c("mracehisp", "mager14", "meduc", "dmar", "mhtr",
  "pwgt_r", "dwgt_r", "wtgain", "bmi",
  "mbstate_rec", "restatus", "wic", "bfed",
  "precare5", "previs_rec", "pay_rec",
  "priorlive", "priordead", "priorterm",
  "mar_p", "fage11", "fracehisp", "feduc", "flgnd")

```

```

rf_vars <- c("cig0_r", "cig1_r", "cig2_r", "cig3_r", "rf_pdiab", "rf_gdiab",
  "urf_phype", "rf_ghype", "urf_ehype", "rf_ppb", "rf_inft",
  "rf_drg", "rf_art", "rf_cesarn",
  "ip_gon", "ip_chlam", "ip_syph", "ip_hepc", "ip_hepb", "flgnd")

```

```

ld_vars <- c("bfacil3", "lbo_rec", "tpo_rec", "illb_r11", "iloo_r11",
  "ilp_r11", "ld_indl", "ld_augm", "ld_ster", "ld_antb", "ld_chor",
  "ld_anes", "me_pres", "me_rout", "me_trial", "ob_succ", "ob_fail",
  "dmeth_rec", "mm_mtr", "mm_plac", "mm_rupt", "mm_uhyst", "mm_aicu",
  "attend", "mtran", "itrans", "apgar5r", "dplural", "setorder_r",
  "sex", "oegest_r10", "bwtr4", "flgnd")

```

```

ab_vars <- c("ab_aven1", "ab_aven6", "ab_nicu", "ab_surf", "ab_anti", "ab_seiz",
  "flgnd")

```

```

ses_vars <-
c("mracehisp", "mager14", "meduc", "dmar", "wic", "bfed", "feduc", "previs_rec", "precare5",
  "pay_rec", "attend", "flgnd")

```

```

ses <- CreateTableOne(vars = ses_vars, strata = "flgnd", data = thesis2, includeNA = T,
  argsApprox = list(correct = T), addOverall = T)
ses_table <- print(ses, showAllLevels = F, printToggle = F, quote = F, noSpaces = T)

parental_char <- CreateTableOne(vars= parental_vars, strata = "flgnd",
  data = thesis2, includeNA = T, test = T,
  argsApprox = list(correct = T), addOverall = T)
parental_table <- print(parental_char, showAllLevels = F, printToggle= F, quote = F,
noSpaces = T)

rf_table <- CreateTableOne(vars= rf_vars, strata = "flgnd", data = thesis2, includeNA =
T, test= T,
  argsApprox = list(correct = T), addOverall = T)
risk_factor_tab <- print(rf_table, showAllLevels = F, printToggle = F, quote = F,
noSpaces = T)

ld_table <- CreateTableOne(vars= ld_vars, strata = "flgnd", data = thesis2, includeNA =
T, test= T,
  argsApprox = list(correct = T), addOverall = T)
labor_tab <- print(ld_table, showAllLevels = F, printToggle = F, quote = F, noSpaces =
T)

ab_table <- CreateTableOne(vars= ab_vars, strata = "flgnd", data = thesis2, includeNA
= T, test= T,
  argsApprox = list(correct = T), addOverall = T)
abnorm_tab <- print(ab_table, showAllLevels = F, printToggle = F, quote = F, noSpaces
= T)

#
# Create training and test data
#

set.seed(12345)
trainingRows <- sample(1:nrow(thesis2), 0.5 * nrow(thesis2))
train <- thesis2[trainingRows, ]
test <- thesis2[-trainingRows, ]

#
# Create risk scores
#

```

```

train$riskscore <- 0

for (i in 1:nrow(train)){
  if (train$bfacil3[i] == "Not Hospital")
  {
    train$riskscore[i] = train$riskscore[i] + (-0.109)
  }
  if (train$mager14[i] == "15")
  {
    train$riskscore[i] = train$riskscore[i] + (-2.492)
  }
  else if (train$mager14[i] == "16")
  {
    train$riskscore[i] = train$riskscore[i] + (-2.411)
  }
  else if (train$mager14[i] == "17")
  {
    train$riskscore[i] = train$riskscore[i] + (-2.364)
  }
  else if (train$mager14[i] == "18")
  {
    train$riskscore[i] = train$riskscore[i] + (-2.232)
  }
  else if (train$mager14[i] == "19")
  {
    train$riskscore[i] = train$riskscore[i] + (-2.420)
  }
  else if (train$mager14[i] == "20-24")
  {
    train$riskscore[i] = train$riskscore[i] + (-2.404)
  }
  else if (train$mager14[i] == "25-29")
  {
    train$riskscore[i] = train$riskscore[i] + (-2.433)
  }
  else if (train$mager14[i] == "30-34")
  {
    train$riskscore[i] = train$riskscore[i] + (-2.390)
  }
  else if (train$mager14[i] == "35-39")
  {
    train$riskscore[i] = train$riskscore[i] + (-2.237)
  }
}

```

```

}
else if (train$mager14[i] == "40-44")
{
  train$riskscore[i] = train$riskscore[i] + (-2.357)
}
else if (train$mager14[i] == "45-49")
{
  train$riskscore[i] = train$riskscore[i] + (-2.109)
}
else if (train$mager14[i] == "50-54")
{
  train$riskscore[i] = train$riskscore[i] + (-1.587)
}
if (train$restatus[i] == "Intrastate Non-res")
{
  train$riskscore[i] = train$riskscore[i] + (0.035)
}
else if (train$mbstate_rec[i] == "Interstate Non-res")
{
  train$riskscore[i] = train$riskscore[i] + (0.010)
}
if (train$mracehisp[i] == "Non-Hisp Black")
{
  train$riskscore[i] = train$riskscore[i] + (-0.101)
}
else if (train$mracehisp[i] == "Non-Hisp AIAN")
{
  train$riskscore[i] = train$riskscore[i] + (-0.602)
}
else if (train$mracehisp[i] == "Non-Hisp Asian")
{
  train$riskscore[i] = train$riskscore[i] + (-0.235)
}
else if (train$mracehisp[i] == "Non-Hisp NHOPI")
{
  train$riskscore[i] = train$riskscore[i] + (-0.661)
}
else if (train$mracehisp[i] == "Non-Hisp More than one race")
{
  train$riskscore[i] = train$riskscore[i] + (-0.199)
}
else if (train$mracehisp[i] == "Hispanic")
{

```

```

    train$riskscore[i] = train$riskscore[i] + (-0.006)
  }
  else if (train$mracehisp[i] == "Unknown")
  {
    train$riskscore[i] = train$riskscore[i] + (-0.148)
  }
  if (train$mar_p[i] == "No")
  {
    train$riskscore[i] = train$riskscore[i] + (0.022)
  }
  else if (train$mar_p[i] == "Unknown")
  {
    train$riskscore[i] = train$riskscore[i] + (-0.328)
  }
  else if (train$mar_p[i] == "Not Applicable")
  {
    train$riskscore[i] = train$riskscore[i] + (0.063)
  }
  if (train$dmар[i] == "Unknown")
  {
    train$riskscore[i] = train$riskscore[i] + (-0.464)
  }
  if (train$meduc[i] == "9-12")
  {
    train$riskscore[i] = train$riskscore[i] + (-0.031)
  }
  else if (train$meduc[i] == "HS Grad/GED")
  {
    train$riskscore[i] = train$riskscore[i] + (-0.030)
  }
  else if (train$meduc[i] == "Some college")
  {
    train$riskscore[i] = train$riskscore[i] + (-0.021)
  }
  else if (train$meduc[i] == "Associate degree")
  {
    train$riskscore[i] = train$riskscore[i] + (-0.017)
  }
  else if (train$meduc[i] == "Bachelor's degree")
  {
    train$riskscore[i] = train$riskscore[i] + (-0.036)
  }
  else if (train$meduc[i] == "Master's degree")

```

```

{
  train$riskscore[i] = train$riskscore[i] + (-0.092)
}
else if (train$meduc[i] == "Doctorate or Professional degree")
{
  train$riskscore[i] = train$riskscore[i] + (-0.370)
}
else if (train$meduc[i] == "Unknown")
{
  train$riskscore[i] = train$riskscore[i] + (-0.121)
}
if (train$fage11[i] == "15-19")
{
  train$riskscore[i] = train$riskscore[i] + (0.453)
}
else if (train$fage11[i] == "20-24")
{
  train$riskscore[i] = train$riskscore[i] + (0.434)
}
else if (train$fage11[i] == "25-29")
{
  train$riskscore[i] = train$riskscore[i] + (0.358)
}
else if (train$fage11[i] == "30-34")
{
  train$riskscore[i] = train$riskscore[i] + (0.455)
}
else if (train$fage11[i] == "35-39")
{
  train$riskscore[i] = train$riskscore[i] + (0.352)
}
else if (train$fage11[i] == "40-44")
{
  train$riskscore[i] = train$riskscore[i] + (0.392)
}
else if (train$fage11[i] == "45-49")
{
  train$riskscore[i] = train$riskscore[i] + (0.501)
}
else if (train$fage11[i] == "50-54")
{
  train$riskscore[i] = train$riskscore[i] + (0.811)
}
}

```

```

else if (train$fage11[i] == "55+")
{
  train$riskscore[i] = train$riskscore[i] + (0.481)
}
else if (train$fage11[i] == "Unknown")
{
  train$riskscore[i] = train$riskscore[i] + (0.780)
}
if (!is.na(train$fracehisp[i]) == "Non-Hisp Black")
{
  train$riskscore[i] = train$riskscore[i] + (-0.060)
}
else if (!is.na(train$fracehisp[i]) == "Non-Hisp AIAN")
{
  train$riskscore[i] = train$riskscore[i] + (-0.095)
}
else if (!is.na(train$fracehisp[i]) == "Non-Hisp Asian")
{
  train$riskscore[i] = train$riskscore[i] + (0.183)
}
else if (!is.na(train$fracehisp[i]) == "Non-Hisp NHOPI")
{
  train$riskscore[i] = train$riskscore[i] + (0.156)
}
else if (!is.na(train$fracehisp[i]) == "Non-Hisp More than one race")
{
  train$riskscore[i] = train$riskscore[i] + (-0.034)
}
else if (!is.na(train$fracehisp[i]) == "Hispanic")
{
  train$riskscore[i] = train$riskscore[i] + (-0.082)
}
else if (!is.na(train$fracehisp[i]) == "Unknown")
{
  train$riskscore[i] = train$riskscore[i] + (-0.186)
}
if (train$feduc[i] == "9-12")
{
  train$riskscore[i] = train$riskscore[i] + (-0.281)
}
else if (train$feduc[i] == "HS Grad/GED")
{
  train$riskscore[i] = train$riskscore[i] + (-0.343)
}

```

```

}
else if (train$feduc[i] == "Some college")
{
  train$riskscore[i] = train$riskscore[i] + (-0.264)
}
else if (train$feduc[i] == "Associate degree")
{
  train$riskscore[i] = train$riskscore[i] + (-0.105)
}
else if (train$feduc[i] == "Bachelor's degree")
{
  train$riskscore[i] = train$riskscore[i] + (-0.167)
}
else if (train$feduc[i] == "Master's degree")
{
  train$riskscore[i] = train$riskscore[i] + (-0.107)
}
else if (train$feduc[i] == "Doctorate or Professional degree")
{
  train$riskscore[i] = train$riskscore[i] + (-0.282)
}
else if (train$feduc[i] == "Unknown")
{
  train$riskscore[i] = train$riskscore[i] + (-0.464)
}
if (train$priorlive[i] != "99")
{
  train$riskscore[i] = train$riskscore[i] + train$priorlive[i]*(-0.003)
}
if (train$priordead[i] != "99")
{
  train$riskscore[i] = train$riskscore[i] + train$priordead[i]*(0.001)
}
if (train$priorterm[i] != "99")
{
  train$riskscore[i] = train$riskscore[i] + train$priorterm[i]*(-0.001)
}
if (train$lbo_rec[i] != "9")
{
  train$riskscore[i] = train$riskscore[i] + train$lbo_rec[i]*(-0.003)
}
if (train$tpo_rec[i] != "9")
{

```

```

    train$riskscore[i] = train$riskscore[i] + train$tpo_rec[i]*(0.008)
}
if (train$illb_r11[i] == "4-11 months")
{
    train$riskscore[i] = train$riskscore[i] + (-0.151)
}
else if (train$illb_r11[i] == "12-17 months")
{
    train$riskscore[i] = train$riskscore[i] + (-0.474)
}
else if (train$illb_r11[i] == "18-23 months")
{
    train$riskscore[i] = train$riskscore[i] + (-0.415)
}
else if (train$illb_r11[i] == "24-35 months")
{
    train$riskscore[i] = train$riskscore[i] + (-0.410)
}
else if (train$illb_r11[i] == "36-47 months")
{
    train$riskscore[i] = train$riskscore[i] + (-0.380)
}
else if (train$illb_r11[i] == "48-59 months")
{
    train$riskscore[i] = train$riskscore[i] + (-0.358)
}
else if (train$illb_r11[i] == "60-71 months")
{
    train$riskscore[i] = train$riskscore[i] + (-0.362)
}
else if (train$illb_r11[i] == "72+ months")
{
    train$riskscore[i] = train$riskscore[i] + (-0.319)
}
else if (train$illb_r11[i] == "1st live birth")
{
    train$riskscore[i] = train$riskscore[i] + (-0.473)
}
else if (train$illb_r11[i] == "Unknown")
{
    train$riskscore[i] = train$riskscore[i] + (-0.361)
}
if (train$iloo_r11[i] == "4-11 months")

```

```

{
  train$riskscore[i] = train$riskscore[i] + (-1.053)
}
else if (train$iloo_r11[i] == "12-17 months")
{
  train$riskscore[i] = train$riskscore[i] + (-1.483)
}
else if (train$iloo_r11[i] == "18-23 months")
{
  train$riskscore[i] = train$riskscore[i] + (-1.241)
}
else if (train$iloo_r11[i] == "24-35 months")
{
  train$riskscore[i] = train$riskscore[i] + (-1.318)
}
else if (train$iloo_r11[i] == "36-47 months")
{
  train$riskscore[i] = train$riskscore[i] + (-1.432)
}
else if (train$iloo_r11[i] == "48-59 months")
{
  train$riskscore[i] = train$riskscore[i] + (-1.582)
}
else if (train$iloo_r11[i] == "60-71 months")
{
  train$riskscore[i] = train$riskscore[i] + (-1.333)
}
else if (train$iloo_r11[i] == "72+ months")
{
  train$riskscore[i] = train$riskscore[i] + (-1.432)
}
else if (train$iloo_r11[i] == "1st live birth")
{
  train$riskscore[i] = train$riskscore[i] + (-1.371)
}
else if (train$iloo_r11[i] == "Unknown")
{
  train$riskscore[i] = train$riskscore[i] + (-1.163)
}
if (train$ilp_r11[i] == "4-11 months")
{
  train$riskscore[i] = train$riskscore[i] + (-0.548)
}

```

```

else if (train$ilp_r11[i] == "12-17 months")
{
  train$riskscore[i] = train$riskscore[i] + (-0.049)
}
else if (train$ilp_r11[i] == "18-23 months")
{
  train$riskscore[i] = train$riskscore[i] + (-0.139)
}
else if (train$ilp_r11[i] == "24-35 months")
{
  train$riskscore[i] = train$riskscore[i] + (-0.037)
}
else if (train$ilp_r11[i] == "36-47 months")
{
  train$riskscore[i] = train$riskscore[i] + (-0.126)
}
else if (train$ilp_r11[i] == "48-59 months")
{
  train$riskscore[i] = train$riskscore[i] + (-0.188)
}
else if (train$ilp_r11[i] == "60-71 months")
{
  train$riskscore[i] = train$riskscore[i] + (-0.083)
}
else if (train$ilp_r11[i] == "72+ months")
{
  train$riskscore[i] = train$riskscore[i] + (-0.171)
}
else if (train$ilp_r11[i] == "1st live birth")
{
  train$riskscore[i] = train$riskscore[i] + (0.027)
}
else if (train$ilp_r11[i] == "Unknown")
{
  train$riskscore[i] = train$riskscore[i] + (-0.230)
}
if (train$precare5[i] == "2nd Trimester")
{
  train$riskscore[i] = train$riskscore[i] + (-0.006)
}
else if (train$precare5[i] == "3rd Trimester")
{
  train$riskscore[i] = train$riskscore[i] + (-0.120)
}

```

```

}
else if (train$precare5[i] == "No prenatal care")
{
  train$riskscore[i] = train$riskscore[i] + (-0.092)
}
else if (train$precare5[i] == "Unknown")
{
  train$riskscore[i] = train$riskscore[i] + (-0.009)
}
if (train$previs_rec[i] == "1-2")
{
  train$riskscore[i] = train$riskscore[i] + (0.056)
}
else if (train$previs_rec[i] == "3-4")
{
  train$riskscore[i] = train$riskscore[i] + (-0.174)
}
else if (train$previs_rec[i] == "5-6")
{
  train$riskscore[i] = train$riskscore[i] + (-0.012)
}
else if (train$previs_rec[i] == "7-8")
{
  train$riskscore[i] = train$riskscore[i] + (0.033)
}
else if (train$previs_rec[i] == "9-10")
{
  train$riskscore[i] = train$riskscore[i] + (-0.013)
}
else if (train$previs_rec[i] == "11-12")
{
  train$riskscore[i] = train$riskscore[i] + (-0.065)
}
else if (train$previs_rec[i] == "13-14")
{
  train$riskscore[i] = train$riskscore[i] + (0.032)
}
else if (train$previs_rec[i] == "15-16")
{
  train$riskscore[i] = train$riskscore[i] + (0.106)
}
else if (train$previs_rec[i] == "17-18")
{

```

```

    train$riskscore[i] = train$riskscore[i] + (0.107)
  }
  else if (train$previs_rec[i] == "19+")
  {
    train$riskscore[i] = train$riskscore[i] + (-0.023)
  }

  if (train$wic[i] == "Yes")
  {
    train$riskscore[i] = train$riskscore[i] + (0.039)
  }
  else if (train$wic[i] == "Unknown")
  {
    train$riskscore[i] = train$riskscore[i] + (-0.074)
  }
  if (train$cig0_r[i] == "1-5")
  {
    train$riskscore[i] = train$riskscore[i] + (0.089)
  }
  else if (train$cig0_r[i] == "6-10")
  {
    train$riskscore[i] = train$riskscore[i] + (0.115)
  }
  else if (train$cig0_r[i] == "11-20")
  {
    train$riskscore[i] = train$riskscore[i] + (-0.030)
  }
  else if (train$cig0_r[i] == "21-40")
  {
    train$riskscore[i] = train$riskscore[i] + (0.342)
  }
  else if (train$cig0_r[i] == "41+")
  {
    train$riskscore[i] = train$riskscore[i] + (0.932)
  }
  else if (train$cig0_r[i] == "Unknown")
  {
    train$riskscore[i] = train$riskscore[i] + (0.477)
  }
  if (train$cig1_r[i] == "1-5")
  {
    train$riskscore[i] = train$riskscore[i] + (-0.419)
  }
}

```

```

else if (train$cig1_r[i] == "6-10")
{
  train$riskscore[i] = train$riskscore[i] + (-0.280)
}
else if (train$cig1_r[i] == "11-20")
{
  train$riskscore[i] = train$riskscore[i] + (-0.432)
}
else if (train$cig1_r[i] == "21-40")
{
  train$riskscore[i] = train$riskscore[i] + (-0.856)
}
else if (train$cig1_r[i] == "Unknown")
{
  train$riskscore[i] = train$riskscore[i] + (-0.315)
}
if (train$cig2_r[i] == "1-5")
{
  train$riskscore[i] = train$riskscore[i] + (0.575)
}
else if (train$cig2_r[i] == "6-10")
{
  train$riskscore[i] = train$riskscore[i] + (0.372)
}
else if (train$cig2_r[i] == "11-20")
{
  train$riskscore[i] = train$riskscore[i] + (0.287)
}
else if (train$cig2_r[i] == "21-40")
{
  train$riskscore[i] = train$riskscore[i] + (1.067)
}
else if (train$cig2_r[i] == "41+")
{
  train$riskscore[i] = train$riskscore[i] + (0)
}
else if (train$cig2_r[i] == "Unknown")
{
  train$riskscore[i] = train$riskscore[i] + (0.573)
}
if (train$cig3_r[i] == "1-5")
{
  train$riskscore[i] = train$riskscore[i] + (-0.205)
}

```

```

}
else if (train$cig3_r[i] == "6-10")
{
  train$riskscore[i] = train$riskscore[i] + (-0.194)
}
else if (train$cig3_r[i] == "11-20")
{
  train$riskscore[i] = train$riskscore[i] + (0.184)
}
else if (train$cig3_r[i] == "21-40")
{
  train$riskscore[i] = train$riskscore[i] + (0.208)
}
else if (train$cig3_r[i] == "41+")
{
  train$riskscore[i] = train$riskscore[i] + (-1.497)
}
else if (train$cig3_r[i] == "Unknown")
{
  train$riskscore[i] = train$riskscore[i] + (-0.500)
}
if (train$mhtr[i] != "99")
{
  train$riskscore[i] = train$riskscore[i] + train$mhtr[i]*(0.001)
}
if (train$bmi[i] != "99.9")
{
  train$riskscore[i] = train$riskscore[i] + train$bmi[i]*(-0.005)
}
if (train$pwgt_r[i] != "999")
{
  train$riskscore[i] = train$riskscore[i] + train$pwgt_r[i]*(0.0005)
}
if (train$dwgt_r[i] != "999")
{
  train$riskscore[i] = train$riskscore[i] + train$dwgt_r[i]*(0.00005)
}
if (train$wtgain[i] != "99")
{
  train$riskscore[i] = train$riskscore[i] + train$wtgain[i]*(0.00006)
}
if (train$rfr_pdiab[i] == "Yes")
{

```

```

    train$riskscore[i] = train$riskscore[i] + (0.096)
  }
else if (train$rf_pdiab[i] == "Unknown")
{
  train$riskscore[i] = train$riskscore[i] + (-0.546)
}
if (train$rf_gdiab[i] == "Yes")
{
  train$riskscore[i] = train$riskscore[i] + (-0.091)
}
if (train$urf_phype[i] == "Yes")
{
  train$riskscore[i] = train$riskscore[i] + (0.029)
}
if (train$urf_ehype[i] == "Yes")
{
  train$riskscore[i] = train$riskscore[i] + (-0.046)
}
if (train$rf_ppb[i] == "Yes")
{
  train$riskscore[i] = train$riskscore[i] + (-0.136)
}
if (train$rf_inft[i] == "Yes")
{
  train$riskscore[i] = train$riskscore[i] + (-0.847)
}
if (train$rf_drg[i] == "Yes")
{
  train$riskscore[i] = train$riskscore[i] + (-0.779)
}
else if (train$rf_drg[i] == "Unknown")
{
  train$riskscore[i] = train$riskscore[i] + (0.639)
}
if (train$rf_art[i] == "Yes")
{
  train$riskscore[i] = train$riskscore[i] + (0.811)
}
if (train$rf_cesarn[i] != "99")
{
  train$riskscore[i] = train$riskscore[i] + train$rf_cesarn*(-0.010)
}
if (train$ip_gon[i] == "Yes")

```

```

{
  train$riskscore[i] = train$riskscore[i] + (0.098)
}
else if (train$ip_gon[i] == "Unknown")
{
  train$riskscore[i] = train$riskscore[i] + (0.452)
}
if (train$ip_syph[i] == "Yes")
{
  train$riskscore[i] = train$riskscore[i] + (0.369)
}
if (train$ip_chlam[i] == "Yes")
{
  train$riskscore[i] = train$riskscore[i] + (-0.110)
}
if (train$ip_hepb[i] == "Yes")
{
  train$riskscore[i] = train$riskscore[i] + (0.777)
}
if (train$ip_hepc[i] == "Yes")
{
  train$riskscore[i] = train$riskscore[i] + (0.178)
}
if (train$ob_succ[i] == "No")
{
  train$riskscore[i] = train$riskscore[i] + (0.481)
}
else if (train$ob_succ[i] == "Unknown")
{
  train$riskscore[i] = train$riskscore[i] + (0.725)
}
if (train$ob_fail[i] == "Yes")
{
  train$riskscore[i] = train$riskscore[i] + (-0.107)
}
if (train$id_indl[i] == "Yes")
{
  train$riskscore[i] = train$riskscore[i] + (0.0004)
}
else if (train$id_indl[i] == "Unknown")
{
  train$riskscore[i] = train$riskscore[i] + (0.267)
}
}

```

```

if (train$ld_augm[i] == "Yes")
{
  train$riskscore[i] = train$riskscore[i] + (0.048)
}
if (train$ld_ster[i] == "Yes")
{
  train$riskscore[i] = train$riskscore[i] + (0.076)
}
if (train$ld_antb[i] == "Yes")
{
  train$riskscore[i] = train$riskscore[i] + (0.077)
}
if (train$ld_chor[i] == "Yes")
{
  train$riskscore[i] = train$riskscore[i] + (0.072)
}
if (train$ld_anes[i] == "Yes")
{
  train$riskscore[i] = train$riskscore[i] + (0.0003)
}
if (train$me_pres[i] == "Breech")
{
  train$riskscore[i] = train$riskscore[i] + (0.007)
}
else if (train$me_pres[i] == "Other")
{
  train$riskscore[i] = train$riskscore[i] + (-0.079)
}
else if (train$me_pres[i] == "Unknown")
{
  train$riskscore[i] = train$riskscore[i] + (0.073)
}
if (train$me_rout[i] == "Forceps")
{
  train$riskscore[i] = train$riskscore[i] + (0.201)
}
else if (train$me_rout[i] == "Vacuum")
{
  train$riskscore[i] = train$riskscore[i] + (-0.050)
}
else if (train$me_rout[i] == "Cesarean")
{
  train$riskscore[i] = train$riskscore[i] + (-0.055)
}

```

```

}
else if (train$me_rout[i] == "Unknown")
{
  train$riskscore[i] = train$riskscore[i] + (0.431)
}
if (train$me_trial[i] == "No")
{
  train$riskscore[i] = train$riskscore[i] + (-0.050)
}
else if (train$me_trial[i] == "Unknown")
{
  train$riskscore[i] = train$riskscore[i] + (-0.342)
}
if (train$mm_mtr[i] == "Yes")
{
  train$riskscore[i] = train$riskscore[i] + (0.089)
}
else if (train$mm_mtr[i] == "Unknown")
{
  train$riskscore[i] = train$riskscore[i] + (-0.623)
}
if (train$mm_plac[i] == "Yes")
{
  train$riskscore[i] = train$riskscore[i] + (0.582)
}
if (train$mm_rupt[i] == "Yes")
{
  train$riskscore[i] = train$riskscore[i] + (-0.097)
}
if (train$mm_uhyst[i] == "Yes")
{
  train$riskscore[i] = train$riskscore[i] + (-0.206)
}
if (train$mm_aicu[i] == "Yes")
{
  train$riskscore[i] = train$riskscore[i] + (-0.276)
}
if (train$attend[i] == "Dr of Osteo")
{
  train$riskscore[i] = train$riskscore[i] + (0.036)
}
else if (train$attend[i] == "Cert Nurse Midwife")
{

```

```

    train$riskscore[i] = train$riskscore[i] + (0.008)
  }
else if (train$attend[i] == "Other Midwife")
{
  train$riskscore[i] = train$riskscore[i] + (-0.529)
}
else if (train$attend[i] == "Other")
{
  train$riskscore[i] = train$riskscore[i] + (0.052)
}
else if (train$attend[i] == "Unknown")
{
  train$riskscore[i] = train$riskscore[i] + (0.421)
}
if (train$mtran[i] == "Yes")
{
  train$riskscore[i] = train$riskscore[i] + (0.080)
}
else if (train$mtran[i] == "Unknown")
{
  train$riskscore[i] = train$riskscore[i] + (-0.759)
}
if (train$pay_rec[i] == "Private Ins")
{
  train$riskscore[i] = train$riskscore[i] + (0.066)
}
else if (train$pay_rec[i] == "Self-pay")
{
  train$riskscore[i] = train$riskscore[i] + (-0.013)
}
else if (train$pay_rec[i] == "Other")
{
  train$riskscore[i] = train$riskscore[i] + (-0.073)
}
else if (train$pay_rec[i] == "Unknown")
{
  train$riskscore[i] = train$riskscore[i] + (-0.137)
}
if (train$apgar5r[i] == "4-6")
{
  train$riskscore[i] = train$riskscore[i] + (-0.104)
}
else if (train$apgar5r[i] == "7-8")

```

```

{
  train$riskscore[i] = train$riskscore[i] + (-0.318)
}
else if (train$apgar5r[i] == "9-10")
{
  train$riskscore[i] = train$riskscore[i] + (-0.403)
}
else if (train$apgar5r[i] == "Unknown")
{
  train$riskscore[i] = train$riskscore[i] + (0.018)
}
if (train$dplural[i] == "Twin")
{
  train$riskscore[i] = train$riskscore[i] + (-0.614)
}
else if (train$dplural[i] == "Triplet")
{
  train$riskscore[i] = train$riskscore[i] + (-0.419)
}
else if (train$dplural[i] == "Quadruplet")
{
  train$riskscore[i] = train$riskscore[i] + (0.451)
}
else if (train$dplural[i] == "Quintuplet+")
{
  train$riskscore[i] = train$riskscore[i] + (0)
}
if (train$setorder_r[i] == "2nd")
{
  train$riskscore[i] = train$riskscore[i] + (-0.225)
}
else if (train$setorder_r[i] == "3rd")
{
  train$riskscore[i] = train$riskscore[i] + (-1.154)
}
else if (train$setorder_r[i] == "4th")
{
  train$riskscore[i] = train$riskscore[i] + (0)
}
else if (train$setorder_r[i] == "5th+")
{
  train$riskscore[i] = train$riskscore[i] + (0)
}
}

```

```

else if (train$setorder_r[i] == "Unknown")
{
  train$riskscore[i] = train$riskscore[i] + (-0.616)
}
if (train$sex[i] == "Female")
{
  train$riskscore[i] = train$riskscore[i] + (0.051)
}
if (train$soegest_r10[i] == "20-27 weeks")
{
  train$riskscore[i] = train$riskscore[i] + (-0.149)
}
else if (train$soegest_r10[i] == "28-31 weeks")
{
  train$riskscore[i] = train$riskscore[i] + (-0.474)
}
else if (train$soegest_r10[i] == "32-33 weeks")
{
  train$riskscore[i] = train$riskscore[i] + (-0.550)
}
else if (train$soegest_r10[i] == "34-36 weeks")
{
  train$riskscore[i] = train$riskscore[i] + (-0.563)
}
else if (train$soegest_r10[i] == "37-38 weeks")
{
  train$riskscore[i] = train$riskscore[i] + (-0.617)
}
else if (train$soegest_r10[i] == "39 weeks")
{
  train$riskscore[i] = train$riskscore[i] + (-0.618)
}
else if (train$soegest_r10[i] == "40 weeks")
{
  train$riskscore[i] = train$riskscore[i] + (-0.595)
}
else if (train$soegest_r10[i] == "41 weeks")
{
  train$riskscore[i] = train$riskscore[i] + (-0.654)
}
else if (train$soegest_r10[i] == "42 weeks")
{
  train$riskscore[i] = train$riskscore[i] + (-0.626)
}

```

```

}
else if (train$oegegest_r10[i] == "Unknown")
{
  train$riskscore[i] = train$riskscore[i] + (0)
}
if (train$bwtr4[i] == "1500-2499 grams")
{
  train$riskscore[i] = train$riskscore[i] + (-0.019)
}
else if (train$bwtr4[i] == "2500-8165 grams")
{
  train$riskscore[i] = train$riskscore[i] + (0.048)
}
else if (train$bwtr4[i] == "Unknown")
{
  train$riskscore[i] = train$riskscore[i] + (1.939)
}
if (train$ab_aven1[i] == "Yes")
{
  train$riskscore[i] = train$riskscore[i] + (0.071)
}
else if (train$ab_aven1[i] == "Unknown")
{
  train$riskscore[i] = train$riskscore[i] + (-1.230)
}
if (train$ab_aven6[i] == "Yes")
{
  train$riskscore[i] = train$riskscore[i] + (-0.005)
}
if (train$ab_nicu[i] == "Yes")
{
  train$riskscore[i] = train$riskscore[i] + (0.025)
}
if (train$ab_surf[i] == "Yes")
{
  train$riskscore[i] = train$riskscore[i] + (0.026)
}
if (train$ab_anti[i] == "Yes")
{
  train$riskscore[i] = train$riskscore[i] + (-0.00003)
}
if (train$ab_seiz[i] == "Yes")
{

```

```

    train$riskscore[i] = train$riskscore[i] + (0.180)
  }
  if (train$itrans[i] == "Yes")
  {
    train$riskscore[i] = train$riskscore[i] + (0.017)
  }
  else if (train$itrans[i] == "Unknown")
  {
    train$riskscore[i] = train$riskscore[i] + (2.321)
  }
  if (train$bfed[i] == "Yes")
  {
    train$riskscore[i] = train$riskscore[i] + (-0.091)
  }
  else if (train$bfed[i] == "Unknown")
  {
    train$riskscore[i] = train$riskscore[i] + (-0.345)
  }
}

```

```
test$riskscore <- 0
```

```

for (i in 1:nrow(test)){
  if (test$bfacil3[i] == "Not Hospital")
  {
    test$riskscore[i] = test$riskscore[i] + (-0.109)
  }
  if (test$mager14[i] == "15")
  {
    test$riskscore[i] = test$riskscore[i] + (-2.492)
  }
  else if (test$mager14[i] == "16")
  {
    test$riskscore[i] = test$riskscore[i] + (-2.411)
  }
  else if (test$mager14[i] == "17")
  {
    test$riskscore[i] = test$riskscore[i] + (-2.364)
  }
  else if (test$mager14[i] == "18")
  {
    test$riskscore[i] = test$riskscore[i] + (-2.232)
  }
}

```

```

else if (test$mager14[i] == "19")
{
  test$riskscore[i] = test$riskscore[i] + (-2.420)
}
else if (test$mager14[i] == "20-24")
{
  test$riskscore[i] = test$riskscore[i] + (-2.404)
}
else if (test$mager14[i] == "25-29")
{
  test$riskscore[i] = test$riskscore[i] + (-2.433)
}
else if (test$mager14[i] == "30-34")
{
  test$riskscore[i] = test$riskscore[i] + (-2.390)
}
else if (test$mager14[i] == "35-39")
{
  test$riskscore[i] = test$riskscore[i] + (-2.237)
}
else if (test$mager14[i] == "40-44")
{
  test$riskscore[i] = test$riskscore[i] + (-2.357)
}
else if (test$mager14[i] == "45-49")
{
  test$riskscore[i] = test$riskscore[i] + (-2.109)
}
else if (test$mager14[i] == "50-54")
{
  test$riskscore[i] = test$riskscore[i] + (-1.587)
}
if (test$restatus[i] == "Intrastate Non-res")
{
  test$riskscore[i] = test$riskscore[i] + (0.035)
}
else if (test$mbstate_rec[i] == "Interstate Non-res")
{
  test$riskscore[i] = test$riskscore[i] + (0.010)
}
if (test$mracehisp[i] == "Non-Hisp Black")
{
  test$riskscore[i] = test$riskscore[i] + (-0.101)
}

```

```

}
else if (test$mracehisp[i] == "Non-Hisp AIAN")
{
  test$riskscore[i] = test$riskscore[i] + (-0.602)
}
else if (test$mracehisp[i] == "Non-Hisp Asian")
{
  test$riskscore[i] = test$riskscore[i] + (-0.235)
}
else if (test$mracehisp[i] == "Non-Hisp NHOPI")
{
  test$riskscore[i] = test$riskscore[i] + (-0.661)
}
else if (test$mracehisp[i] == "Non-Hisp More than one race")
{
  test$riskscore[i] = test$riskscore[i] + (-0.199)
}
else if (test$mracehisp[i] == "Hispanic")
{
  test$riskscore[i] = test$riskscore[i] + (-0.006)
}
else if (test$mracehisp[i] == "Unknown")
{
  test$riskscore[i] = test$riskscore[i] + (-0.148)
}
if (test$mar_p[i] == "No")
{
  test$riskscore[i] = test$riskscore[i] + (0.022)
}
else if (test$mar_p[i] == "Unknown")
{
  test$riskscore[i] = test$riskscore[i] + (-0.328)
}
else if (test$mar_p[i] == "Not Applicable")
{
  test$riskscore[i] = test$riskscore[i] + (0.063)
}
if (test$dmarr[i] == "Unknown")
{
  test$riskscore[i] = test$riskscore[i] + (-0.464)
}
if (test$meduc[i] == "9-12")
{

```

```

    test$riskscore[i] = test$riskscore[i] + (-0.031)
}
else if (test$meduc[i] == "HS Grad/GED")
{
    test$riskscore[i] = test$riskscore[i] + (-0.030)
}
else if (test$meduc[i] == "Some college")
{
    test$riskscore[i] = test$riskscore[i] + (-0.021)
}
else if (test$meduc[i] == "Associate degree")
{
    test$riskscore[i] = test$riskscore[i] + (-0.017)
}
else if (test$meduc[i] == "Bachelor's degree")
{
    test$riskscore[i] = test$riskscore[i] + (-0.036)
}
else if (test$meduc[i] == "Master's degree")
{
    test$riskscore[i] = test$riskscore[i] + (-0.092)
}
else if (test$meduc[i] == "Doctorate or Professional degree")
{
    test$riskscore[i] = test$riskscore[i] + (-0.370)
}
else if (test$meduc[i] == "Unknown")
{
    test$riskscore[i] = test$riskscore[i] + (-0.121)
}
if (test$fage11[i] == "15-19")
{
    test$riskscore[i] = test$riskscore[i] + (0.453)
}
else if (test$fage11[i] == "20-24")
{
    test$riskscore[i] = test$riskscore[i] + (0.434)
}
else if (test$fage11[i] == "25-29")
{
    test$riskscore[i] = test$riskscore[i] + (0.358)
}
else if (test$fage11[i] == "30-34")

```

```

{
  test$riskscore[i] = test$riskscore[i] + (0.455)
}
else if (test$fage11[i] == "35-39")
{
  test$riskscore[i] = test$riskscore[i] + (0.352)
}
else if (test$fage11[i] == "40-44")
{
  test$riskscore[i] = test$riskscore[i] + (0.392)
}
else if (test$fage11[i] == "45-49")
{
  test$riskscore[i] = test$riskscore[i] + (0.501)
}
else if (test$fage11[i] == "50-54")
{
  test$riskscore[i] = test$riskscore[i] + (0.811)
}
else if (test$fage11[i] == "55+")
{
  test$riskscore[i] = test$riskscore[i] + (0.481)
}
else if (test$fage11[i] == "Unknown")
{
  test$riskscore[i] = test$riskscore[i] + (0.780)
}
if (!is.na(test$fracehisp[i]) == "Non-Hisp Black")
{
  test$riskscore[i] = test$riskscore[i] + (-0.060)
}
else if (!is.na(test$fracehisp[i]) == "Non-Hisp AIAN")
{
  test$riskscore[i] = test$riskscore[i] + (-0.095)
}
else if (!is.na(test$fracehisp[i]) == "Non-Hisp Asian")
{
  test$riskscore[i] = test$riskscore[i] + (0.183)
}
else if (!is.na(test$fracehisp[i]) == "Non-Hisp NHOPI")
{
  test$riskscore[i] = test$riskscore[i] + (0.156)
}

```

```

else if (!is.na(test$fracehisp[i]) == "Non-Hisp More than one race")
{
  test$riskscore[i] = test$riskscore[i] + (-0.034)
}
else if (!is.na(test$fracehisp[i]) == "Hispanic")
{
  test$riskscore[i] = test$riskscore[i] + (-0.082)
}
else if (!is.na(test$fracehisp[i]) == "Unknown")
{
  test$riskscore[i] = test$riskscore[i] + (-0.186)
}
if (test$feduc[i] == "9-12")
{
  test$riskscore[i] = test$riskscore[i] + (-0.281)
}
else if (test$feduc[i] == "HS Grad/GED")
{
  test$riskscore[i] = test$riskscore[i] + (-0.343)
}
else if (test$feduc[i] == "Some college")
{
  test$riskscore[i] = test$riskscore[i] + (-0.264)
}
else if (test$feduc[i] == "Associate degree")
{
  test$riskscore[i] = test$riskscore[i] + (-0.105)
}
else if (test$feduc[i] == "Bachelor's degree")
{
  test$riskscore[i] = test$riskscore[i] + (-0.167)
}
else if (test$feduc[i] == "Master's degree")
{
  test$riskscore[i] = test$riskscore[i] + (-0.107)
}
else if (test$feduc[i] == "Doctorate or Professional degree")
{
  test$riskscore[i] = test$riskscore[i] + (-0.282)
}
else if (test$feduc[i] == "Unknown")
{
  test$riskscore[i] = test$riskscore[i] + (-0.464)
}

```

```

}
if (test$priorlive[i] != "99")
{
  test$riskscore[i] = test$riskscore[i] + test$priorlive[i]*(-0.003)
}
if (test$priordead[i] != "99")
{
  test$riskscore[i] = test$riskscore[i] + test$priordead[i]*(0.001)
}
if (test$priorterm[i] != "99")
{
  test$riskscore[i] = test$riskscore[i] + test$priorterm[i]*(-0.001)
}
if (test$lbo_rec[i] != "9")
{
  test$riskscore[i] = test$riskscore[i] + test$lbo_rec[i]*(-0.003)
}
if (test$tpo_rec[i] != "9")
{
  test$riskscore[i] = test$riskscore[i] + test$tpo_rec[i]*(0.008)
}
if (test$illb_r11[i] == "4-11 months")
{
  test$riskscore[i] = test$riskscore[i] + (-0.151)
}
else if (test$illb_r11[i] == "12-17 months")
{
  test$riskscore[i] = test$riskscore[i] + (-0.474)
}
else if (test$illb_r11[i] == "18-23 months")
{
  test$riskscore[i] = test$riskscore[i] + (-0.415)
}
else if (test$illb_r11[i] == "24-35 months")
{
  test$riskscore[i] = test$riskscore[i] + (-0.410)
}
else if (test$illb_r11[i] == "36-47 months")
{
  test$riskscore[i] = test$riskscore[i] + (-0.380)
}
else if (test$illb_r11[i] == "48-59 months")
{

```

```

    test$riskscore[i] = test$riskscore[i] + (-0.358)
}
else if (test$illb_r11[i] == "60-71 months")
{
    test$riskscore[i] = test$riskscore[i] + (-0.362)
}
else if (test$illb_r11[i] == "72+ months")
{
    test$riskscore[i] = test$riskscore[i] + (-0.319)
}
else if (test$illb_r11[i] == "1st live birth")
{
    test$riskscore[i] = test$riskscore[i] + (-0.473)
}
else if (test$illb_r11[i] == "Unknown")
{
    test$riskscore[i] = test$riskscore[i] + (-0.361)
}
if (test$iloo_r11[i] == "4-11 months")
{
    test$riskscore[i] = test$riskscore[i] + (-1.053)
}
else if (test$iloo_r11[i] == "12-17 months")
{
    test$riskscore[i] = test$riskscore[i] + (-1.483)
}
else if (test$iloo_r11[i] == "18-23 months")
{
    test$riskscore[i] = test$riskscore[i] + (-1.241)
}
else if (test$iloo_r11[i] == "24-35 months")
{
    test$riskscore[i] = test$riskscore[i] + (-1.318)
}
else if (test$iloo_r11[i] == "36-47 months")
{
    test$riskscore[i] = test$riskscore[i] + (-1.432)
}
else if (test$iloo_r11[i] == "48-59 months")
{
    test$riskscore[i] = test$riskscore[i] + (-1.582)
}
else if (test$iloo_r11[i] == "60-71 months")

```

```

{
  test$riskscore[i] = test$riskscore[i] + (-1.333)
}
else if (test$iloo_r11[i] == "72+ months")
{
  test$riskscore[i] = test$riskscore[i] + (-1.432)
}
else if (test$iloo_r11[i] == "1st live birth")
{
  test$riskscore[i] = test$riskscore[i] + (-1.371)
}
else if (test$iloo_r11[i] == "Unknown")
{
  test$riskscore[i] = test$riskscore[i] + (-1.163)
}
if (test$ilp_r11[i] == "4-11 months")
{
  test$riskscore[i] = test$riskscore[i] + (-0.548)
}
else if (test$ilp_r11[i] == "12-17 months")
{
  test$riskscore[i] = test$riskscore[i] + (-0.049)
}
else if (test$ilp_r11[i] == "18-23 months")
{
  test$riskscore[i] = test$riskscore[i] + (-0.139)
}
else if (test$ilp_r11[i] == "24-35 months")
{
  test$riskscore[i] = test$riskscore[i] + (-0.037)
}
else if (test$ilp_r11[i] == "36-47 months")
{
  test$riskscore[i] = test$riskscore[i] + (-0.126)
}
else if (test$ilp_r11[i] == "48-59 months")
{
  test$riskscore[i] = test$riskscore[i] + (-0.188)
}
else if (test$ilp_r11[i] == "60-71 months")
{
  test$riskscore[i] = test$riskscore[i] + (-0.083)
}
}

```

```

else if (test$ilp_r11[i] == "72+ months")
{
  test$riskscore[i] = test$riskscore[i] + (-0.171)
}
else if (test$ilp_r11[i] == "1st live birth")
{
  test$riskscore[i] = test$riskscore[i] + (0.027)
}
else if (test$ilp_r11[i] == "Unknown")
{
  test$riskscore[i] = test$riskscore[i] + (-0.230)
}
if (test$precare5[i] == "2nd Trimester")
{
  test$riskscore[i] = test$riskscore[i] + (-0.006)
}
else if (test$precare5[i] == "3rd Trimester")
{
  test$riskscore[i] = test$riskscore[i] + (-0.120)
}
else if (test$precare5[i] == "No prenatal care")
{
  test$riskscore[i] = test$riskscore[i] + (-0.092)
}
else if (test$precare5[i] == "Unknown")
{
  test$riskscore[i] = test$riskscore[i] + (-0.009)
}
if (test$previs_rec[i] == "1-2")
{
  test$riskscore[i] = test$riskscore[i] + (0.056)
}
else if (test$previs_rec[i] == "3-4")
{
  test$riskscore[i] = test$riskscore[i] + (-0.174)
}
else if (test$previs_rec[i] == "5-6")
{
  test$riskscore[i] = test$riskscore[i] + (-0.012)
}
else if (test$previs_rec[i] == "7-8")
{
  test$riskscore[i] = test$riskscore[i] + (0.033)
}

```

```

}
else if (test$previs_rec[i] == "9-10")
{
  test$riskscore[i] = test$riskscore[i] + (-0.013)
}
else if (test$previs_rec[i] == "11-12")
{
  test$riskscore[i] = test$riskscore[i] + (-0.065)
}
else if (test$previs_rec[i] == "13-14")
{
  test$riskscore[i] = test$riskscore[i] + (0.032)
}
else if (test$previs_rec[i] == "15-16")
{
  test$riskscore[i] = test$riskscore[i] + (0.106)
}
else if (test$previs_rec[i] == "17-18")
{
  test$riskscore[i] = test$riskscore[i] + (0.107)
}
else if (test$previs_rec[i] == "19+")
{
  test$riskscore[i] = test$riskscore[i] + (-0.023)
}

if (test$wic[i] == "Yes")
{
  test$riskscore[i] = test$riskscore[i] + (0.039)
}
else if (test$wic[i] == "Unknown")
{
  test$riskscore[i] = test$riskscore[i] + (-0.074)
}
if (test$cig0_r[i] == "1-5")
{
  test$riskscore[i] = test$riskscore[i] + (0.089)
}
else if (test$cig0_r[i] == "6-10")
{
  test$riskscore[i] = test$riskscore[i] + (0.115)
}
else if (test$cig0_r[i] == "11-20")

```

```

{
  test$riskscore[i] = test$riskscore[i] + (-0.030)
}
else if (test$cig0_r[i] == "21-40")
{
  test$riskscore[i] = test$riskscore[i] + (0.342)
}
else if (test$cig0_r[i] == "41+")
{
  test$riskscore[i] = test$riskscore[i] + (0.932)
}
else if (test$cig0_r[i] == "Unknown")
{
  test$riskscore[i] = test$riskscore[i] + (0.477)
}
if (test$cig1_r[i] == "1-5")
{
  test$riskscore[i] = test$riskscore[i] + (-0.419)
}
else if (test$cig1_r[i] == "6-10")
{
  test$riskscore[i] = test$riskscore[i] + (-0.280)
}
else if (test$cig1_r[i] == "11-20")
{
  test$riskscore[i] = test$riskscore[i] + (-0.432)
}
else if (test$cig1_r[i] == "21-40")
{
  test$riskscore[i] = test$riskscore[i] + (-0.856)
}
else if (test$cig1_r[i] == "Unknown")
{
  test$riskscore[i] = test$riskscore[i] + (-0.315)
}
if (test$cig2_r[i] == "1-5")
{
  test$riskscore[i] = test$riskscore[i] + (0.575)
}
else if (test$cig2_r[i] == "6-10")
{
  test$riskscore[i] = test$riskscore[i] + (0.372)
}
}

```

```

else if (test$cig2_r[i] == "11-20")
{
  test$riskscore[i] = test$riskscore[i] + (0.287)
}
else if (test$cig2_r[i] == "21-40")
{
  test$riskscore[i] = test$riskscore[i] + (1.067)
}
else if (test$cig2_r[i] == "41+")
{
  test$riskscore[i] = test$riskscore[i] + (0)
}
else if (test$cig2_r[i] == "Unknown")
{
  test$riskscore[i] = test$riskscore[i] + (0.573)
}
if (test$cig3_r[i] == "1-5")
{
  test$riskscore[i] = test$riskscore[i] + (-0.205)
}
else if (test$cig3_r[i] == "6-10")
{
  test$riskscore[i] = test$riskscore[i] + (-0.194)
}
else if (test$cig3_r[i] == "11-20")
{
  test$riskscore[i] = test$riskscore[i] + (0.184)
}
else if (test$cig3_r[i] == "21-40")
{
  test$riskscore[i] = test$riskscore[i] + (0.208)
}
else if (test$cig3_r[i] == "41+")
{
  test$riskscore[i] = test$riskscore[i] + (-1.497)
}
else if (test$cig3_r[i] == "Unknown")
{
  test$riskscore[i] = test$riskscore[i] + (-0.500)
}
if (test$mhtr[i] != "99")
{
  test$riskscore[i] = test$riskscore[i] + test$mhtr[i]*(0.001)
}

```

```

}
if (test$bmi[i] != "99.9")
{
  test$riskscore[i] = test$riskscore[i] + test$bmi[i]*(-0.005)
}
if (test$pwgt_r[i] != "999")
{
  test$riskscore[i] = test$riskscore[i] + test$pwgt_r[i]*(0.0005)
}
if (test$dwgt_r[i] != "999")
{
  test$riskscore[i] = test$riskscore[i] + test$dwgt_r[i]*(0.00005)
}
if (test$wtgain[i] != "99")
{
  test$riskscore[i] = test$riskscore[i] + test$wtgain[i]*(0.00006)
}
if (test$rf_pdiab[i] == "Yes")
{
  test$riskscore[i] = test$riskscore[i] + (0.096)
}
else if (test$rf_pdiab[i] == "Unknown")
{
  test$riskscore[i] = test$riskscore[i] + (-0.546)
}
if (test$rf_gdiab[i] == "Yes")
{
  test$riskscore[i] = test$riskscore[i] + (-0.091)
}
if (test$urf_phype[i] == "Yes")
{
  test$riskscore[i] = test$riskscore[i] + (0.029)
}
if (test$urf_ehype[i] == "Yes")
{
  test$riskscore[i] = test$riskscore[i] + (-0.046)
}
if (test$rf_ppb[i] == "Yes")
{
  test$riskscore[i] = test$riskscore[i] + (-0.136)
}
if (test$rf_inft[i] == "Yes")
{

```

```

    test$riskscore[i] = test$riskscore[i] + (-0.847)
}
if (test$rf_drg[i] == "Yes")
{
    test$riskscore[i] = test$riskscore[i] + (-0.779)
}
else if (test$rf_drg[i] == "Unknown")
{
    test$riskscore[i] = test$riskscore[i] + (0.639)
}
if (test$rf_art[i] == "Yes")
{
    test$riskscore[i] = test$riskscore[i] + (0.811)
}
if (test$rf_cesarn[i] != "99")
{
    test$riskscore[i] = test$riskscore[i] + test$rf_cesarn*(-0.010)
}
if (test$ip_gon[i] == "Yes")
{
    test$riskscore[i] = test$riskscore[i] + (0.098)
}
else if (test$ip_gon[i] == "Unknown")
{
    test$riskscore[i] = test$riskscore[i] + (0.452)
}
if (test$ip_syph[i] == "Yes")
{
    test$riskscore[i] = test$riskscore[i] + (0.369)
}
if (test$ip_chlam[i] == "Yes")
{
    test$riskscore[i] = test$riskscore[i] + (-0.110)
}
if (test$ip_hepb[i] == "Yes")
{
    test$riskscore[i] = test$riskscore[i] + (0.777)
}
if (test$ip_hepc[i] == "Yes")
{
    test$riskscore[i] = test$riskscore[i] + (0.178)
}
if (test$ob_succ[i] == "No")

```

```

{
  test$riskscore[i] = test$riskscore[i] + (0.481)
}
else if (test$ob_succ[i] == "Unknown")
{
  test$riskscore[i] = test$riskscore[i] + (0.725)
}
if (test$ob_fail[i] == "Yes")
{
  test$riskscore[i] = test$riskscore[i] + (-0.107)
}
if (test$id_indl[i] == "Yes")
{
  test$riskscore[i] = test$riskscore[i] + (0.0004)
}
else if (test$id_indl[i] == "Unknown")
{
  test$riskscore[i] = test$riskscore[i] + (0.267)
}
if (test$id_augm[i] == "Yes")
{
  test$riskscore[i] = test$riskscore[i] + (0.048)
}
if (test$id_ster[i] == "Yes")
{
  test$riskscore[i] = test$riskscore[i] + (0.076)
}
if (test$id_antb[i] == "Yes")
{
  test$riskscore[i] = test$riskscore[i] + (0.077)
}
if (test$id_chor[i] == "Yes")
{
  test$riskscore[i] = test$riskscore[i] + (0.072)
}
if (test$id_anes[i] == "Yes")
{
  test$riskscore[i] = test$riskscore[i] + (0.0003)
}
if (test$me_pres[i] == "Breech")
{
  test$riskscore[i] = test$riskscore[i] + (0.007)
}
}

```

```

else if (test$me_pres[i] == "Other")
{
  test$riskscore[i] = test$riskscore[i] + (-0.079)
}
else if (test$me_pres[i] == "Unknown")
{
  test$riskscore[i] = test$riskscore[i] + (0.073)
}
if (test$me_rout[i] == "Forceps")
{
  test$riskscore[i] = test$riskscore[i] + (0.201)
}
else if (test$me_rout[i] == "Vacuum")
{
  test$riskscore[i] = test$riskscore[i] + (-0.050)
}
else if (test$me_rout[i] == "Cesarean")
{
  test$riskscore[i] = test$riskscore[i] + (-0.055)
}
else if (test$me_rout[i] == "Unknown")
{
  test$riskscore[i] = test$riskscore[i] + (0.431)
}
if (test$me_trial[i] == "No")
{
  test$riskscore[i] = test$riskscore[i] + (-0.050)
}
else if (test$me_trial[i] == "Unknown")
{
  test$riskscore[i] = test$riskscore[i] + (-0.342)
}
if (test$mm_mtr[i] == "Yes")
{
  test$riskscore[i] = test$riskscore[i] + (0.089)
}
else if (test$mm_mtr[i] == "Unknown")
{
  test$riskscore[i] = test$riskscore[i] + (-0.623)
}
if (test$mm_plac[i] == "Yes")
{
  test$riskscore[i] = test$riskscore[i] + (0.582)
}

```

```

}
if (test$mm_rupt[i] == "Yes")
{
  test$riskscore[i] = test$riskscore[i] + (-0.097)
}
if (test$mm_uhyst[i] == "Yes")
{
  test$riskscore[i] = test$riskscore[i] + (-0.206)
}
if (test$mm_aicu[i] == "Yes")
{
  test$riskscore[i] = test$riskscore[i] + (-0.276)
}
if (test$attend[i] == "Dr of Osteo")
{
  test$riskscore[i] = test$riskscore[i] + (0.036)
}
else if (test$attend[i] == "Cert Nurse Midwife")
{
  test$riskscore[i] = test$riskscore[i] + (0.008)
}
else if (test$attend[i] == "Other Midwife")
{
  test$riskscore[i] = test$riskscore[i] + (-0.529)
}
else if (test$attend[i] == "Other")
{
  test$riskscore[i] = test$riskscore[i] + (0.052)
}
else if (test$attend[i] == "Unknown")
{
  test$riskscore[i] = test$riskscore[i] + (0.421)
}
if (test$mtran[i] == "Yes")
{
  test$riskscore[i] = test$riskscore[i] + (0.080)
}
else if (test$mtran[i] == "Unknown")
{
  test$riskscore[i] = test$riskscore[i] + (-0.759)
}
if (test$pay_rec[i] == "Private Ins")
{

```

```

    test$riskscore[i] = test$riskscore[i] + (0.066)
}
else if (test$pay_rec[i] == "Self-pay")
{
    test$riskscore[i] = test$riskscore[i] + (-0.013)
}
else if (test$pay_rec[i] == "Other")
{
    test$riskscore[i] = test$riskscore[i] + (-0.073)
}
else if (test$pay_rec[i] == "Unknown")
{
    test$riskscore[i] = test$riskscore[i] + (-0.137)
}
if (test$apgar5r[i] == "4-6")
{
    test$riskscore[i] = test$riskscore[i] + (-0.104)
}
else if (test$apgar5r[i] == "7-8")
{
    test$riskscore[i] = test$riskscore[i] + (-0.318)
}
else if (test$apgar5r[i] == "9-10")
{
    test$riskscore[i] = test$riskscore[i] + (-0.403)
}
else if (test$apgar5r[i] == "Unknown")
{
    test$riskscore[i] = test$riskscore[i] + (0.018)
}
if (test$dplural[i] == "Twin")
{
    test$riskscore[i] = test$riskscore[i] + (-0.614)
}
else if (test$dplural[i] == "Triplet")
{
    test$riskscore[i] = test$riskscore[i] + (-0.419)
}
else if (test$dplural[i] == "Quadruplet")
{
    test$riskscore[i] = test$riskscore[i] + (0.451)
}
else if (test$dplural[i] == "Quintuplet+")

```

```

{
  test$riskscore[i] = test$riskscore[i] + (0)
}
if (test$setorder_r[i] == "2nd")
{
  test$riskscore[i] = test$riskscore[i] + (-0.225)
}
else if (test$setorder_r[i] == "3rd")
{
  test$riskscore[i] = test$riskscore[i] + (-1.154)
}
else if (test$setorder_r[i] == "4th")
{
  test$riskscore[i] = test$riskscore[i] + (0)
}
else if (test$setorder_r[i] == "5th+")
{
  test$riskscore[i] = test$riskscore[i] + (0)
}
else if (test$setorder_r[i] == "Unknown")
{
  test$riskscore[i] = test$riskscore[i] + (-0.616)
}
if (test$sex[i] == "Female")
{
  test$riskscore[i] = test$riskscore[i] + (0.051)
}
if (test$oekest_r10[i] == "20-27 weeks")
{
  test$riskscore[i] = test$riskscore[i] + (-0.149)
}
else if (test$oekest_r10[i] == "28-31 weeks")
{
  test$riskscore[i] = test$riskscore[i] + (-0.474)
}
else if (test$oekest_r10[i] == "32-33 weeks")
{
  test$riskscore[i] = test$riskscore[i] + (-0.550)
}
else if (test$oekest_r10[i] == "34-36 weeks")
{
  test$riskscore[i] = test$riskscore[i] + (-0.563)
}
}

```

```

else if (test$oegegest_r10[i] == "37-38 weeks")
{
  test$riskscore[i] = test$riskscore[i] + (-0.617)
}
else if (test$oegegest_r10[i] == "39 weeks")
{
  test$riskscore[i] = test$riskscore[i] + (-0.618)
}
else if (test$oegegest_r10[i] == "40 weeks")
{
  test$riskscore[i] = test$riskscore[i] + (-0.595)
}
else if (test$oegegest_r10[i] == "41 weeks")
{
  test$riskscore[i] = test$riskscore[i] + (-0.654)
}
else if (test$oegegest_r10[i] == "42 weeks")
{
  test$riskscore[i] = test$riskscore[i] + (-0.626)
}
else if (test$oegegest_r10[i] == "Unknown")
{
  test$riskscore[i] = test$riskscore[i] + (0)
}
if (test$bwtr4[i] == "1500-2499 grams")
{
  test$riskscore[i] = test$riskscore[i] + (-0.019)
}
else if (test$bwtr4[i] == "2500-8165 grams")
{
  test$riskscore[i] = test$riskscore[i] + (0.048)
}
else if (test$bwtr4[i] == "Unknown")
{
  test$riskscore[i] = test$riskscore[i] + (1.939)
}
if (test$ab_aven1[i] == "Yes")
{
  test$riskscore[i] = test$riskscore[i] + (0.071)
}
else if (test$ab_aven1[i] == "Unknown")
{
  test$riskscore[i] = test$riskscore[i] + (-1.230)
}

```

```

}
if (test$ab_aven6[i] == "Yes")
{
  test$riskscore[i] = test$riskscore[i] + (-0.005)
}
if (test$ab_nicu[i] == "Yes")
{
  test$riskscore[i] = test$riskscore[i] + (0.025)
}
if (test$ab_surf[i] == "Yes")
{
  test$riskscore[i] = test$riskscore[i] + (0.026)
}
if (test$ab_anti[i] == "Yes")
{
  test$riskscore[i] = test$riskscore[i] + (-0.00003)
}
if (test$ab_seiz[i] == "Yes")
{
  test$riskscore[i] = test$riskscore[i] + (0.180)
}
if (test$itran[i] == "Yes")
{
  test$riskscore[i] = test$riskscore[i] + (0.017)
}
else if (test$itran[i] == "Unknown")
{
  test$riskscore[i] = test$riskscore[i] + (2.321)
}
if (test$bfed[i] == "Yes")
{
  test$riskscore[i] = test$riskscore[i] + (-0.091)
}
else if (test$bfed[i] == "Unknown")
{
  test$riskscore[i] = test$riskscore[i] + (-0.345)
}
}

```

```
thesis2$riskscore <- 0
```

```

for (i in 1:nrow(thesis2)){
  if (thesis2$bfacil3[i] == "Not Hospital")

```

```

{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.109)
}
if (thesis2$mager14[i] == "15")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-2.492)
}
else if (thesis2$mager14[i] == "16")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-2.411)
}
else if (thesis2$mager14[i] == "17")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-2.364)
}
else if (thesis2$mager14[i] == "18")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-2.232)
}
else if (thesis2$mager14[i] == "19")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-2.420)
}
else if (thesis2$mager14[i] == "20-24")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-2.404)
}
else if (thesis2$mager14[i] == "25-29")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-2.433)
}
else if (thesis2$mager14[i] == "30-34")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-2.390)
}
else if (thesis2$mager14[i] == "35-39")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-2.237)
}
else if (thesis2$mager14[i] == "40-44")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-2.357)
}
}

```

```

else if (thesis2$mager14[i] == "45-49")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-2.109)
}
else if (thesis2$mager14[i] == "50-54")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-1.587)
}
if (thesis2$restatus[i] == "Intrastate Non-res")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0.035)
}
else if (thesis2$mbstate_rec[i] == "Interstate Non-res")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0.010)
}
if (thesis2$mracehisp[i] == "Non-Hisp Black")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.101)
}
else if (thesis2$mracehisp[i] == "Non-Hisp AIAN")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.602)
}
else if (thesis2$mracehisp[i] == "Non-Hisp Asian")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.235)
}
else if (thesis2$mracehisp[i] == "Non-Hisp NHOPI")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.661)
}
else if (thesis2$mracehisp[i] == "Non-Hisp More than one race")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.199)
}
else if (thesis2$mracehisp[i] == "Hispanic")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.006)
}
else if (thesis2$mracehisp[i] == "Unknown")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.148)
}

```

```

}
if (thesis2$mar_p[i] == "No")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0.022)
}
else if (thesis2$mar_p[i] == "Unknown")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.328)
}
else if (thesis2$mar_p[i] == "Not Applicable")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0.063)
}
if (thesis2$dmар[i] == "Unknown")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.464)
}
if (thesis2$meduc[i] == "9-12")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.031)
}
else if (thesis2$meduc[i] == "HS Grad/GED")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.030)
}
else if (thesis2$meduc[i] == "Some college")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.021)
}
else if (thesis2$meduc[i] == "Associate degree")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.017)
}
else if (thesis2$meduc[i] == "Bachelor's degree")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.036)
}
else if (thesis2$meduc[i] == "Master's degree")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.092)
}
else if (thesis2$meduc[i] == "Doctorate or Professional degree")
{

```

```

thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.370)
}
else if (thesis2$meduc[i] == "Unknown")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.121)
}
if (thesis2$fage11[i] == "15-19")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0.453)
}
else if (thesis2$fage11[i] == "20-24")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0.434)
}
else if (thesis2$fage11[i] == "25-29")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0.358)
}
else if (thesis2$fage11[i] == "30-34")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0.455)
}
else if (thesis2$fage11[i] == "35-39")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0.352)
}
else if (thesis2$fage11[i] == "40-44")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0.392)
}
else if (thesis2$fage11[i] == "45-49")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0.501)
}
else if (thesis2$fage11[i] == "50-54")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0.811)
}
else if (thesis2$fage11[i] == "55+")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0.481)
}
else if (thesis2$fage11[i] == "Unknown")

```

```

{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0.780)
}
if (!is.na(thesis2$fracehisp[i]) == "Non-Hisp Black")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.060)
}
else if (!is.na(thesis2$fracehisp[i]) == "Non-Hisp AIAN")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.095)
}
else if (!is.na(thesis2$fracehisp[i]) == "Non-Hisp Asian")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0.183)
}
else if (!is.na(thesis2$fracehisp[i]) == "Non-Hisp NHOP")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0.156)
}
else if (!is.na(thesis2$fracehisp[i]) == "Non-Hisp More than one race")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.034)
}
else if (!is.na(thesis2$fracehisp[i]) == "Hispanic")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.082)
}
else if (!is.na(thesis2$fracehisp[i]) == "Unknown")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.186)
}
if (thesis2$feduc[i] == "9-12")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.281)
}
else if (thesis2$feduc[i] == "HS Grad/GED")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.343)
}
else if (thesis2$feduc[i] == "Some college")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.264)
}
}

```

```

else if (thesis2$feduc[i] == "Associate degree")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.105)
}
else if (thesis2$feduc[i] == "Bachelor's degree")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.167)
}
else if (thesis2$feduc[i] == "Master's degree")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.107)
}
else if (thesis2$feduc[i] == "Doctorate or Professional degree")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.282)
}
else if (thesis2$feduc[i] == "Unknown")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.464)
}
if (thesis2$priorlive[i] != "99")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + thesis2$priorlive[i]*(-0.003)
}
if (thesis2$priordead[i] != "99")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + thesis2$priordead[i]*(0.001)
}
if (thesis2$priorterm[i] != "99")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + thesis2$priorterm[i]*(-0.001)
}
if (thesis2$lbo_rec[i] != "9")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + thesis2$lbo_rec[i]*(-0.003)
}
if (thesis2$tpo_rec[i] != "9")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + thesis2$tpo_rec[i]*(0.008)
}
if (thesis2$illb_r11[i] == "4-11 months")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.151)
}

```

```

}
else if (thesis2$illb_r11[i] == "12-17 months")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.474)
}
else if (thesis2$illb_r11[i] == "18-23 months")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.415)
}
else if (thesis2$illb_r11[i] == "24-35 months")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.410)
}
else if (thesis2$illb_r11[i] == "36-47 months")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.380)
}
else if (thesis2$illb_r11[i] == "48-59 months")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.358)
}
else if (thesis2$illb_r11[i] == "60-71 months")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.362)
}
else if (thesis2$illb_r11[i] == "72+ months")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.319)
}
else if (thesis2$illb_r11[i] == "1st live birth")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.473)
}
else if (thesis2$illb_r11[i] == "Unknown")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.361)
}
if (thesis2$iloo_r11[i] == "4-11 months")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-1.053)
}
else if (thesis2$iloo_r11[i] == "12-17 months")
{

```

```

thesis2$riskscore[i] = thesis2$riskscore[i] + (-1.483)
}
else if (thesis2$iloo_r11[i] == "18-23 months")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-1.241)
}
else if (thesis2$iloo_r11[i] == "24-35 months")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-1.318)
}
else if (thesis2$iloo_r11[i] == "36-47 months")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-1.432)
}
else if (thesis2$iloo_r11[i] == "48-59 months")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-1.582)
}
else if (thesis2$iloo_r11[i] == "60-71 months")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-1.333)
}
else if (thesis2$iloo_r11[i] == "72+ months")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-1.432)
}
else if (thesis2$iloo_r11[i] == "1st live birth")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-1.371)
}
else if (thesis2$iloo_r11[i] == "Unknown")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-1.163)
}
if (thesis2$ilp_r11[i] == "4-11 months")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.548)
}
else if (thesis2$ilp_r11[i] == "12-17 months")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.049)
}
else if (thesis2$ilp_r11[i] == "18-23 months")

```

```

{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.139)
}
else if (thesis2$ilp_r11[i] == "24-35 months")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.037)
}
else if (thesis2$ilp_r11[i] == "36-47 months")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.126)
}
else if (thesis2$ilp_r11[i] == "48-59 months")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.188)
}
else if (thesis2$ilp_r11[i] == "60-71 months")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.083)
}
else if (thesis2$ilp_r11[i] == "72+ months")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.171)
}
else if (thesis2$ilp_r11[i] == "1st live birth")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0.027)
}
else if (thesis2$ilp_r11[i] == "Unknown")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.230)
}
if (thesis2$precare5[i] == "2nd Trimester")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.006)
}
else if (thesis2$precare5[i] == "3rd Trimester")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.120)
}
else if (thesis2$precare5[i] == "No prenatal care")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.092)
}
}

```

```

else if (thesis2$precare5[i] == "Unknown")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.009)
}
if (thesis2$previs_rec[i] == "1-2")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0.056)
}
else if (thesis2$previs_rec[i] == "3-4")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.174)
}
else if (thesis2$previs_rec[i] == "5-6")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.012)
}
else if (thesis2$previs_rec[i] == "7-8")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0.033)
}
else if (thesis2$previs_rec[i] == "9-10")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.013)
}
else if (thesis2$previs_rec[i] == "11-12")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.065)
}
else if (thesis2$previs_rec[i] == "13-14")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0.032)
}
else if (thesis2$previs_rec[i] == "15-16")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0.106)
}
else if (thesis2$previs_rec[i] == "17-18")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0.107)
}
else if (thesis2$previs_rec[i] == "19+")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.023)
}

```

```

}

if (thesis2$wic[i] == "Yes")
{
  thesis2$riskscore[i] = thesis2$riskscore[i] + (0.039)
}
else if (thesis2$wic[i] == "Unknown")
{
  thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.074)
}
if (thesis2$cig0_r[i] == "1-5")
{
  thesis2$riskscore[i] = thesis2$riskscore[i] + (0.089)
}
else if (thesis2$cig0_r[i] == "6-10")
{
  thesis2$riskscore[i] = thesis2$riskscore[i] + (0.115)
}
else if (thesis2$cig0_r[i] == "11-20")
{
  thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.030)
}
else if (thesis2$cig0_r[i] == "21-40")
{
  thesis2$riskscore[i] = thesis2$riskscore[i] + (0.342)
}
else if (thesis2$cig0_r[i] == "41+")
{
  thesis2$riskscore[i] = thesis2$riskscore[i] + (0.932)
}
else if (thesis2$cig0_r[i] == "Unknown")
{
  thesis2$riskscore[i] = thesis2$riskscore[i] + (0.477)
}
if (thesis2$cig1_r[i] == "1-5")
{
  thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.419)
}
else if (thesis2$cig1_r[i] == "6-10")
{
  thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.280)
}
else if (thesis2$cig1_r[i] == "11-20")

```

```

{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.432)
}
else if (thesis2$cig1_r[i] == "21-40")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.856)
}
else if (thesis2$cig1_r[i] == "Unknown")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.315)
}
if (thesis2$cig2_r[i] == "1-5")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0.575)
}
else if (thesis2$cig2_r[i] == "6-10")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0.372)
}
else if (thesis2$cig2_r[i] == "11-20")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0.287)
}
else if (thesis2$cig2_r[i] == "21-40")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (1.067)
}
else if (thesis2$cig2_r[i] == "41+")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0)
}
else if (thesis2$cig2_r[i] == "Unknown")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0.573)
}
if (thesis2$cig3_r[i] == "1-5")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.205)
}
else if (thesis2$cig3_r[i] == "6-10")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.194)
}
}

```

```

else if (thesis2$cig3_r[i] == "11-20")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0.184)
}
else if (thesis2$cig3_r[i] == "21-40")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0.208)
}
else if (thesis2$cig3_r[i] == "41+")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-1.497)
}
else if (thesis2$cig3_r[i] == "Unknown")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.500)
}
if (thesis2$mhtr[i] != "99")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + thesis2$mhtr[i]*(0.001)
}
if (thesis2$bmi[i] != "99.9")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + thesis2$bmi[i]*(-0.005)
}
if (thesis2$pwgt_r[i] != "999")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + thesis2$pwgt_r[i]*(0.0005)
}
if (thesis2$dwgt_r[i] != "999")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + thesis2$dwgt_r[i]*(0.00005)
}
if (thesis2$wtgain[i] != "99")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + thesis2$wtgain[i]*(0.00006)
}
if (thesis2$rf_pdiab[i] == "Yes")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0.096)
}
else if (thesis2$rf_pdiab[i] == "Unknown")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.546)
}

```

```

}
if (thesis2$rf_gdiab[i] == "Yes")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.091)
}
if (thesis2$urf_phype[i] == "Yes")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0.029)
}
if (thesis2$urf_ehype[i] == "Yes")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.046)
}
if (thesis2$rf_ppb[i] == "Yes")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.136)
}
if (thesis2$rf_inft[i] == "Yes")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.847)
}
if (thesis2$rf_drg[i] == "Yes")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.779)
}
else if (thesis2$rf_drg[i] == "Unknown")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0.639)
}
if (thesis2$rf_art[i] == "Yes")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0.811)
}
if (thesis2$rf_cesarn[i] != "99")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + thesis2$rf_cesarn*(-0.010)
}
if (thesis2$ip_gon[i] == "Yes")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0.098)
}
else if (thesis2$ip_gon[i] == "Unknown")
{

```

```

thesis2$riskscore[i] = thesis2$riskscore[i] + (0.452)
}
if (thesis2$ip_syph[i] == "Yes")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0.369)
}
if (thesis2$ip_chlam[i] == "Yes")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.110)
}
if (thesis2$ip_hepb[i] == "Yes")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0.777)
}
if (thesis2$ip_hepc[i] == "Yes")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0.178)
}
if (thesis2$ob_succ[i] == "No")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0.481)
}
else if (thesis2$ob_succ[i] == "Unknown")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0.725)
}
if (thesis2$ob_fail[i] == "Yes")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.107)
}
if (thesis2$ld_indl[i] == "Yes")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0.0004)
}
else if (thesis2$ld_indl[i] == "Unknown")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0.267)
}
if (thesis2$ld_augm[i] == "Yes")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0.048)
}
if (thesis2$ld_ster[i] == "Yes")

```

```

{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0.076)
}
if (thesis2$ld_antb[i] == "Yes")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0.077)
}
if (thesis2$ld_chor[i] == "Yes")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0.072)
}
if (thesis2$ld_anes[i] == "Yes")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0.0003)
}
if (thesis2$me_pres[i] == "Breech")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0.007)
}
else if (thesis2$me_pres[i] == "Other")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.079)
}
else if (thesis2$me_pres[i] == "Unknown")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0.073)
}
if (thesis2$me_rout[i] == "Forceps")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0.201)
}
else if (thesis2$me_rout[i] == "Vacuum")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.050)
}
else if (thesis2$me_rout[i] == "Cesarean")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.055)
}
else if (thesis2$me_rout[i] == "Unknown")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0.431)
}
}

```

```

if (thesis2$me_trial[i] == "No")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.050)
}
else if (thesis2$me_trial[i] == "Unknown")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.342)
}
if (thesis2$mm_mtr[i] == "Yes")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0.089)
}
else if (thesis2$mm_mtr[i] == "Unknown")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.623)
}
if (thesis2$mm_plac[i] == "Yes")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0.582)
}
if (thesis2$mm_rupt[i] == "Yes")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.097)
}
if (thesis2$mm_uhyst[i] == "Yes")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.206)
}
if (thesis2$mm_aicu[i] == "Yes")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.276)
}
if (thesis2$attend[i] == "Dr of Osteo")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0.036)
}
else if (thesis2$attend[i] == "Cert Nurse Midwife")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0.008)
}
else if (thesis2$attend[i] == "Other Midwife")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.529)
}

```

```

}
else if (thesis2$attend[i] == "Other")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0.052)
}
else if (thesis2$attend[i] == "Unknown")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0.421)
}
if (thesis2$mtran[i] == "Yes")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0.080)
}
else if (thesis2$mtran[i] == "Unknown")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.759)
}
if (thesis2$pay_rec[i] == "Private Ins")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0.066)
}
else if (thesis2$pay_rec[i] == "Self-pay")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.013)
}
else if (thesis2$pay_rec[i] == "Other")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.073)
}
else if (thesis2$pay_rec[i] == "Unknown")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.137)
}
if (thesis2$apgar5r[i] == "4-6")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.104)
}
else if (thesis2$apgar5r[i] == "7-8")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.318)
}
else if (thesis2$apgar5r[i] == "9-10")
{

```

```

thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.403)
}
else if (thesis2$apgar5r[i] == "Unknown")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0.018)
}
if (thesis2$dplural[i] == "Twin")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.614)
}
else if (thesis2$dplural[i] == "Triplet")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.419)
}
else if (thesis2$dplural[i] == "Quadruplet")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0.451)
}
else if (thesis2$dplural[i] == "Quintuplet+")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0)
}
if (thesis2$setorder_r[i] == "2nd")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.225)
}
else if (thesis2$setorder_r[i] == "3rd")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-1.154)
}
else if (thesis2$setorder_r[i] == "4th")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0)
}
else if (thesis2$setorder_r[i] == "5th+")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0)
}
else if (thesis2$setorder_r[i] == "Unknown")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.616)
}
if (thesis2$sex[i] == "Female")

```

```

{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0.051)
}
if (thesis2$oekest_r10[i] == "20-27 weeks")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.149)
}
else if (thesis2$oekest_r10[i] == "28-31 weeks")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.474)
}
else if (thesis2$oekest_r10[i] == "32-33 weeks")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.550)
}
else if (thesis2$oekest_r10[i] == "34-36 weeks")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.563)
}
else if (thesis2$oekest_r10[i] == "37-38 weeks")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.617)
}
else if (thesis2$oekest_r10[i] == "39 weeks")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.618)
}
else if (thesis2$oekest_r10[i] == "40 weeks")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.595)
}
else if (thesis2$oekest_r10[i] == "41 weeks")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.654)
}
else if (thesis2$oekest_r10[i] == "42 weeks")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.626)
}
else if (thesis2$oekest_r10[i] == "Unknown")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0)
}
}

```

```

if (thesis2$bwtr4[i] == "1500-2499 grams")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.019)
}
else if (thesis2$bwtr4[i] == "2500-8165 grams")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0.048)
}
else if (thesis2$bwtr4[i] == "Unknown")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (1.939)
}
if (thesis2$ab_aven1[i] == "Yes")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0.071)
}
else if (thesis2$ab_aven1[i] == "Unknown")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-1.230)
}
if (thesis2$ab_aven6[i] == "Yes")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.005)
}
if (thesis2$ab_nicu[i] == "Yes")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0.025)
}
if (thesis2$ab_surf[i] == "Yes")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0.026)
}
if (thesis2$ab_anti[i] == "Yes")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.00003)
}
if (thesis2$ab_seiz[i] == "Yes")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0.180)
}
if (thesis2$itran[i] == "Yes")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (0.017)
}

```

```

}
else if (thesis2$itran[i] == "Unknown")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (2.321)
}
if (thesis2$bfed[i] == "Yes")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.091)
}
else if (thesis2$bfed[i] == "Unknown")
{
thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.345)
}
}

#
# Create categories for risk score
#

train$riskscore <- exp(train$riskscore)
test$riskscore <- exp(test$riskscore)
thesis2$riskscore<- exp(thesis2$riskscore)

attach(thesis2)
thesis2$riskcat[riskscore < 0.005466591]<- "Low"
thesis2$riskcat[riskscore >= 0.005466591]<- "High"
detach(thesis2)

thesis2$riskcat <- factor(thesis2$riskcat, levels = c("Low","High"))

attach(train)
train$riskcat[riskscore < 0.005466591]<- "Low"
train$riskcat[riskscore >= 0.005466591]<- "High"
detach(train)

train$riskcat <- factor(train$riskcat, levels = c("Low","High"))

attach(test)
test$riskcat[riskscore < 0.005466591]<- "Low"
test$riskcat[riskscore >= 0.005466591]<- "High"
detach(test)

```

```

test$riskcat <- factor(test$riskcat, levels = c("Low","High"))

#
# Kaplan Meier plots
# mracehisp, mar_p, meduc+feduc, oegest_r10, bwt4, attend, apgar5r, sex, bfed

KM_risk_train <- survfit(Surv(os_mon, flgnd)~ riskcat, data= train,
                        conf.type= 'log-log')

KM_risk_test <- survfit(Surv(os_mon, flgnd)~ riskcat, data= test,
                       conf.type= 'log-log')

KM_risk_fit1 <- list(KM_risk_train, KM_risk_test)
ggsurvplot_combine(KM_risk_fit1, data= thesis2,
                  break.time.by= 1,
                  palette = rainbow(4),
                  conf.int= T,
                  pval = TRUE,
                  ggtheme = theme_survminer(),
                  legend.labs = c("Training Low Risk", "Training High Risk",
                                "Test Low Risk", "Test High Risk"),
                  xlab = "Time (Months)")

tr<- data.frame("time"=train$os_mon, "event"= train$flgnd, "score"= train$riskcat)
ts<- data.frame("time"=test$os_mon, "event"= test$flgnd, "score"= test$riskcat)
sbrier.score2proba(data.tr = tr, data.ts = ts, method = "cox") # 0.096 (lower better 0-1)

risk_cox_train <- coxph(Surv(os_mon, flgnd)~ riskscore, data = train, ties = "efron")
risk_pred <- predict(risk_cox_train, newdata = test, type = "risk")
pred_prob<-risk_pred
pred_prob <- ifelse(pred_prob > 1,1, 0)
table(pred_prob, train$flgnd)
TP<- 2818
FN<- 2774
FP<- 923
TN<- 962
risk_sensitivity <- TP/(TP+FN)
risk_specificity<- TN/(TN+FP)
risk_precision <- TP/(TP+FP)
risk_npv <- TN/(TN+FN)
risk_accuracy <- (TP+TN)/(TP+TN+FP+FN)

KM_risk <- survfit(Surv(os_mon, flgnd) ~ riskcat, data= thesis2, conf.type= 'log-log')

```

```

ggsurvplot(KM_risk, data= thesis2,
  pval = T, # <0.0001
  break.time.by = 1,
  fontsize = 20,
  risk.table = F,
  risk.table.fontsize = 5,
  surv.median.line = "hv",
  palette = c("red", "blue"),
  legend.labs = c("Low", "High"),
  xlab = "Time (Months)")

```

```

KM_mrcehisp <- survfit(Surv(time = os_mon, event = flgnd)~ mrcehisp, data=
thesis2,
  conf.type= 'log-log')
surv_summary(KM_risk, thesis2)

```

```

ggsurvplot(KM_mrcehisp, data= thesis2,
  pval = T, # 0.0016
  break.time.by = 1,
  palette = rainbow(8),
  surv.median.line = "hv",
  fontsize = 20,
  risk.table = F,
  risk.table.fontsize = 3,
  legend.labs = c("Non-Hisp White", "Non-Hisp Black", "Non-Hisp AIAN",
    "Non-Hisp Asian", "Non-Hisp NHOPI", "Non-Hisp More than one race",
    "Hispanic", "Unknown"),
  xlab = "Time (Months)")

```

```

KM_marriage <- survfit(Surv(time = os_mon, event = flgnd)~ dmar, data= thesis2,
  conf.type= 'log-log')

```

```

ggsurvplot(KM_marriage, data= thesis2,
  pval = T, # <0.0001
  break.time.by = 1,
  palette = rainbow(3),
  fontsize = 20,
  surv.median.line = "hv",
  risk.table = F,
  risk.table.fontsize = 3,

```

```
legend.labs = c("Married", "Unmarried", "Unknown"),  
xlab = "Time (Months)")
```

```
KM_gestation <- survfit(Surv(time = os_mon, event = flgnd)~ oegest_r10, data= thesis2,  
  conf.type= 'log-log')
```

```
ggsurvplot(KM_gestation, data= thesis2,  
  pval = T, # < 0.0001  
  break.time.by = 1,  
  palette = rainbow(11),  
  legend.labs = c("< 20 weeks", "20-27 weeks", "28-31 weeks",  
    "32-33 weeks", "34-36 weeks", "37-38 weeks",  
    "39 weeks", "40 weeks", "41 weeks", "42+ weeks", "Unknown"),  
  xlab = "Time (Months)")
```

```
KM_birth_weight <- survfit(Surv(time = os_mon, event = flgnd)~ bwtr4, data= thesis2,  
  conf.type= 'log-log')
```

```
ggsurvplot(KM_birth_weight, data= thesis2,  
  pval = T, # < 0.0001  
  break.time.by = 1,  
  palette = rainbow(4),  
  fontsize = 20,  
  surv.median.line = "hv",  
  risk.table = F,  
  risk.table.fontsize = 3,  
  legend.labs = c("227-1499 grams", "1500-2499 grams",  
    "2500-8165 grams", "Unknown"),  
  xlab = "Time (Months)")
```

```
KM_attend <- survfit(Surv(time = os_mon, event = flgnd)~ attend, data= thesis2)
```

```
ggsurvplot(KM_attend, data= thesis2,  
  pval = T, # 0.00054  
  break.time.by = 1,  
  palette =c("red", "blue", "green3", "purple", "dodgerblue", "orange"),  
  fontsize = 20,  
  surv.median.line = "hv",  
  risk.table = F,  
  risk.table.fontsize = 3,
```

```
legend.labs = c("Dr of Med", "Dr of Osteo", "Cert Nurse Midwife", "Other Midwife",  
              "Other", "Unknown"),  
xlab = "Time (Months)")
```

```
KM_apgar5 <- survfit(Surv(time = os_mon, event = flgnd)~ apgar5r, data= thesis2,  
                    conf.type= 'log-log')
```

```
ggsurvplot(KM_apgar5, data= thesis2,  
           pval = T, # < 0.0001  
           break.time.by = 1,  
           palette = rainbow(5),  
           fontsize = 20,  
           surv.median.line = "hv",  
           risk.table = F,  
           risk.table.fontsize = 3,  
           legend.labs = c("0-3", "4-6", "7-8", "9-10", "Unknown"),  
           xlab = "Time (Months)")
```

```
KM_sex <- survfit(Surv(time = os_mon, event = flgnd)~ sex, data= thesis2,  
                 conf.type= 'log-log')
```

```
ggsurvplot(KM_sex, data= thesis2,  
           pval = T, # 0.52  
           break.time.by = 1,  
           palette = c("red", "blue"),  
           fontsize = 20,  
           surv.median.line = "hv",  
           risk.table = F,  
           risk.table.fontsize = 3,  
           legend.labs = c("Male", "Female"),  
           xlab = "Time (Months)")
```

```
KM_bfed <- survfit(Surv(time = os_mon, event = flgnd)~ bfed, data= thesis2,  
                  conf.type= 'log-log')
```

```
ggsurvplot(KM_bfed, data= thesis2,  
           pval = T, # < 0.0001  
           break.time.by = 1,  
           palette = c("red", "purple", "blue4"),  
           fontsize = 20,
```

```
surv.median.line = "hv",  
risk.table = F,  
risk.table.fontsize = 3,  
legend.labs = c("Yes", "No", "Unknown"),  
xlab = "Time (Months)")
```

```
KM_Meducation <- survfit(Surv(os_mon, flgnd) ~ meduc, data= thesis2,  
  conf.type= 'log-log')
```

```
ggsurvplot(KM_Meducation, data= thesis2,  
  pval = T, # < 0.0001  
  break.time.by = 1,  
  palette = c("red", "orange", "goldenrod", "green1", "green3", "dodgerblue", "blue4",  
  "purple", "gray"),  
  fontsize = 20,  
  surv.median.line = "hv",  
  risk.table = F,  
  risk.table.fontsize = 3,  
  legend.labs = c("< 9th grade", "9-12 grade", "HS Grad/GED", "Some College",  
  "Associate Degree", "Bachelor's Degree", "Master's Degree",  
  "PhD or Professional degree", "Unknown"),  
  xlab = "Time (Months)")
```

```
KM_Feducation <- survfit(Surv(os_mon, flgnd) ~ feduc, data = thesis2,  
  conf.type= 'log-log')
```

```
ggsurvplot(KM_Feducation, data= thesis2,  
  pval = T, # < 0.0001  
  break.time.by = 1,  
  palette = c("red", "orange", "goldenrod", "green1",  
  "green3", "dodgerblue", "blue4", "purple", "gray"),  
  fontsize = 20,  
  surv.median.line = "hv",  
  risk.table = F,  
  risk.table.fontsize = 3,  
  legend.labs = c("< 9th grade", "9-12 grade", "HS Grad/GED", "Some College",  
  "Associate Degree", "Bachelor's Degree", "Master's Degree",  
  "PhD or Professional degree", "Unknown"),  
  xlab = "Time (Months)")
```

```
KM_wic <- survfit(Surv(os_mon, flgnd) ~ wic, data = thesis2,  
  conf.type = 'log-log')
```

```

ggsurvplot(KM_wic, data= thesis2,
  pval = T, # < 0.0001
  break.time.by = 1,
  palette = rainbow(3),
  fontsize = 20,
  surv.median.line = "hv",
  risk.table = F,
  risk.table.fontsize = 3,
  legend.labs = c("No", "Yes", "Unknown"),
  xlab = "Time (Months)")

```

```

KM_mager14 <- survfit(Surv(os_mon, flgnd) ~ mager14, data = thesis2,
  conf.type = 'log-log')
surv_median(KM_mager14)

```

```

ggsurvplot(KM_mager14, data= thesis2,
  pval = T, #<0.0001
  break.time.by = 1,
  palette = rainbow(13),
  fontsize = 20,
  surv.median.line = "hv",
  risk.table = F,
  risk.table.fontsize = 3,
  legend.labs = c("< 15", "15", "16", "17", "18", "19", "20-24",
    "25-29", "30-34", "35-39", "40-44", "45-49",
    "50-54"),
  xlab = "Time (Months)")

```

```

KM_previs_rec <- survfit(Surv(os_mon, flgnd) ~ previs_rec, data = thesis2,
  conf.type = 'log-log')

```

```

ggsurvplot(KM_previs_rec, data= thesis2,
  pval = T, # <0.0001
  break.time.by = 1,
  palette = rainbow(12),
  fontsize = 20,
  surv.median.line = "hv",
  risk.table = F,
  risk.table.fontsize = 3,
  legend.labs = c("None", "1-2", "3-4", "5-6", "7-8", "9-10",
    "11-12", "13-14", "15-16", "17-18", "19+", "Unknown"),
  xlab = "Time (Months)")

```

```
KM_precare5 <- survfit(Surv(os_mon, flgnd) ~ precare5, data = thesis2,  
  conf.type = 'log-log')
```

```
ggsurvplot(KM_precare5, data= thesis2,  
  pval = T, # < 0.0001  
  break.time.by = 1,  
  palette = rainbow(5),  
  fontsize = 20,  
  surv.median.line = "hv",  
  risk.table = F,  
  risk.table.fontsize = 3,  
  legend.labs = c("1st Trimester", "2nd Trimester", "3rd Trimester",  
    "No Prenatal Care", "Unknown"),  
  xlab = "Time (Months)")
```

```
KM_pay_rec <- survfit(Surv(os_mon, flgnd) ~ pay_rec, data = thesis2,  
  conf.type = 'log-log')
```

```
ggsurvplot(KM_pay_rec, data= thesis2,  
  pval = T, # <0.0001  
  break.time.by = 1,  
  palette = rainbow(5),  
  fontsize = 20,  
  surv.median.line = "hv",  
  risk.table = F,  
  risk.table.fontsize = 3,  
  legend.labs = c("Medicaid", "Private Ins", "Self-pay", "Other", "Unknown"),  
  xlab = "Time (Months)")
```

```
#
```

```
# Univariate Coxph Models
```

```
#
```

```
covariates <- c("meduc", "sex", "mager14", "wic", "mracehisp",  
  "pay_rec", "precare5", "previs_rec", "feduc", "bfed",  
  "apgar5r", "oegest_r10", "attend", "dmar", "bwtr4", "riskcat")  
univ_formulas <- sapply(covariates,  
  function(x) as.formula(paste('Surv(os_mon, flgnd)~', x)))  
univ_models <- lapply( univ_formulas, function(x){coxph(x, data = thesis2)})  
univ_results <- lapply(univ_models,  
  function(x){  
    x <- summary(x)
```

```

beta<-signif(x$coef[1], digits=4);#coeficient beta
HR <-signif(x$coef[2], digits=4);#exp(beta)
HR.confint.lower <- signif(x$conf.int["lower .95"], 2)
HR.confint.upper <- signif(x$conf.int["upper .95"],2)
HR <- paste0(HR, " (",
HR.confint.lower, "-", HR.confint.upper, ")")
res<-c(beta, HR)
names(res)<-c("beta", "HR (95% CI for HR)")
return(res))

```

```

#
# Multivariate Coxph Models
#

```

```

Model <- coxph(Surv(os_mon, flgnd)~ bfacil3 + mager14 + restatus + mracehisp +
mar_p + dmar + meduc + fage11 + fracehisp + feduc + priorlive + priordead + priorterm
+ lbo_rec + tpo_rec + illb_r11 + iloo_r11 + ilp_r11 + precare5 + previs_rec + wic +
cig0_r + cig1_r + cig2_r + cig3_r + mhtr + bmi + pwgt_r + dwgt_r + wtgain + rf_pdiab +
rf_gdiab + urf_phype + rf_ghype + urf_ehype + rf_ppb + rf_inft + rf_drg + rf_art +
rf_cesarn + ip_gon + ip_syph + ip_chlam + ip_hepb + ip_hepc + ob_succ + ob_fail +
ld_indl + ld_augm + ld_ster + ld_antb + ld_chor + ld_anes + me_pres + me_rout +
me_trial + dmeth_rec + mm_mtr + mm_plac + mm_rupt + mm_uhyst + mm_aicu +
attend + mtran + pay_rec + apgar5r + dplural + setorder_r + sex + oegest_r10 + bwtr4 +
ab_aven1 + ab_aven6 + ab_nicu + ab_surf + ab_anti + ab_seiz + itran + bfed, data=
train, x= T, ties = "efron")

```

```

selectCox(Surv(os_mon, flgnd)~ bfacil3 + mager14 + mbstate_rec + restatus +
mracehisp + mar_p + meduc + fage11 + fracehisp + feduc + priorlive + priordead +
priorterm + lbo_rec + tpo_rec + illb_r11 + iloo_r11 + ilp_r11 + precare5 + wic + cig0_r +
cig1_r + cig3_r + mhtr + bmi + pwgt_r + dwgt_r + wtgain + ob_succ + dmeth_rec +
attend + mtran + pay_rec + apgar5r + dplural + setorder_r + sex + oegest_r10 + bwtr4 +
itrans + bfed, data= thesis2, rule = "aic")
# apgar5r oegest_r10 bwtr4

```

```

cox_base <- coxph(Surv(os_mon, flgnd)~ apgar5r + oegest_r10 + bwtr4, data = thesis2,
ties = "efron")

```

```

thesis2$os_mon[thesis2$os_mon == 12] <- NA

```

```

coxmod <- coxph(Surv(os_mon, flgnd) ~ mracehisp + meduc + wic + bfed + oegest_r10
+ apgar5r + dmar + pay_rec + feduc + precare5 + previs_rec + mager14 + attend +
bwtr4, data= thesis2, ties = "efron", na.action = na.omit)

```

```

survMisc::gof(cox_base)
survMisc::gof(coxmod)

concord_base <- concordance(cox_base, timewt = "n", influence = 3)
concord_ses <- concordance(coxmod, timewt = "n", influence = 3)

baseROC <- timeROC(T= thesis2$os_mon, delta = thesis2$flgnd, marker = thesis2$lp2,
  cause = 1, weighting = "cox", times = c(1,2,3,4,5,6,7,8,9,10,11),
  ROC = T, iid = F)

sesROC <- timeROC(T= thesis2$os_mon, delta = thesis2$flgnd, marker = thesis2$lp,
  cause = 1, weighting = "cox", times = c(1,2,3,4,5,6,7,8,9,10,11),
  ROC = T, iid = F)

#
## Plot ROC curves
#

plot(sesROC,time=1)
plot(baseROC, time=1, add=T, col= "blue")
plot(sesROC,time=2)
plot(baseROC, time=2, add=T, col= "blue")
plot(sesROC,time=3)
plot(baseROC, time=3, add=T, col= "blue")
plot(sesROC,time=4)
plot(baseROC, time=4, add=T, col= "blue")
plot(sesROC,time=5)
plot(baseROC, time=5, add=T, col= "blue")
plot(sesROC,time=6)
plot(baseROC, time=6, add=T, col= "blue")
plot(sesROC,time=7)
plot(baseROC, time=7, add=T, col= "blue")
plot(sesROC,time=8)
plot(baseROC, time=8, add=T, col= "blue")
plot(sesROC,time=9)
plot(baseROC, time=9, add=T, col= "blue")
plot(sesROC,time=10)
plot(baseROC, time=10, add=T, col= "blue")
plot(sesROC,time=11,lty = 1, col= "red")
plot(baseROC, time=11, add=T, col= "blue")

```