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Infant Mortality in the United States: Socioeconomic Factors Predicting Infant Survival in Late Neo-natal and Post Neo-natal Infants from Birth Certificate Data

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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

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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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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.

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) [1]. 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 [2]. 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 [3,4].

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 [5]. 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 [5]. 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 [6]. 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 [7]. 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 [8]. 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 [9]. 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 [9].

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 [6]. 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 [10]. 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 [11].

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^{th} 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^{th} 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 [12]. 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 364th 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 [13]. 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 [14]. 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 2nd trimester, the hazard ratio was 0.93 (95% CI= [0.87-0.99], $p= 0.013$), and for the 3rd 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.

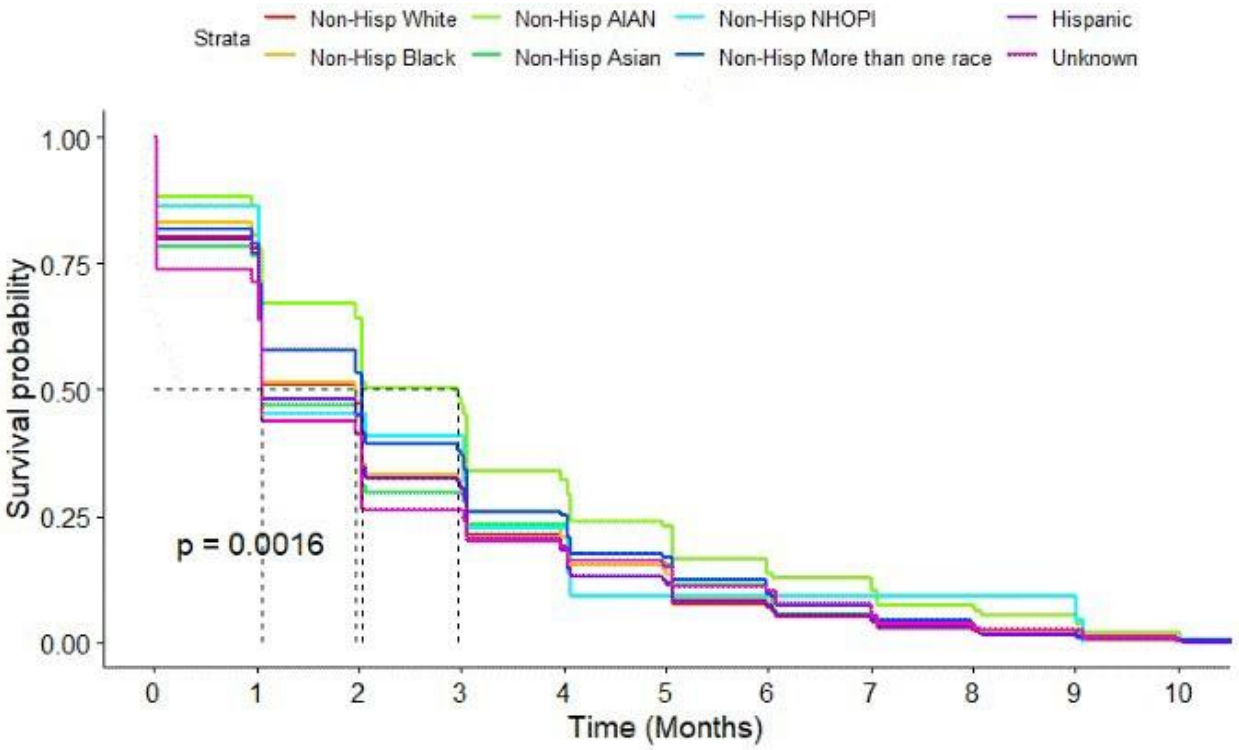

Figure 4.2.1 Maternal Race Kaplan Meier Curve

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 Naitons 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.

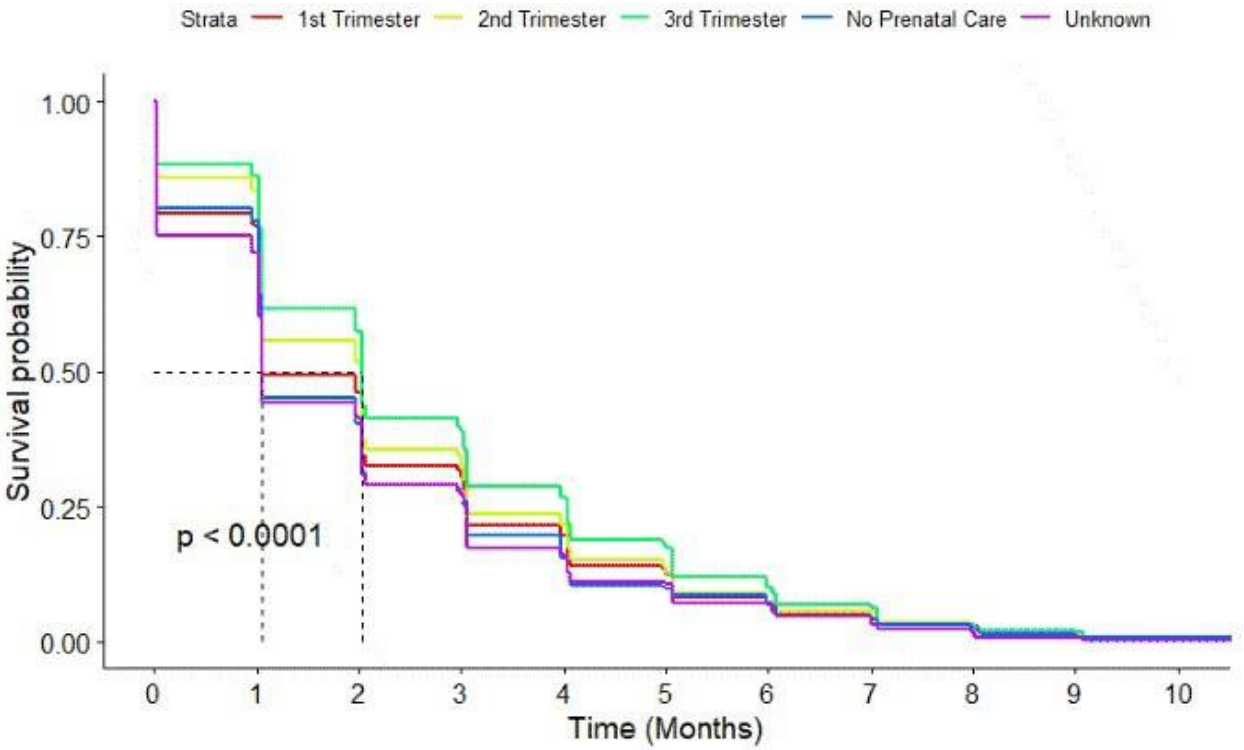

Figure 4.2.2 Prenatal Care Start Kaplan Meier Curve

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).

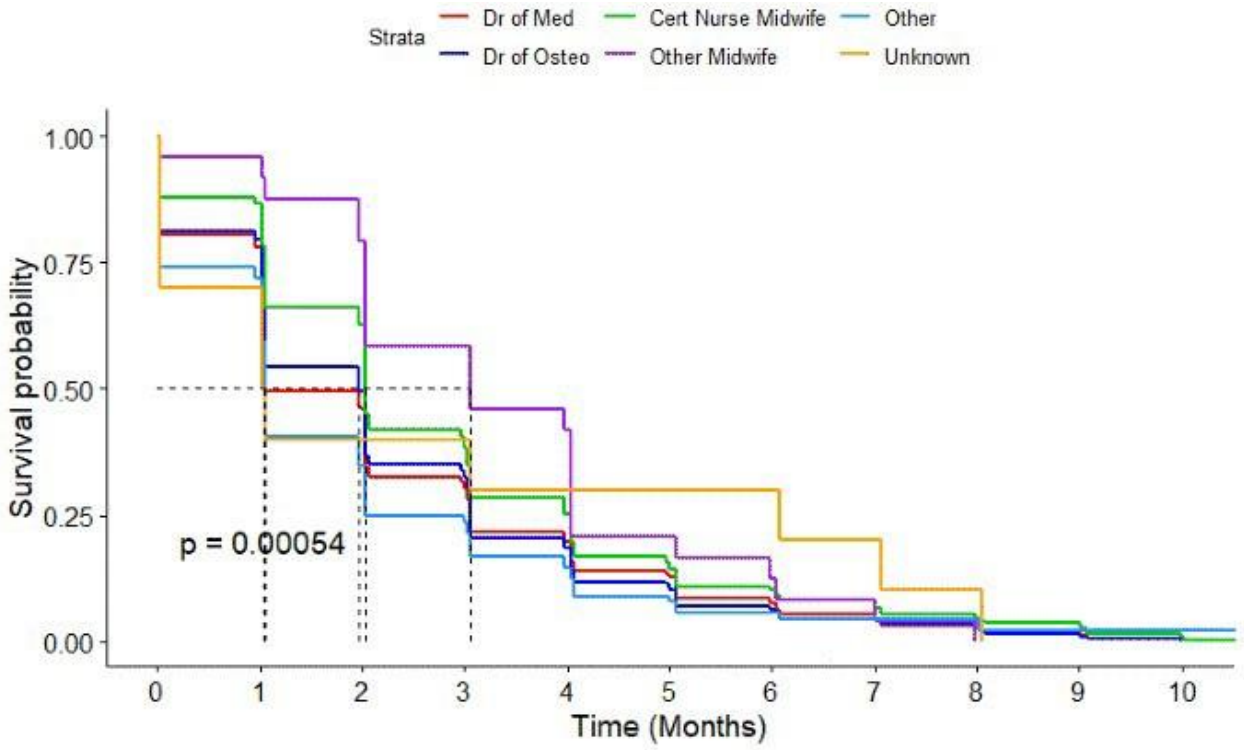

Figure 4.2.3 Attending Health Care Provider Kaplan Meier Curve

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

		HR	95% LCL	95% UCL	p
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) [15]. 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.

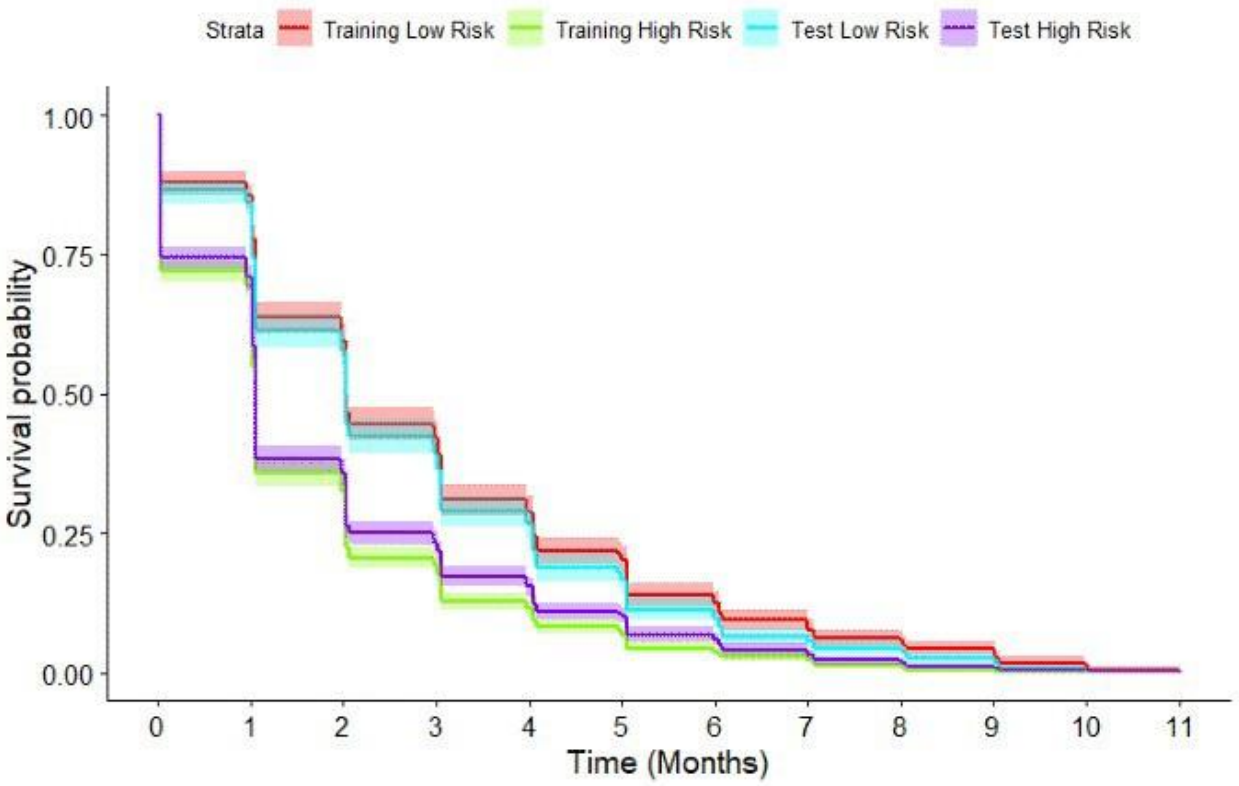

Figure 4.4.1 Kaplan Meier Curve of Risk Categories on Training and Test Datasets

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 [1]. 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 [5]. 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.

References

[1]M. MacDorman and T. Mathews, "The Challenge of Infant Mortality: Have We Reached a Plateau?", *SAGE Journals*, 2009. [Online]. Available: https://doi.org/10.1177/003335490912400509. [Accessed: 05- Mar- 2020]

[2]W. Nersesian, "Infant Mortality in Socially Vulnerable Populations", *Annualreviews.org*, 1988. [Online]. Available: https://www.annualreviews.org/doi/pdf/10.1146/annurev.pu.09.050188.002045. [Accessed: 04- Mar- 2020]

[3]F. Mardones, G. Marshall, P. Viviani, L. Villarroel, B. Burkhalter, J. Tapia, J. Cerda, T. Garcia-Huidobro, C. Ralph, E. Ovarzun and F. Mardones-Restat, "Estimation of individual neonatal survival using birthweight and gestational age: a way to improve neonatal care", *Journal of health, population, and nutrition*, vol. 26, no. 1, pp. 54-63, 2008.

[4]J. Kurinczuk, J. Hollowell, P. Brocklehurst and R. Gray, *Infant Mortality: Overview and Context*. National Perinatal Epidemiology Unit, University of Oxford, 2009 [Online]. Available: https://www.npeu.ox.ac.uk/downloads/files/infant-mortality/Infant-Mortality-Briefing-Paper-1.pdf. [Accessed: 19- Apr- 2020]

[5]T. Elder, J. Goddeeris and S. Haider, "Racial and ethnic infant mortality gaps and the role of socio-economic status", *sciencedirect.com*, 2016. [Online]. Available: https://www.sciencedirect.com/science/article/pii/S0927537116300033?via%3Dihub. [Accessed: 19- Apr- 2020]

[6]J. Lorenz, C. Ananth and R. Polin, "Infant mortality in the United States", *J Perinatol*, no. 36, pp. 797-801, 2016 [Online]. Available: https://www.nature.com/articles/jp201663. [Accessed: 19- Apr- 2020]

[7]A. Chen, E. Oster and H. Williams, "Why Is Infant Mortality Higher in the United States than in Europe?", *American Economic Journal: Economic Policy*, vol. 8, no. 2, pp. 89-124, 2016.

[8]R. Kamal, J. Hudman and D. McDermott, "What do we know about infant mortality in the U.S. and comparable countries? - Peterson-Kaiser Health System Tracker", *Peterson-Kaiser Health System Tracker*, 2019. [Online]. Available: https://www.healthsystemtracker.org/chart-collection/infant-mortality-u-s-compare-countries/#item-start. [Accessed: 19- Apr- 2020]

[9]T. Dominguez, "Adverse Birth Outcomes in African American Women: The Social Context of Persistent Reproductive Disadvantage", *Social Work in Public Health*, vol. 26, no. 1, pp. 3-16, 2011.

[10]S. Nkansah-Amankra, A. Dhawain, J. Hussey and K. Luchok, "Maternal Social Support and Neighborhood Income Inequality as Predictors of Low Birth Weight and Preterm Birth Outcome Disparities: Analysis of South Carolina Pregnancy Risk Assessment and Monitoring System Survey, 2000–2003", *Maternal and Child Health Journal*, vol. 14, no. 5, pp. 774-785, 2010.

[11]S. Nkansah-Amankra, K. Luchok, J. Hussey, K. Watkins and X. Liu, "Effects of Maternal Stress on Low Birth Weight and Preterm Birth Outcomes Across Neighborhoods of South Carolina, 2000–2003", *Maternal and Child Health Journal*, vol. 14, no. 2, pp. 215-226, 2010.

[12] "The Apgar Score", *PEDIATRICS*, vol. 136, no. 4, pp. 819-822, 2015.

[13] T. Therneau, "Survival Analysis [R package survival version 3.1-12]", *Cran.r-project.org*, 2020. [Online]. Available: https://CRAN.R-project.org/package=survival. [Accessed: 19- Apr- 2020]

[14]P. Heagerty and P. Saha-Chaudhuri, "survivalROC: Time-dependent ROC curve estimation from censored survival data", *Cran.r-project.org*, 2013. [Online]. Available: https://CRAN.R-project.org/package=survivalROC. [Accessed: 19- Apr- 2020]

[15]C. Dardis, "survMisc: Miscellaneous Functions for Survival Data", *Cran.r-project.org*, 2018. [Online]. Available: https://CRAN.R-project.org/package=survMisc. [Accessed: 19- Apr- 2020]

Appendix A: Summary Tables

Table 3.A1: Raw dataset by parental characteristics

		Overall	Survived		
	Level		Yes	No	X^2 p
n		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)	31.40 (16.94)	<0.001
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)	
	Unknown	2729 (18.2)	870 (11.6)	1859 (24.9)	
Paternal Race (%)	Hispanic	2596 (17.4)	1460 (19.5)	1136 (15.2)	<0.001
	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)	249 (3.3)	<0.001
	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

		Overall	Survived		
	Level		Yes	No	X^2 p
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)	6195 (82.9)	<0.001
	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)	<0.001
	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

		Overall	Survived		
	Level		Yes	No	X^2 p
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)	*Cont.*

	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 Midwife	1053 (7.0)	676 (9.0)	377 (5.0)	
	Other Midwife	89 (0.6)	65 (0.9)	24 (0.3)	
	Other	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)	
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)	

Table 3.A4: Raw dataset by infant abnormalities

		Overall	Survived		
	Level		Yes	No	X^2 p
n		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^2 p	
Maternal Race						**0.001**
	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						**<0.001**
	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						**< 0.001**
	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						**<0.001**
	Unmarried	0.86	0.81	0.90	<0.001	
	Unknown	0.90	0.81	0.99	0.022	
Prenatal Care Start						**<0.001**
	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						**<0.001**
	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						**0.525**
	Female	1.02	0.97	1.06		
Breast Fed						**<0.001**
	No	1.11	1.05	1.16	<0.001	
	Unknown	1.16	1.08	1.23	<0.001	*Cont.*

Apgar 5 Minutes						**<0.001**
	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)						**<0.001**
	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						**<0.001**
	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)						**<0.001**
	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						**<0.001**
	Yes	0.89	0.85	0.94	<0.001	
	Unknown	1.00	0.83	1.18	0.985	
Payer						**<0.001**
	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						**<0.001**
	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	*Cont.*

	PhD/Professional	1.08	0.83	1.33	0.545	
	Unknown	0.97	0.83	1.10	0.606	
Risk Category						**<0.001**
	High	1.42	1.38	1.47		

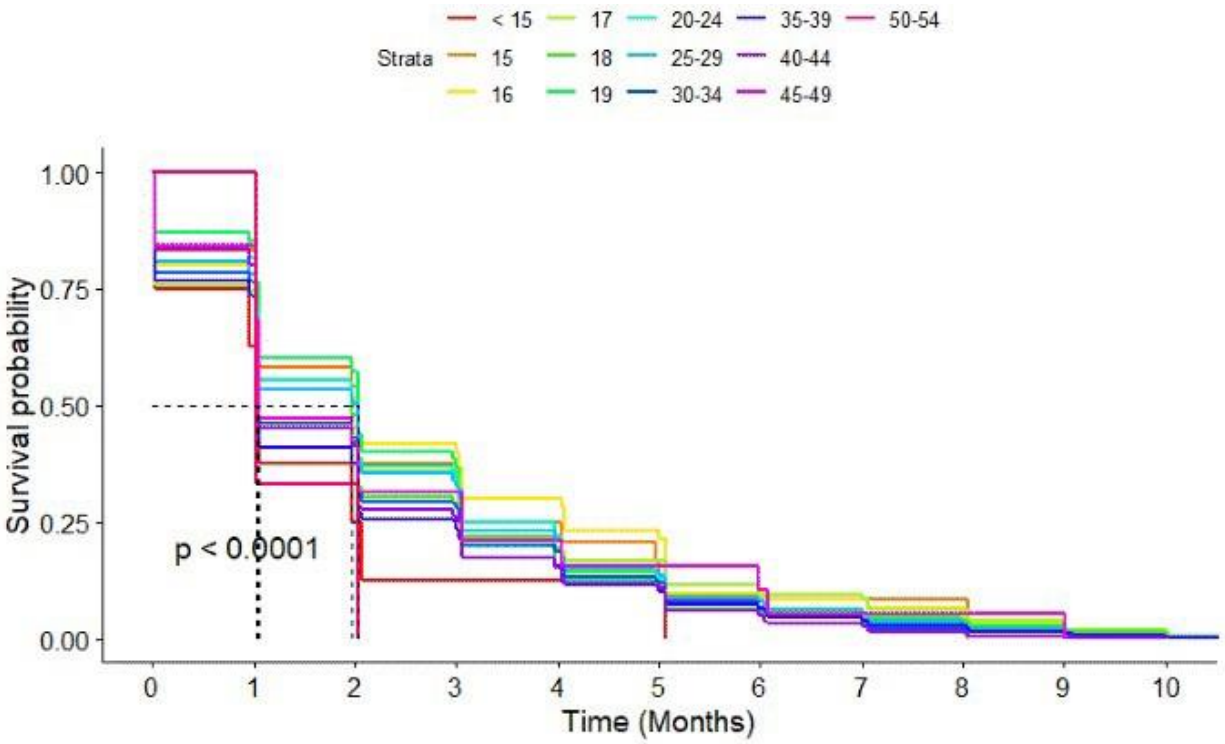

Figure 4.2.A1 Maternal Age Kaplan Meier Curve

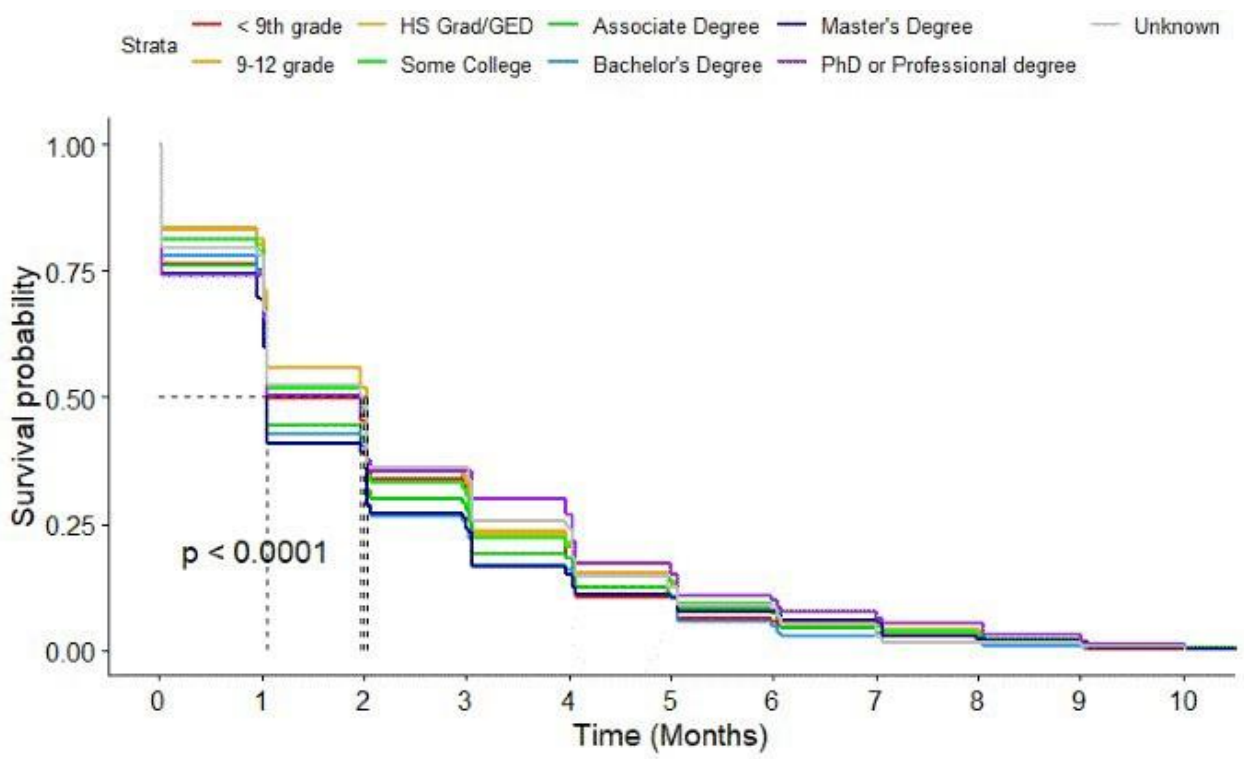

Figure 4.2.A2 Maternal Education Kaplan Meier Curve

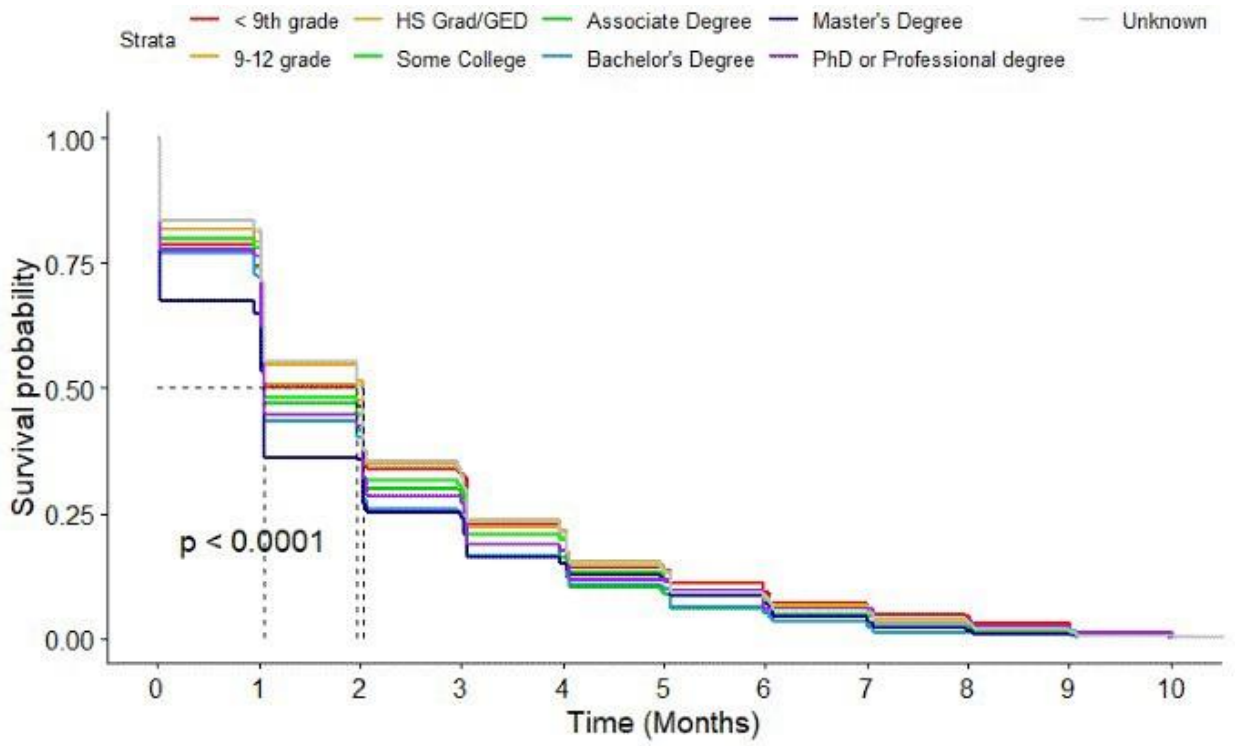

Figure 4.2.A3 Paternal Education Kaplan Meier Curve

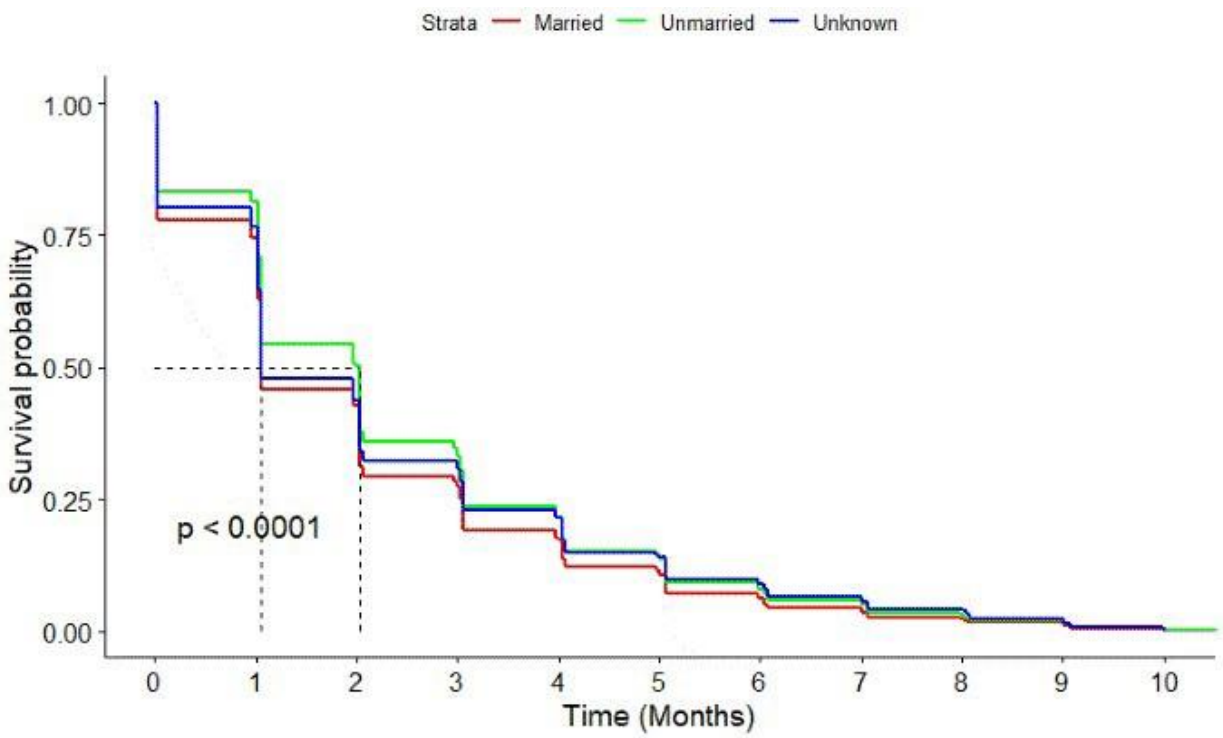

Figure 4.2.A4 Maternal Marriage Status Kaplan Meier Curve

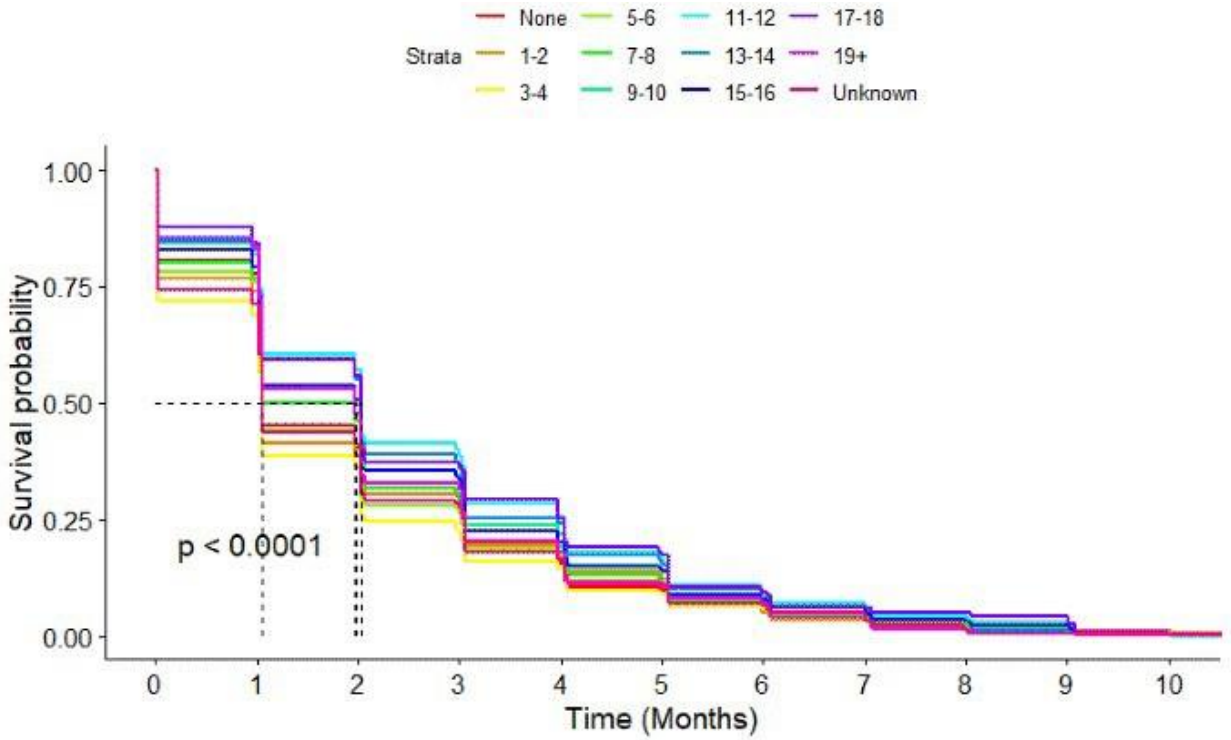

Figure 4.2.A5 Number of Prenatal Visits Kaplan Meier Curve

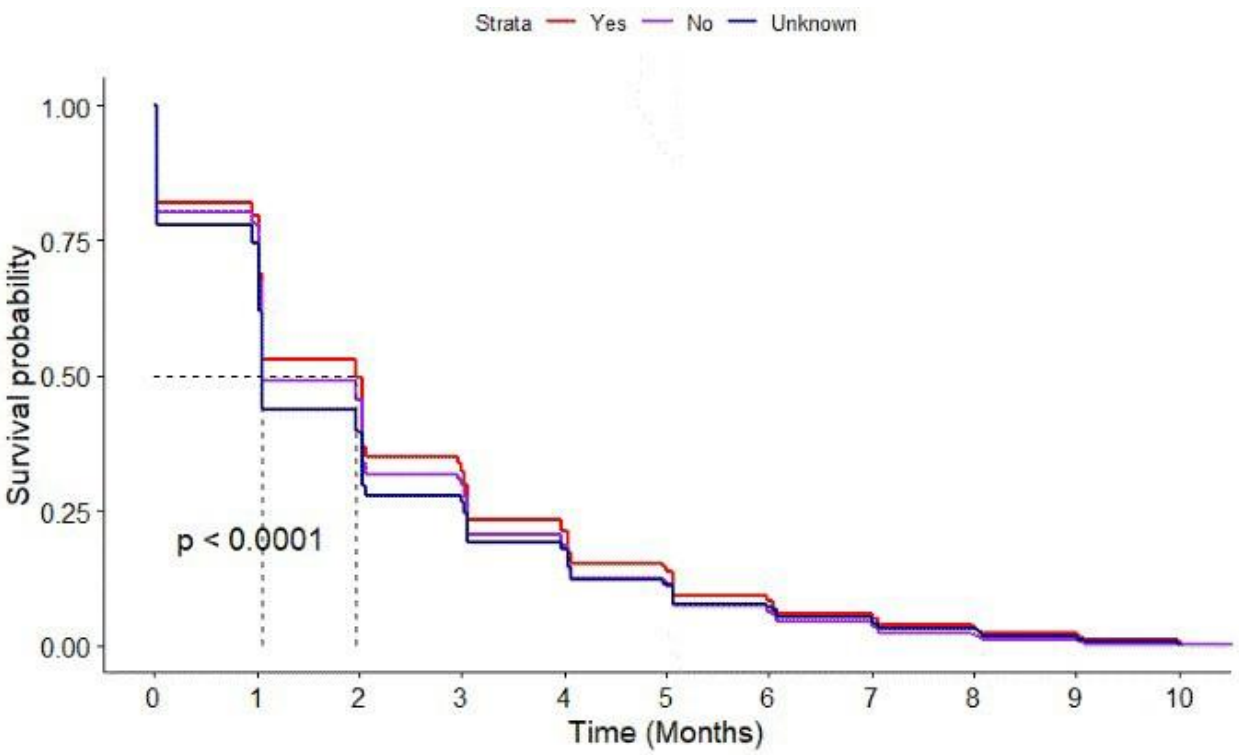

Figure 4.2.A7 WIC Benefits Status Kaplan Meier Curve

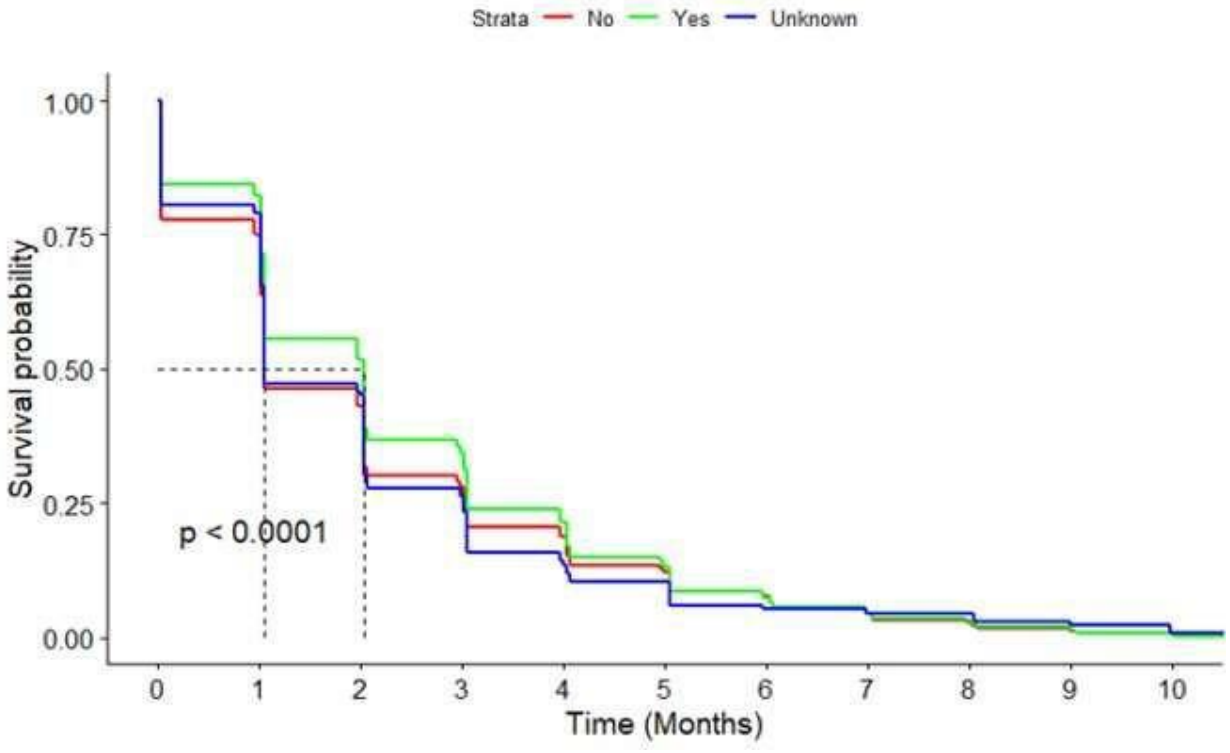

Figure 4.2.A6 Breast Feeding Status Kaplan Meier Curve

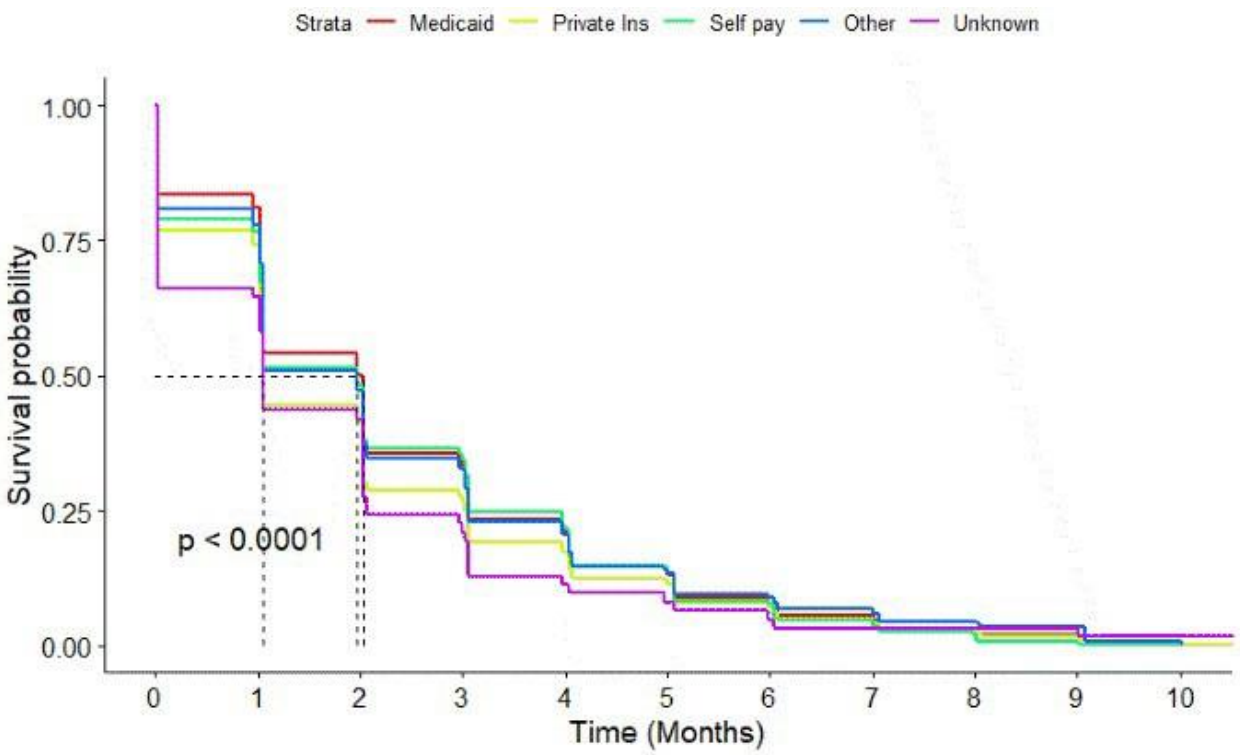

Figure 4.2.A8 Payer Kaplan Meier Curve

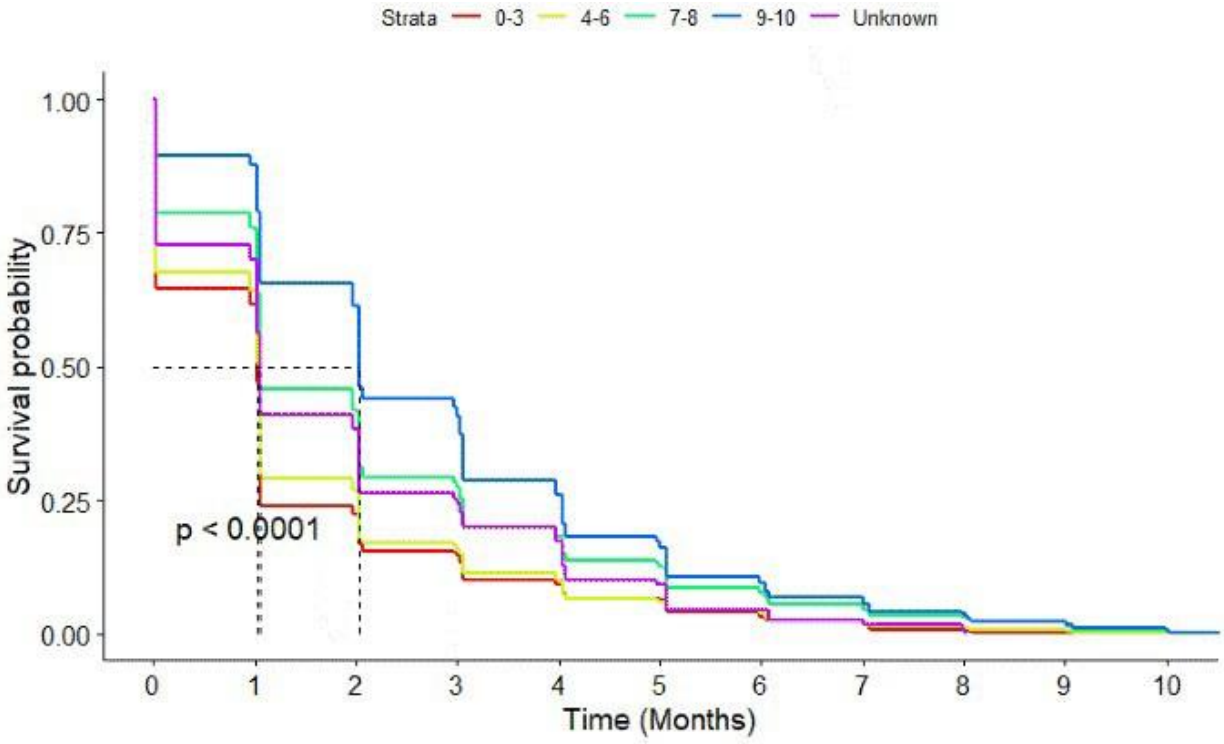

Figure 4.2.A9 5-Minute Apgar Score Kaplan Meier Curve

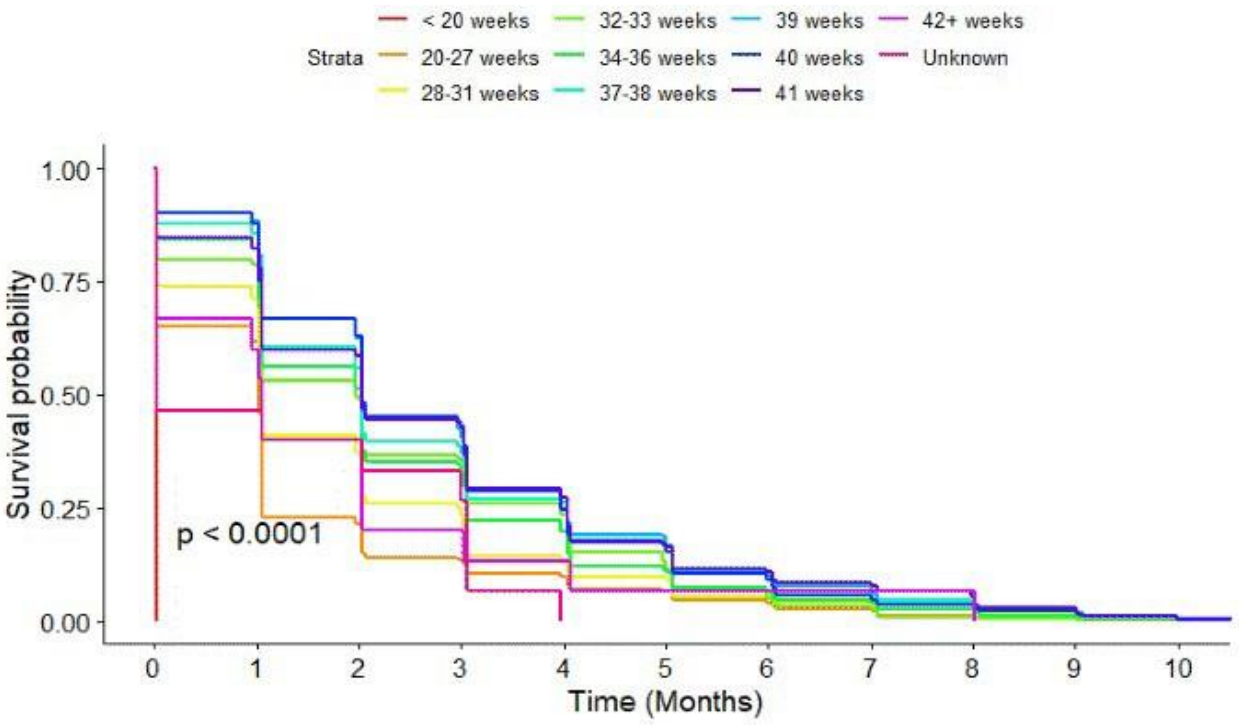

Figure 4.2.A10 Gestation Age Kaplan Meier Curve

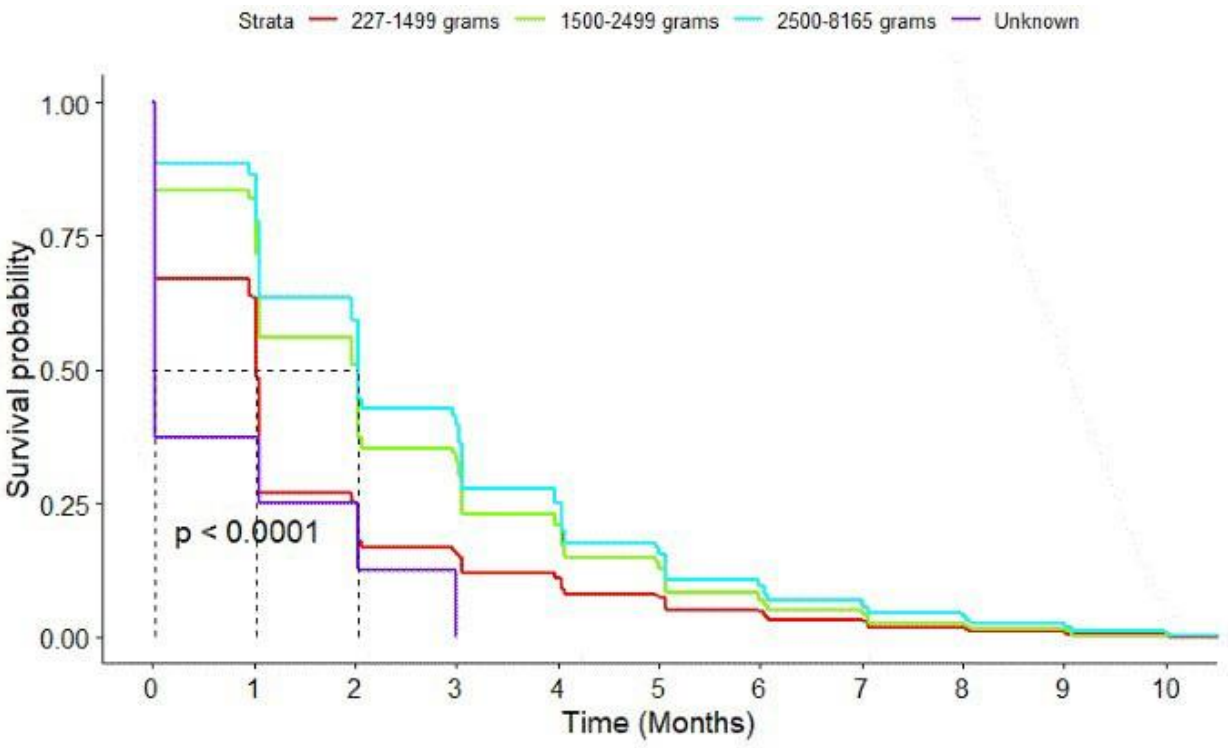

Figure 4.2.A11 Birthweight Kaplan Meier Curve

Table 4.3.A2 Multivariate Cox Regression SES Model

		HR	95% LCL	95% UCL	p
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

Cont.

	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

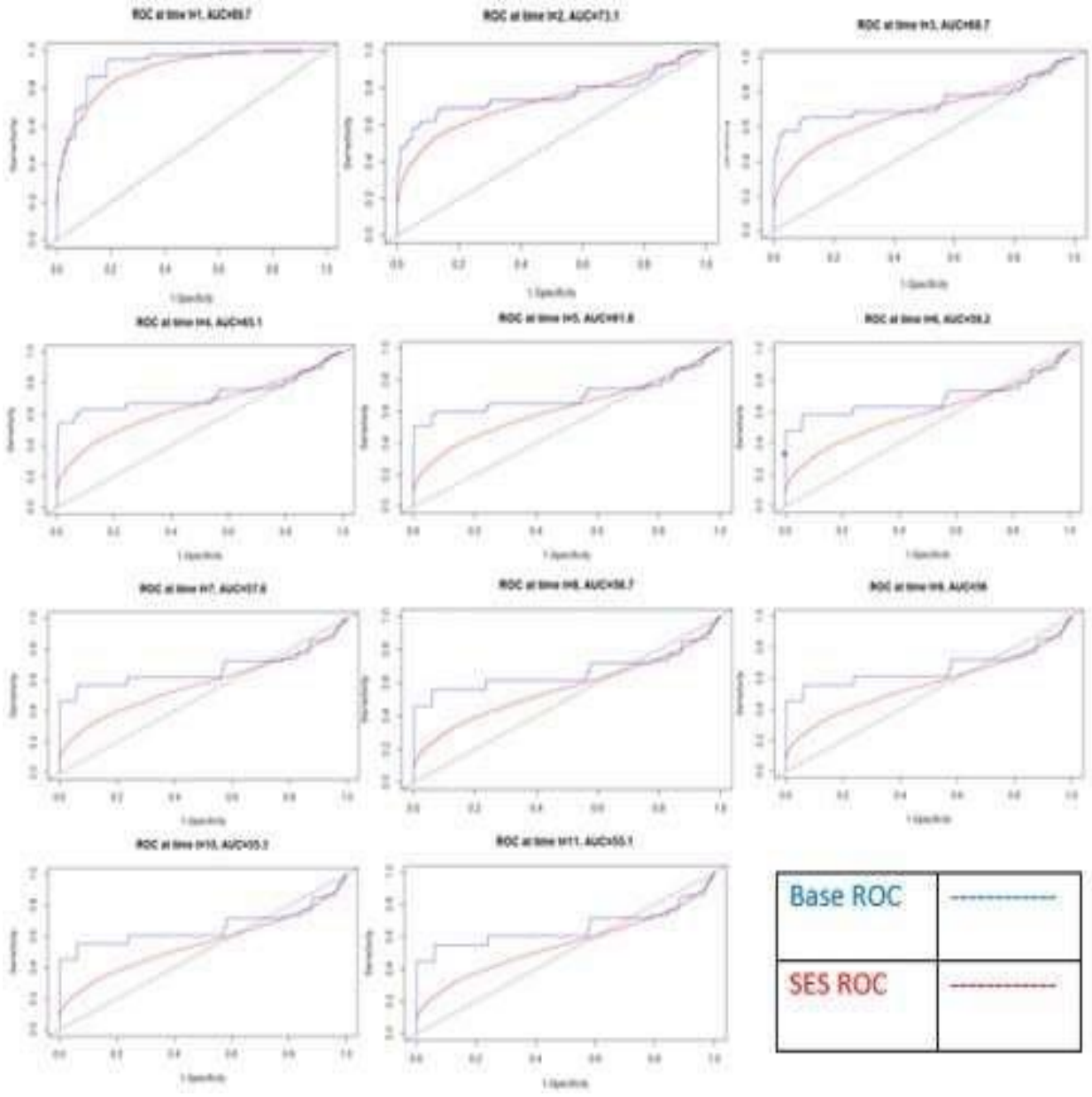

Figure 4.3.A1 Model Comparison of Time Dependent ROCs

```
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  fhisp_r     length=3    label="Father's Hispanic Origin Recode 0 Non-Hispanic";
attrib  f_fhisp     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
Version0 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 lmpused       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  bwtimp     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
Palate0 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  mhisp_r          1.
@116  f_mhisp          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  fhisp_r          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 dlmp_mm 2.
@481 dlmp_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 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  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";
```

```
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  fhisp_r     length=3     label="Father's Hispanic Origin Recode 0 Non-Hispanic";
attrib  f_fhisp     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
Version0 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 lmpused       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  bwtimp     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
Palate0 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  mhisp_r          1.
@116  f_mhisp          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 fhisp_r 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 dlmp_mm 2.
@481 dlmp_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 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  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.
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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";
```

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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  fhisp_r      length=3     label="Father's Hispanic Origin Recode 0 Non-Hispanic";
attrib  f_fhisp      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-
```

```
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
Version0 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-
```

```
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";
```

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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  lmpused     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  bwtimp    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";
```

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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
Palate0 Non-Reporting";
attrib  f_ca_clpal   length=3     label="Reporting Flag for Cleft Palate Alone 0 Non-
Reporting";
```

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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  mhisp_r         1.
@116  f_mhisp         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  fhisp_r         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.

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@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  dlmp_mm           2.
@481  dlmp_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  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 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$lmpused[is.na(thesis$lmpused)]<-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$cig0_r <- factor(thesis1$cig0_r,# levels = c("0","1","2","3","4","5","6"),
                     levels = c("Nonsmoker","1-5","6-10","11-20","21-40","41+","Unknown"))
thesis1$cig1_r <- factor(thesis1$cig1_r, #levels = c("0","1","2","3","4","5","6"),
                     levels = c("Nonsmoker","1-5","6-10","11-20","21-40","41+","Unknown"))
thesis1$cig2_r <- factor(thesis1$cig2_r, #levels = c("0","1","2","3","4","5","6"),
                     levels = c("Nonsmoker","1-5","6-10","11-20","21-40","41+","Unknown"))
thesis1$cig3_r <- factor(thesis1$cig3_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$ld_indl <- factor(thesis1$ld_indl, #levels = c("Y","N","U"),
                    levels = c("No","Yes","Unknown"))
thesis1$ld_augm <- factor(thesis1$ld_augm, #levels = c("Y","N","U"),
                    levels = c("No","Yes","Unknown"))
thesis1$ld_ster <- factor(thesis1$ld_ster, #levels = c("Y","N","U"),
                    levels = c("No","Yes","Unknown"))
thesis1$ld_antb <- factor(thesis1$ld_antb, #levels = c("Y","N","U"),
                    levels = c("No","Yes","Unknown"))
thesis1$ld_chor <- factor(thesis1$ld_chor, #levels = c("Y","N","U"),
                    levels = c("No","Yes","Unknown"))
thesis1$ld_anes <- factor(thesis1$ld_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$oegest_r10 <- factor(thesis1$oegest_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$itran <- factor(thesis1$itran,# 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$urf_phype <- factor(thesis1$urf_phype, #levels = c("1","2","9"),
                            levels = c("No","Yes","Unknown"))
thesis1$urf_ehype <- factor(thesis1$urf_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", "itran", "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$dmar[i] == "Unknown")
{
  train$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$wtgain[i]*(0.00006)
}
if (train$rf_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$ld_indl[i] == "Yes")
{
  train$riskscore[i] = train$riskscore[i] + (0.0004)
}
else if (train$ld_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$oegest_r10[i] == "20-27 weeks")
{
  train$riskscore[i] = train$riskscore[i] + (-0.149)
}
else if (train$oegest_r10[i] == "28-31 weeks")
{
  train$riskscore[i] = train$riskscore[i] + (-0.474)
}
else if (train$oegest_r10[i] == "32-33 weeks")
{
  train$riskscore[i] = train$riskscore[i] + (-0.550)
}
else if (train$oegest_r10[i] == "34-36 weeks")
{
  train$riskscore[i] = train$riskscore[i] + (-0.563)
}
else if (train$oegest_r10[i] == "37-38 weeks")
{
  train$riskscore[i] = train$riskscore[i] + (-0.617)
}
else if (train$oegest_r10[i] == "39 weeks")
{
  train$riskscore[i] = train$riskscore[i] + (-0.618)
}
else if (train$oegest_r10[i] == "40 weeks")
{
  train$riskscore[i] = train$riskscore[i] + (-0.595)
}
else if (train$oegest_r10[i] == "41 weeks")
{
  train$riskscore[i] = train$riskscore[i] + (-0.654)
}
else if (train$oegest_r10[i] == "42 weeks")
{
  train$riskscore[i] = train$riskscore[i] + (-0.626)
```

```
}
else if (train$oegest_r10[i] == "Unknown")
{
  train$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$itran[i] == "Yes")
  {
    train$riskscore[i] = train$riskscore[i] + (0.017)
  }
  else if (train$itran[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$riskscore[i] + (0.063)
}
if (test$dmar[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$ld_indl[i] == "Yes")
{
  test$riskscore[i] = test$riskscore[i] + (0.0004)
}
else if (test$ld_indl[i] == "Unknown")
{
  test$riskscore[i] = test$riskscore[i] + (0.267)
}
if (test$ld_augm[i] == "Yes")
{
  test$riskscore[i] = test$riskscore[i] + (0.048)
}
if (test$ld_ster[i] == "Yes")
{
  test$riskscore[i] = test$riskscore[i] + (0.076)
}
if (test$ld_antb[i] == "Yes")
{
  test$riskscore[i] = test$riskscore[i] + (0.077)
}
if (test$ld_chor[i] == "Yes")
{
  test$riskscore[i] = test$riskscore[i] + (0.072)
}
if (test$ld_anes[i] == "Yes")
{
  test$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$oegest_r10[i] == "20-27 weeks")
{
  test$riskscore[i] = test$riskscore[i] + (-0.149)
}
else if (test$oegest_r10[i] == "28-31 weeks")
{
  test$riskscore[i] = test$riskscore[i] + (-0.474)
}
else if (test$oegest_r10[i] == "32-33 weeks")
{
  test$riskscore[i] = test$riskscore[i] + (-0.550)
}
else if (test$oegest_r10[i] == "34-36 weeks")
{
  test$riskscore[i] = test$riskscore[i] + (-0.563)
}
```

```
else if (test$oegest_r10[i] == "37-38 weeks")
{
  test$riskscore[i] = test$riskscore[i] + (-0.617)
}
else if (test$oegest_r10[i] == "39 weeks")
{
  test$riskscore[i] = test$riskscore[i] + (-0.618)
}
else if (test$oegest_r10[i] == "40 weeks")
{
  test$riskscore[i] = test$riskscore[i] + (-0.595)
}
else if (test$oegest_r10[i] == "41 weeks")
{
  test$riskscore[i] = test$riskscore[i] + (-0.654)
}
else if (test$oegest_r10[i] == "42 weeks")
{
  test$riskscore[i] = test$riskscore[i] + (-0.626)
}
else if (test$oegest_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$riskscore[i] + (0.063)
}
if (thesis2$dmar[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 NHOPI")
{
  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$oegest_r10[i] == "20-27 weeks")
{
  thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.149)
}
else if (thesis2$oegest_r10[i] == "28-31 weeks")
{
  thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.474)
}
else if (thesis2$oegest_r10[i] == "32-33 weeks")
{
  thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.550)
}
else if (thesis2$oegest_r10[i] == "34-36 weeks")
{
  thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.563)
}
else if (thesis2$oegest_r10[i] == "37-38 weeks")
{
  thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.617)
}
else if (thesis2$oegest_r10[i] == "39 weeks")
{
  thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.618)
}
else if (thesis2$oegest_r10[i] == "40 weeks")
{
  thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.595)
}
else if (thesis2$oegest_r10[i] == "41 weeks")
{
  thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.654)
}
else if (thesis2$oegest_r10[i] == "42 weeks")
{
  thesis2$riskscore[i] = thesis2$riskscore[i] + (-0.626)
}
else if (thesis2$oegest_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_sensitiviy <- 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_mracehisp <- survfit(Surv(time = os_mon, event = flgnd)~ mracehisp, data=
thesis2,
                        conf.type= 'log-log')
surv_summary(KM_risk, thesis2)

ggsurvplot(KM_mracehisp, 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 +
itran + 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")
```