risk of CS among multi-parous women

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##Load important pakage

library(tidyverse)

## ── Attaching core tidyverse packages ──────────────────────── tidyverse 2.0.0 ──  
## ✔ dplyr 1.1.4 ✔ readr 2.1.4  
## ✔ forcats 1.0.0 ✔ stringr 1.5.1  
## ✔ ggplot2 3.4.4 ✔ tibble 3.2.1  
## ✔ lubridate 1.9.3 ✔ tidyr 1.3.0  
## ✔ purrr 1.0.2   
## ── Conflicts ────────────────────────────────────────── tidyverse\_conflicts() ──  
## ✖ dplyr::filter() masks stats::filter()  
## ✖ dplyr::lag() masks stats::lag()  
## ℹ Use the conflicted package (<http://conflicted.r-lib.org/>) to force all conflicts to become errors

library(gtsummary)  
library(PredictABEL)  
library(pROC)

## Type 'citation("pROC")' for a citation.  
##   
## Attaching package: 'pROC'  
##   
## The following objects are masked from 'package:stats':  
##   
## cov, smooth, var

library(readxl)  
library(haven)  
library(boot)  
library(ggplot2)  
library(tidyverse)  
library(MASS)

##   
## Attaching package: 'MASS'  
##   
## The following object is masked from 'package:gtsummary':  
##   
## select  
##   
## The following object is masked from 'package:dplyr':  
##   
## select

## import the data

library(haven)  
dat\_cs <- read\_sav("thesis\_data\_NB.sav")

## explore the data

str(dat\_cs)

## tibble [461 × 88] (S3: tbl\_df/tbl/data.frame)  
## $ PP\_uptake : dbl+lbl [1:461] 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 1, 0, ...  
## ..@ format.spss : chr "F8.2"  
## ..@ display\_width: int 11  
## ..@ labels : Named num [1:2] 0 1  
## .. ..- attr(\*, "names")= chr [1:2] "no" "yes"  
## $ participant\_id : num [1:461] 1 2 3 4 5 6 7 8 9 10 ...  
## ..- attr(\*, "label")= chr "participant id"  
## ..- attr(\*, "format.spss")= chr "F3.0"  
## ..- attr(\*, "display\_width")= int 16  
## $ age : num [1:461] 35 22 30 32 32 30 27 30 33 35 ...  
## ..- attr(\*, "label")= chr "age of the mother"  
## ..- attr(\*, "format.spss")= chr "F2.0"  
## ..- attr(\*, "display\_width")= int 5  
## $ residence : dbl+lbl [1:461] 2, 2, 1, 1, 1, 1, 2, 2, 1, 2, 2, 2, 1, 1, 2, 1, 1, 1, ...  
## ..@ label : chr "residence of participant"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 11  
## ..@ labels : Named num [1:2] 1 2  
## .. ..- attr(\*, "names")= chr [1:2] "rural" "urban"  
## $ religion : dbl+lbl [1:461] 2, 1, 1, 1, 1, 1, 2, 2, 1, 1, 3, 3, 1, 3, 2, 2, 1, 1, ...  
## ..@ label : chr "religion"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 10  
## ..@ labels : Named num [1:4] 1 2 3 4  
## .. ..- attr(\*, "names")= chr [1:4] "protestant" "orthodox" "muslim" "other"  
## $ ethnicity : dbl+lbl [1:461] 3, 1, 1, 1, 1, 1, 3, 3, 3, 3, 3, 1, 1, 3, 2, 3, 1, 1, ...  
## ..@ label : chr "ethnicity"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 11  
## ..@ labels : Named num [1:4] 1 2 3 4  
## .. ..- attr(\*, "names")= chr [1:4] "SNNP" "amhara" "oromo" "other"  
## $ marital\_status : dbl+lbl [1:461] 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, ...  
## ..@ label : chr "current marital status"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 16  
## ..@ labels : Named num [1:5] 1 2 3 4 5  
## .. ..- attr(\*, "names")= chr [1:5] "married" "single" "widowed" "divorced" ...  
## $ mother\_education : dbl+lbl [1:461] 1, 3, 3, 1, 1, 3, 4, 5, 1, 3, 3, 3, 1, 1, 3, 3, 1, 4, ...  
## ..@ label : chr "educational status of mother"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 18  
## ..@ labels : Named num [1:5] 1 2 3 4 5  
## .. ..- attr(\*, "names")= chr [1:5] "none" "read and write" "primary" "secondary" ...  
## $ occupation\_mother : dbl+lbl [1:461] 1, 1, 1, 1, 1, 1, 3, 2, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, ...  
## ..@ label : chr "occupation of mother"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 19  
## ..@ labels : Named num [1:5] 1 2 3 4 5  
## .. ..- attr(\*, "names")= chr [1:5] "housewife" "gov't employee" "private" "merchant" ...  
## $ income : num [1:461] 2800 500 2000 2500 1000 3500 2000 8000 1500 3000 ...  
## ..- attr(\*, "label")= chr "monthly income"  
## ..- attr(\*, "format.spss")= chr "F5.0"  
## $ husband\_education : dbl+lbl [1:461] 3, 1, 4, 3, 3, 5, 4, 5, 1, 4, 5, 3, 1, 1, 4, 3, 3, 4, ...  
## ..@ label : chr "education of husband"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 19  
## ..@ labels : Named num [1:5] 1 2 3 4 5  
## .. ..- attr(\*, "names")= chr [1:5] "none" "read and write" "primary" "secondary" ...  
## $ husband\_occupation : dbl+lbl [1:461] 1, 5, 1, 1, 1, 2, 3, 2, 1, 4, 2, 4, 1, 1, 3, 1, 1, 3, ...  
## ..@ label : chr "occupation of husband"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 20  
## ..@ labels : Named num [1:5] 1 2 3 4 5  
## .. ..- attr(\*, "names")= chr [1:5] "farming" "gov't employee" "private" "merchant" ...  
## $ gravidity : num [1:461] 6 2 5 6 8 5 3 4 6 8 ...  
## ..- attr(\*, "label")= chr "number of pregnancy"  
## ..- attr(\*, "format.spss")= chr "F2.0"  
## ..- attr(\*, "display\_width")= int 11  
## $ parity : num [1:461] 6 2 5 6 8 5 2 3 4 8 ...  
## ..- attr(\*, "label")= chr "number of delivery"  
## ..- attr(\*, "format.spss")= chr "F2.0"  
## $ live\_birth : num [1:461] 6 1 4 6 8 5 2 3 4 6 ...  
## ..- attr(\*, "label")= chr "total live births"  
## ..- attr(\*, "format.spss")= chr "F2.0"  
## ..- attr(\*, "display\_width")= int 12  
## $ abortion : dbl+lbl [1:461] 2, 2, 2, 2, 2, 2, 1, 1, 1, 2, 2, 2, 2, 1, 2, 1, 2, 1, ...  
## ..@ label : chr "abortion"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 10  
## ..@ labels : Named num [1:2] 1 2  
## .. ..- attr(\*, "names")= chr [1:2] "yes" "no"  
## $ IUFD : dbl+lbl [1:461] 2, 1, 2, 2, 2, 2, 2, 2, 2, 1, 2, 2, 2, 2, 2, 2, 2, 1, ...  
## ..@ label : chr "IUFD"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 6  
## ..@ labels : Named num [1:2] 1 2  
## .. ..- attr(\*, "names")= chr [1:2] "yes" "no"  
## $ Preterm\_d : dbl+lbl [1:461] 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, ...  
## ..@ label : chr "preterm delivery"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 11  
## ..@ labels : Named num [1:2] 1 2  
## .. ..- attr(\*, "names")= chr [1:2] "yes" "no"  
## $ instrumental\_d : dbl+lbl [1:461] 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, ...  
## ..@ label : chr "instrumental delivery"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 16  
## ..@ labels : Named num [1:2] 1 2  
## .. ..- attr(\*, "names")= chr [1:2] "yes" "no"  
## $ C\_S : dbl+lbl [1:461] 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, ...  
## ..@ label : chr "C/S"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 5  
## ..@ labels : Named num [1:2] 1 2  
## .. ..- attr(\*, "names")= chr [1:2] "yes" "no"  
## $ other : dbl+lbl [1:461] 2, 2, 2, 2, 1, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, ...  
## ..@ label : chr "other"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 7  
## ..@ labels : Named num [1:2] 1 2  
## .. ..- attr(\*, "names")= chr [1:2] "yes" "no"  
## $ medical\_illness : dbl+lbl [1:461] 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, ...  
## ..@ label : chr "medical illness previous"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 17  
## ..@ labels : Named num [1:2] 1 2  
## .. ..- attr(\*, "names")= chr [1:2] "yes" "no"  
## $ type\_medicalill : dbl+lbl [1:461] NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA...  
## ..@ label : chr "type of medical illness"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 17  
## ..@ labels : Named num [1:4] 1 2 3 4  
## .. ..- attr(\*, "names")= chr [1:4] "HTN" "DM" "Cardiac" "others"  
## $ ANC : dbl+lbl [1:461] 1, 1, 1, 2, 1, 1, 1, 1, 1, 1, 1, 1, 1, 2, 1, 1, 1, 1, ...  
## ..@ label : chr "ANC visit"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 5  
## ..@ labels : Named num [1:2] 1 2  
## .. ..- attr(\*, "names")= chr [1:2] "yes" "no"  
## $ GA\_atfirstvisit : num [1:461] 24 24 20 NA 12 24 12 4 28 45 ...  
## ..- attr(\*, "label")= chr "GA at first booking"  
## ..- attr(\*, "format.spss")= chr "F2.0"  
## ..- attr(\*, "display\_width")= int 17  
## $ number\_ANC : dbl+lbl [1:461] 4, 4, 3, NA, 5, 2, 5, 5, 3, 1, 3, 5, 2, NA...  
## ..@ label : chr "number of ANC visit"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 12  
## ..@ labels : Named num [1:5] 1 2 3 4 5  
## .. ..- attr(\*, "names")= chr [1:5] "one" "two" "three" "four" ...  
## $ place\_delivery\_last: dbl+lbl [1:461] 1, 2, 1, 1, 2, 1, 2, 2, 1, 1, 1, 2, 1, 2, 2, 2, 1, 2, ...  
## ..@ label : chr "place of last delivery"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 21  
## ..@ labels : Named num [1:2] 1 2  
## .. ..- attr(\*, "names")= chr [1:2] "home" "HI"  
## $ mode\_delivery\_last : dbl+lbl [1:461] 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 2, 1, 1, 1, 1, ...  
## ..@ label : chr "mode of delivery last"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 20  
## ..@ labels : Named num [1:3] 1 2 3  
## .. ..- attr(\*, "names")= chr [1:3] "vaginal" "c-section" "instrumental"  
## $ distance : dbl+lbl [1:461] 2, 2, 2, 3, 3, 1, 2, 1, 3, 1, 1, 2, 1, 3, 3, 2, 3, 2, ...  
## ..@ label : chr "distance frmo health f"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 10  
## ..@ labels : Named num [1:3] 1 2 3  
## .. ..- attr(\*, "names")= chr [1:3] "less than 15 min" "15-30 min" "more than 30 min"  
## $ FP : dbl+lbl [1:461] 1, 1, 1, 2, 1, 2, 1, 1, 2, 1, 1, 1, 1, 1, 1, 1, 2, 2, ...  
## ..@ label : chr "Hx of FP"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 4  
## ..@ labels : Named num [1:2] 1 2  
## .. ..- attr(\*, "names")= chr [1:2] "yes" "no"  
## $ type\_FP : dbl+lbl [1:461] 1, 1, 2, NA, 1, NA, 1, 5, NA, 5, 2, 1, 2, 2...  
## ..@ label : chr "type of FP"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 9  
## ..@ labels : Named num [1:5] 1 2 3 4 5  
## .. ..- attr(\*, "names")= chr [1:5] "injectable" "implant" "ocp" "natural" ...  
## $ planned\_px : dbl+lbl [1:461] 1, 1, 1, 1, 2, 2, 1, 1, 1, 1, 1, 1, 1, 1, 2, 1, 2, 1, ...  
## ..@ label : chr "planned px"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 12  
## ..@ labels : Named num [1:2] 1 2  
## .. ..- attr(\*, "names")= chr [1:2] "yes" "no"  
## $ GA\_delivery : num [1:461] 39.6 39.6 NA NA NA NA NA NA NA 40.6 ...  
## ..- attr(\*, "label")= chr "GA at delivery"  
## ..- attr(\*, "format.spss")= chr "F6.2"  
## ..- attr(\*, "display\_width")= int 13  
## $ BMI : num [1:461] NA NA NA NA NA NA NA NA NA NA ...  
## ..- attr(\*, "label")= chr "prepx BMI"  
## ..- attr(\*, "format.spss")= chr "F4.0"  
## ..- attr(\*, "display\_width")= int 6  
## $ DM : dbl+lbl [1:461] 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, ...  
## ..@ label : chr "Diabetes"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 4  
## ..@ labels : Named num [1:2] 1 2  
## .. ..- attr(\*, "names")= chr [1:2] "yes" "no"  
## $ PROM : dbl+lbl [1:461] 2, 2, 1, 2, 2, 2, 2, 2, 2, 2, 1, 2, 2, 2, 2, 2, 2, 2, ...  
## ..@ label : chr "PROM"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 6  
## ..@ labels : Named num [1:2] 1 2  
## .. ..- attr(\*, "names")= chr [1:2] "yes" "no"  
## $ PTL : dbl+lbl [1:461] 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, ...  
## ..@ label : chr "preterm L"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 5  
## ..@ labels : Named num [1:2] 1 2  
## .. ..- attr(\*, "names")= chr [1:2] "yes" "no"  
## $ APH : dbl+lbl [1:461] 2, 2, 2, 1, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 1, 2, ...  
## ..@ label : chr "APH"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 5  
## ..@ labels : Named num [1:2] 1 2  
## .. ..- attr(\*, "names")= chr [1:2] "yes" "no"  
## $ malpresentation : dbl+lbl [1:461] 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, ...  
## ..@ label : chr "malpresentation"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 17  
## ..@ labels : Named num [1:2] 1 2  
## .. ..- attr(\*, "names")= chr [1:2] "yes" "no"  
## $ HDP : dbl+lbl [1:461] 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, ...  
## ..@ label : chr "HDP"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 5  
## ..@ labels : Named num [1:2] 1 2  
## .. ..- attr(\*, "names")= chr [1:2] "yes" "no"  
## $ anemia : dbl+lbl [1:461] 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, ...  
## ..@ label : chr "Anemia"  
## ..@ format.spss: chr "F1.0"  
## ..@ labels : Named num [1:2] 1 2  
## .. ..- attr(\*, "names")= chr [1:2] "yes" "no"  
## $ others : dbl+lbl [1:461] 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 1, 2, 2, 2, 1, 2, 2, ...  
## ..@ label : chr "others"  
## ..@ format.spss: chr "F1.0"  
## ..@ labels : Named num [1:2] 1 2  
## .. ..- attr(\*, "names")= chr [1:2] "yes" "no"  
## $ labor\_duration : num [1:461] 10 9 8 NA 12 48 19 10 NA 6 ...  
## ..- attr(\*, "label")= chr "duration of labor"  
## ..- attr(\*, "format.spss")= chr "F2.0"  
## ..- attr(\*, "display\_width")= int 16  
## $ mode\_delivery : dbl+lbl [1:461] 1, 1, 1, 5, 1, 6, 3, 3, 5, 1, 1, 1, 1, 5, 1, 5, 1, 1, ...  
## ..@ label : chr "mode of delivery"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 15  
## ..@ labels : Named num [1:7] 1 2 3 4 5 6 7  
## .. ..- attr(\*, "names")= chr [1:7] "SVD" "VD with epi" "VD with tear" "instrumental" ...  
## $ labor\_start : dbl+lbl [1:461] 1, 1, 2, NA, 1, 1, 1, 1, 1, 2, 1, 1, 1, NA...  
## ..@ label : chr "labor starts"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 13  
## ..@ labels : Named num [1:2] 1 2  
## .. ..- attr(\*, "names")= chr [1:2] "spontanously" "induced"  
## $ Diabetes\_M : dbl+lbl [1:461] 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, ...  
## ..@ label : chr "DM"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 12  
## ..@ labels : Named num [1:2] 1 2  
## .. ..- attr(\*, "names")= chr [1:2] "yes" "no"  
## $ HTN : dbl+lbl [1:461] 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, ...  
## ..@ label : chr "HDP"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 5  
## ..@ labels : Named num [1:2] 1 2  
## .. ..- attr(\*, "names")= chr [1:2] "yes" "no"  
## $ Antepartum\_H : dbl+lbl [1:461] 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, ...  
## ..@ label : chr "APH"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 14  
## ..@ labels : Named num [1:2] 1 2  
## .. ..- attr(\*, "names")= chr [1:2] "yes" "no"  
## $ induction\_aug : dbl+lbl [1:461] 2, 2, 1, 2, 2, 2, 2, 2, 2, 2, 2, 2, 1, 2, 2, 2, 2, 2, ...  
## ..@ label : chr "induction aug"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 15  
## ..@ labels : Named num [1:2] 1 2  
## .. ..- attr(\*, "names")= chr [1:2] "yes" "no"  
## $ ux\_rupture : dbl+lbl [1:461] 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, ...  
## ..@ label : chr "uterine rupture"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 12  
## ..@ labels : Named num [1:2] 1 2  
## .. ..- attr(\*, "names")= chr [1:2] "yes" "no"  
## $ PPH : dbl+lbl [1:461] 2, 2, 2, 2, 1, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, ...  
## ..@ label : chr "PPH"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 5  
## ..@ labels : Named num [1:2] 1 2  
## .. ..- attr(\*, "names")= chr [1:2] "yes" "no"  
## $ Anemia1 : dbl+lbl [1:461] 2, 2, 2, 1, 1, 2, 2, 2, 1, 2, 2, 2, 2, 2, 2, 2, 1, 1, ...  
## ..@ label : chr "anemia"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 9  
## ..@ labels : Named num [1:2] 1 2  
## .. ..- attr(\*, "names")= chr [1:2] "yes" "no"  
## $ transfusion : dbl+lbl [1:461] 2, 2, 2, 1, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 1, 1, ...  
## ..@ label : chr "blood transfusion"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 13  
## ..@ labels : Named num [1:2] 1 2  
## .. ..- attr(\*, "names")= chr [1:2] "yes" "no"  
## $ ICU : dbl+lbl [1:461] 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, ...  
## ..@ label : chr "ICU admission"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 5  
## ..@ labels : Named num [1:2] 1 2  
## .. ..- attr(\*, "names")= chr [1:2] "yes" "no"  
## $ CPD\_obstructed : dbl+lbl [1:461] 2, 2, 2, 2, 2, 1, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, ...  
## ..@ label : chr "CPD/obstructed labor"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 16  
## ..@ labels : Named num [1:2] 1 2  
## .. ..- attr(\*, "names")= chr [1:2] "yes" "no"  
## $ renal : dbl+lbl [1:461] 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, ...  
## ..@ label : chr "renal dysfn"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 7  
## ..@ labels : Named num [1:2] 1 2  
## .. ..- attr(\*, "names")= chr [1:2] "yes" "no"  
## $ DIC : dbl+lbl [1:461] 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, ...  
## ..@ label : chr "DIC"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 5  
## ..@ labels : Named num [1:2] 1 2  
## .. ..- attr(\*, "names")= chr [1:2] "yes" "no"  
## $ sepsis : dbl+lbl [1:461] 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 1, 1, ...  
## ..@ label : chr "maternal sepsis"  
## ..@ format.spss: chr "F1.0"  
## ..@ labels : Named num [1:2] 1 2  
## .. ..- attr(\*, "names")= chr [1:2] "yes" "no"  
## $ maternal\_death : dbl+lbl [1:461] 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, ...  
## ..@ label : chr "maternal death"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 16  
## ..@ labels : Named num [1:2] 1 2  
## .. ..- attr(\*, "names")= chr [1:2] "yes" "no"  
## $ others1 : dbl+lbl [1:461] 2, 2, 2, 2, 2, 2, 2, 2, 1, 2, 2, 2, 2, 2, 2, 1, 2, 2, ...  
## ..@ label : chr "others"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 9  
## ..@ labels : Named num [1:2] 1 2  
## .. ..- attr(\*, "names")= chr [1:2] "yes" "no"  
## $ GA : num [1:461] 39.6 39.6 NA NA NA NA NA NA NA 40.6 ...  
## ..- attr(\*, "label")= chr "GA"  
## ..- attr(\*, "format.spss")= chr "F6.2"  
## $ weight : num [1:461] 3500 2900 2300 2600 2400 2700 2700 2300 2500 3800 ...  
## ..- attr(\*, "label")= chr "newborn weight"  
## ..- attr(\*, "format.spss")= chr "F4.0"  
## $ apgar : num [1:461] 9 9 0 9 8 0 9 9 0 8 ...  
## ..- attr(\*, "label")= chr "apgar score"  
## ..- attr(\*, "format.spss")= chr "F2.0"  
## ..- attr(\*, "display\_width")= int 7  
## $ sex : dbl+lbl [1:461] 2, 2, 2, 2, 2, 1, 2, 1, 1, 1, 1, 1, 1, 2, 1, 1, 1, 1, ...  
## ..@ label : chr "newborn sex"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 5  
## ..@ labels : Named num [1:2] 1 2  
## .. ..- attr(\*, "names")= chr [1:2] "male" "female"  
## $ alive : dbl+lbl [1:461] 1, 1, 2, 1, 1, 2, 1, 1, 2, 1, 1, 1, 1, 1, 1, 1, 2, 2, ...  
## ..@ label : chr "alive"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 7  
## ..@ labels : Named num [1:2] 1 2  
## .. ..- attr(\*, "names")= chr [1:2] "yes" "no"  
## $ stillborn : dbl+lbl [1:461] 2, 2, 1, 2, 2, 1, 2, 2, 1, 2, 2, 2, 2, 2, 2, 2, 1, 1, ...  
## ..@ label : chr "stillborn"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 11  
## ..@ labels : Named num [1:2] 1 2  
## .. ..- attr(\*, "names")= chr [1:2] "yes" "no"  
## $ dead\_afterdelivery : dbl+lbl [1:461] 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, ...  
## ..@ label : chr "dead after delivery"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 20  
## ..@ labels : Named num [1:2] 1 2  
## .. ..- attr(\*, "names")= chr [1:2] "yes" "no"  
## $ cong\_malf : dbl+lbl [1:461] 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, ...  
## ..@ label : chr "congenital malfn"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 11  
## ..@ labels : Named num [1:2] 1 2  
## .. ..- attr(\*, "names")= chr [1:2] "yes" "no"  
## $ meconium : dbl+lbl [1:461] 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, ...  
## ..@ label : chr "meconium stained"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 10  
## ..@ labels : Named num [1:2] 1 2  
## .. ..- attr(\*, "names")= chr [1:2] "yes" "no"  
## $ resuscitat : dbl+lbl [1:461] 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, ...  
## ..@ label : chr "need for resuscn"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 12  
## ..@ labels : Named num [1:2] 1 2  
## .. ..- attr(\*, "names")= chr [1:2] "yes" "no"  
## $ NICU : dbl+lbl [1:461] 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 1, 2, 1, 2, 2, ...  
## ..@ label : chr "admitted to NICU"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 6  
## ..@ labels : Named num [1:2] 1 2  
## .. ..- attr(\*, "names")= chr [1:2] "yes" "no"  
## $ others2 : dbl+lbl [1:461] 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, ...  
## ..@ label : chr "others"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 9  
## ..@ labels : Named num [1:2] 1 2  
## .. ..- attr(\*, "names")= chr [1:2] "yes" "no"  
## $ conseling : dbl+lbl [1:461] 1, 1, 2, 2, 2, 1, 1, 2, 2, 1, 1, 1, 1, 2, 1, 2, 2, 2, ...  
## ..@ label : chr "counseled about FP"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 11  
## ..@ labels : Named num [1:2] 1 2  
## .. ..- attr(\*, "names")= chr [1:2] "yes" "no"  
## $ FP\_use : dbl+lbl [1:461] 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 1, 2, 2, 2, 1, 2, ...  
## ..@ label : chr "did you use FP"  
## ..@ format.spss: chr "F1.0"  
## ..@ labels : Named num [1:2] 1 2  
## .. ..- attr(\*, "names")= chr [1:2] "yes" "no"  
## $ type\_contn : dbl+lbl [1:461] NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, 1, NA...  
## ..@ label : chr "type of contraception"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 12  
## ..@ labels : Named num [1:3] 1 2 3  
## .. ..- attr(\*, "names")= chr [1:3] "implant" "PP iud" "others"  
## $ reason\_notFP : dbl+lbl [1:461] 2, 1, 4, 4, 4, 4, 2, 4, 4, 4, 2, 2, NA, 4...  
## ..@ label : chr "reason for not taking FP"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 14  
## ..@ labels : Named num [1:4] 1 2 3 4  
## .. ..- attr(\*, "names")= chr [1:4] "desire for more childn" "fear of side effects" "religion" "others"  
## $ future\_plan : dbl+lbl [1:461] 1, 2, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, ...  
## ..@ label : chr "future plan"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 13  
## ..@ labels : Named num [1:2] 1 2  
## .. ..- attr(\*, "names")= chr [1:2] "yes" "no"  
## $ agenew : dbl+lbl [1:461] 3, 2, 2, 2, 2, 2, 2, 2, 2, 3, 2, 2, 3, 2, 2, 2, 2, 2, ...  
## ..@ format.spss : chr "F8.2"  
## ..@ display\_width: int 10  
## ..@ labels : Named num [1:3] 1 2 3  
## .. ..- attr(\*, "names")= chr [1:3] "<20" "21-34" ">34"  
## $ newpreg : dbl+lbl [1:461] 2, 1, 2, 2, 3, 2, 1, 1, 2, 3, 2, 1, 2, 2, 1, 1, 2, 1, ...  
## ..@ format.spss : chr "F8.2"  
## ..@ display\_width: int 10  
## ..@ labels : Named num [1:3] 1 2 3  
## .. ..- attr(\*, "names")= chr [1:3] "<5" "5-7" ">7"  
## $ newlive : dbl+lbl [1:461] 2, 1, 2, 2, 3, 2, 1, 1, 2, 2, 2, 1, 2, 2, 2, 1, 2, 1, ...  
## ..@ format.spss : chr "F8.2"  
## ..@ display\_width: int 10  
## ..@ labels : Named num [1:3] 1 2 3  
## .. ..- attr(\*, "names")= chr [1:3] "<4" "4-7" ">7"  
## $ newparity : num [1:461] 2 1 2 2 3 2 1 1 1 3 ...  
## ..- attr(\*, "format.spss")= chr "F8.2"  
## ..- attr(\*, "display\_width")= int 11  
## $ newmode : dbl+lbl [1:461] 1, 1, 1, 2, 1, 1, 1, 1, 2, 1, 1, 1, 1, 2, 1, 2, 1, 1, ...  
## ..@ format.spss : chr "F8.2"  
## ..@ display\_width: int 10  
## ..@ labels : Named num [1:2] 1 2  
## .. ..- attr(\*, "names")= chr [1:2] "vaginal" "cesarean"  
## $ newmontic : dbl+lbl [1:461] 2, 1, 2, 2, 1, 2, 2, 3, 2, 2, 2, 1, 1, 1, 3, 2, 1, 1, ...  
## ..@ format.spss : chr "F8.2"  
## ..@ display\_width: int 11  
## ..@ labels : Named num [1:3] 1 2 3  
## .. ..- attr(\*, "names")= chr [1:3] "1000 and below" "1001-5000" "above 5000"  
## $ current\_obs\_ccn : dbl+lbl [1:461] 0, 0, 1, 1, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 1, 0, ...  
## ..@ format.spss : chr "F8.2"  
## ..@ display\_width: int 17  
## ..@ labels : Named num [1:2] 0 1  
## .. ..- attr(\*, "names")= chr [1:2] "no" "yes"  
## $ religion\_cat : dbl+lbl [1:461] 2, 1, 1, 1, 1, 1, 2, 2, 1, 1, 3, 3, 1, 3, 2, 2, 1, 1, ...  
## ..@ format.spss : chr "F8.2"  
## ..@ display\_width: int 14  
## ..@ labels : Named num [1:3] 1 2 3  
## .. ..- attr(\*, "names")= chr [1:3] "protestant" "orthodox" "muslim"  
## $ mother\_occ\_cat : dbl+lbl [1:461] 1, 1, 1, 1, 1, 1, 3, 2, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, ...  
## ..@ format.spss : chr "F8.2"  
## ..@ display\_width: int 16  
## ..@ labels : Named num [1:4] 1 2 3 4  
## .. ..- attr(\*, "names")= chr [1:4] "housewife" "gov't employee" "private" "merchant"  
## $ Booking\_cat : dbl+lbl [1:461] 2, 2, 2, 2, 1, 2, 1, 1, 2, 2, 2, 1, 2, 2, 2, 1, 1, 2, ...  
## ..@ format.spss : chr "F8.2"  
## ..@ display\_width: int 13  
## ..@ labels : Named num [1:2] 1 2  
## .. ..- attr(\*, "names")= chr [1:2] "16 and below" "above 16"  
## $ number\_ANC\_cat : dbl+lbl [1:461] 2, 2, 2, 2, 2, 1, 2, 2, 2, 1, 2, 2, 1, 2, 2, 2, 2, 2, ...  
## ..@ format.spss : chr "F8.2"  
## ..@ display\_width: int 16  
## ..@ labels : Named num [1:2] 1 2  
## .. ..- attr(\*, "names")= chr [1:2] "2 and less" "3 or more"  
## - attr(\*, "label")= chr "Dataset 1"

dat\_cs <- dat\_cs[-310, ]

## filter the data

new\_data <- dat\_cs %>%   
 dplyr::select(participant\_id, age, gravidity, parity, abortion, IUFD, Preterm\_d, instrumental\_d, C\_S, ANC, mode\_delivery\_last, DM, PROM, PTL, APH, HDP, mode\_delivery,medical\_illness,number\_ANC\_cat, residence)

## explore the new data

colSums(is.na(new\_data))

## participant\_id age gravidity parity   
## 0 0 0 0   
## abortion IUFD Preterm\_d instrumental\_d   
## 0 0 0 0   
## C\_S ANC mode\_delivery\_last DM   
## 0 0 0 0   
## PROM PTL APH HDP   
## 0 0 0 0   
## mode\_delivery medical\_illness number\_ANC\_cat residence   
## 0 0 0 0

str(new\_data)

## tibble [460 × 20] (S3: tbl\_df/tbl/data.frame)  
## $ participant\_id : num [1:460] 1 2 3 4 5 6 7 8 9 10 ...  
## ..- attr(\*, "label")= chr "participant id"  
## ..- attr(\*, "format.spss")= chr "F3.0"  
## ..- attr(\*, "display\_width")= int 16  
## $ age : num [1:460] 35 22 30 32 32 30 27 30 33 35 ...  
## ..- attr(\*, "label")= chr "age of the mother"  
## ..- attr(\*, "format.spss")= chr "F2.0"  
## ..- attr(\*, "display\_width")= int 5  
## $ gravidity : num [1:460] 6 2 5 6 8 5 3 4 6 8 ...  
## ..- attr(\*, "label")= chr "number of pregnancy"  
## ..- attr(\*, "format.spss")= chr "F2.0"  
## ..- attr(\*, "display\_width")= int 11  
## $ parity : num [1:460] 6 2 5 6 8 5 2 3 4 8 ...  
## ..- attr(\*, "label")= chr "number of delivery"  
## ..- attr(\*, "format.spss")= chr "F2.0"  
## $ abortion : dbl+lbl [1:460] 2, 2, 2, 2, 2, 2, 1, 1, 1, 2, 2, 2, 2, 1, 2, 1, 2, 1, ...  
## ..@ label : chr "abortion"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 10  
## ..@ labels : Named num [1:2] 1 2  
## .. ..- attr(\*, "names")= chr [1:2] "yes" "no"  
## $ IUFD : dbl+lbl [1:460] 2, 1, 2, 2, 2, 2, 2, 2, 2, 1, 2, 2, 2, 2, 2, 2, 2, 1, ...  
## ..@ label : chr "IUFD"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 6  
## ..@ labels : Named num [1:2] 1 2  
## .. ..- attr(\*, "names")= chr [1:2] "yes" "no"  
## $ Preterm\_d : dbl+lbl [1:460] 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, ...  
## ..@ label : chr "preterm delivery"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 11  
## ..@ labels : Named num [1:2] 1 2  
## .. ..- attr(\*, "names")= chr [1:2] "yes" "no"  
## $ instrumental\_d : dbl+lbl [1:460] 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, ...  
## ..@ label : chr "instrumental delivery"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 16  
## ..@ labels : Named num [1:2] 1 2  
## .. ..- attr(\*, "names")= chr [1:2] "yes" "no"  
## $ C\_S : dbl+lbl [1:460] 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, ...  
## ..@ label : chr "C/S"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 5  
## ..@ labels : Named num [1:2] 1 2  
## .. ..- attr(\*, "names")= chr [1:2] "yes" "no"  
## $ ANC : dbl+lbl [1:460] 1, 1, 1, 2, 1, 1, 1, 1, 1, 1, 1, 1, 1, 2, 1, 1, 1, 1, ...  
## ..@ label : chr "ANC visit"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 5  
## ..@ labels : Named num [1:2] 1 2  
## .. ..- attr(\*, "names")= chr [1:2] "yes" "no"  
## $ mode\_delivery\_last: dbl+lbl [1:460] 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 2, 1, 1, 1, 1, ...  
## ..@ label : chr "mode of delivery last"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 20  
## ..@ labels : Named num [1:3] 1 2 3  
## .. ..- attr(\*, "names")= chr [1:3] "vaginal" "c-section" "instrumental"  
## $ DM : dbl+lbl [1:460] 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, ...  
## ..@ label : chr "Diabetes"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 4  
## ..@ labels : Named num [1:2] 1 2  
## .. ..- attr(\*, "names")= chr [1:2] "yes" "no"  
## $ PROM : dbl+lbl [1:460] 2, 2, 1, 2, 2, 2, 2, 2, 2, 2, 1, 2, 2, 2, 2, 2, 2, 2, ...  
## ..@ label : chr "PROM"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 6  
## ..@ labels : Named num [1:2] 1 2  
## .. ..- attr(\*, "names")= chr [1:2] "yes" "no"  
## $ PTL : dbl+lbl [1:460] 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, ...  
## ..@ label : chr "preterm L"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 5  
## ..@ labels : Named num [1:2] 1 2  
## .. ..- attr(\*, "names")= chr [1:2] "yes" "no"  
## $ APH : dbl+lbl [1:460] 2, 2, 2, 1, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 1, 2, ...  
## ..@ label : chr "APH"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 5  
## ..@ labels : Named num [1:2] 1 2  
## .. ..- attr(\*, "names")= chr [1:2] "yes" "no"  
## $ HDP : dbl+lbl [1:460] 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, ...  
## ..@ label : chr "HDP"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 5  
## ..@ labels : Named num [1:2] 1 2  
## .. ..- attr(\*, "names")= chr [1:2] "yes" "no"  
## $ mode\_delivery : dbl+lbl [1:460] 1, 1, 1, 5, 1, 6, 3, 3, 5, 1, 1, 1, 1, 5, 1, 5, 1, 1, ...  
## ..@ label : chr "mode of delivery"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 15  
## ..@ labels : Named num [1:7] 1 2 3 4 5 6 7  
## .. ..- attr(\*, "names")= chr [1:7] "SVD" "VD with epi" "VD with tear" "instrumental" ...  
## $ medical\_illness : dbl+lbl [1:460] 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, ...  
## ..@ label : chr "medical illness previous"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 17  
## ..@ labels : Named num [1:2] 1 2  
## .. ..- attr(\*, "names")= chr [1:2] "yes" "no"  
## $ number\_ANC\_cat : dbl+lbl [1:460] 2, 2, 2, 2, 2, 1, 2, 2, 2, 1, 2, 2, 1, 2, 2, 2, 2, 2, ...  
## ..@ format.spss : chr "F8.2"  
## ..@ display\_width: int 16  
## ..@ labels : Named num [1:2] 1 2  
## .. ..- attr(\*, "names")= chr [1:2] "2 and less" "3 or more"  
## $ residence : dbl+lbl [1:460] 2, 2, 1, 1, 1, 1, 2, 2, 1, 2, 2, 2, 1, 1, 2, 1, 1, 1, ...  
## ..@ label : chr "residence of participant"  
## ..@ format.spss : chr "F1.0"  
## ..@ display\_width: int 11  
## ..@ labels : Named num [1:2] 1 2  
## .. ..- attr(\*, "names")= chr [1:2] "rural" "urban"  
## - attr(\*, "label")= chr "Dataset 1"

## recode variables

## outcome  
new\_data <- mutate(new\_data, outcome= ifelse(as.character(new\_data$mode\_delivery) == "5", 1, 0))  
##Advanced age  
new\_data<-mutate(new\_data, Advanced\_age=ifelse(age>34,1,0))  
##history of any medical illness   
new\_data$medical\_illness<-ifelse(as.character(new\_data$medical\_illness)=="1", 1, 0)  
##ANC visit  
new\_data$number\_ANC\_cat<-ifelse(as.character(new\_data$number\_ANC\_cat)=="1", 1, 0)  
## Abortion  
new\_data$abortion <-ifelse(as.character(new\_data$abortion) == "1", 1, 0)  
  
## IUFD  
new\_data$IUFD <-ifelse(as.character(new\_data$IUFD) == "1", 1, 0)  
  
## PRETERM  
new\_data$Preterm\_d <-ifelse(as.character(new\_data$Preterm\_d) == "1", 1, 0)  
  
## inst delivery  
new\_data$instrumental\_d <-ifelse(as.character(new\_data$instrumental\_d) == "1", 1, 0)  
  
## CS  
new\_data$C\_S <-ifelse(as.character(new\_data$C\_S) == "1", 1, 0)  
  
## ANC  
new\_data$ANC <-ifelse(as.character(new\_data$ANC) == "2", 1, 0)  
  
## previous mode del  
new\_data$mode\_delivery\_last <-ifelse(as.character(new\_data$mode\_delivery\_last) == "2", 1, 0)  
  
## PROM  
new\_data$PROM <-ifelse(as.character(new\_data$PROM) == "1", 1, 0)  
  
## HDP  
new\_data$HDP <-ifelse(as.character(new\_data$HDP) == "1", 1, 0)  
  
## Parity  
new\_data <- mutate(new\_data, parity\_cat= ifelse(parity > 4, 1,0))  
  
#APH  
new\_data$APH <- ifelse(as.character(new\_data$APH) == "1", 1,0)

## Descriptive table

library(table1)

##   
## Attaching package: 'table1'

## The following objects are masked from 'package:base':  
##   
## units, units<-

table1(~ as.factor(Advanced\_age) + as.factor(medical\_illness) + as.factor(number\_ANC\_cat) + as.factor(abortion) + as.factor(IUFD) + as.factor(Preterm\_d) + as.factor(C\_S) + as.factor(ANC) + as.factor(mode\_delivery\_last) + as.factor(PROM) + as.factor(HDP) + as.factor(parity\_cat) + as.factor(APH) | as.factor(outcome), data= new\_data)

## Get nicer `table1` .docx output by simply installing the `flextable` package

## 0 1 Overall  
## 1 (N=396) (N=64) (N=460)  
## 2 as.factor(Advanced\_age)   
## 3 0 330 (83.3%) 53 (82.8%) 383 (83.3%)  
## 4 1 66 (16.7%) 11 (17.2%) 77 (16.7%)  
## 5 as.factor(medical\_illness)   
## 6 0 370 (93.4%) 57 (89.1%) 427 (92.8%)  
## 7 1 26 (6.6%) 7 (10.9%) 33 (7.2%)  
## 8 as.factor(number\_ANC\_cat)   
## 9 0 345 (87.1%) 58 (90.6%) 403 (87.6%)  
## 10 1 51 (12.9%) 6 (9.4%) 57 (12.4%)  
## 11 as.factor(abortion)   
## 12 0 331 (83.6%) 52 (81.3%) 383 (83.3%)  
## 13 1 65 (16.4%) 12 (18.8%) 77 (16.7%)  
## 14 as.factor(IUFD)   
## 15 0 351 (88.6%) 60 (93.8%) 411 (89.3%)  
## 16 1 45 (11.4%) 4 (6.3%) 49 (10.7%)  
## 17 as.factor(Preterm\_d)   
## 18 0 393 (99.2%) 63 (98.4%) 456 (99.1%)  
## 19 1 3 (0.8%) 1 (1.6%) 4 (0.9%)  
## 20 as.factor(C\_S)   
## 21 0 382 (96.5%) 44 (68.8%) 426 (92.6%)  
## 22 1 14 (3.5%) 20 (31.3%) 34 (7.4%)  
## 23 as.factor(ANC)   
## 24 0 346 (87.4%) 60 (93.8%) 406 (88.3%)  
## 25 1 50 (12.6%) 4 (6.3%) 54 (11.7%)  
## 26 as.factor(mode\_delivery\_last)   
## 27 0 378 (95.5%) 32 (50.0%) 410 (89.1%)  
## 28 1 18 (4.5%) 32 (50.0%) 50 (10.9%)  
## 29 as.factor(PROM)   
## 30 0 379 (95.7%) 62 (96.9%) 441 (95.9%)  
## 31 1 17 (4.3%) 2 (3.1%) 19 (4.1%)  
## 32 as.factor(HDP)   
## 33 0 373 (94.2%) 56 (87.5%) 429 (93.3%)  
## 34 1 23 (5.8%) 8 (12.5%) 31 (6.7%)  
## 35 as.factor(parity\_cat)   
## 36 0 258 (65.2%) 45 (70.3%) 303 (65.9%)  
## 37 1 138 (34.8%) 19 (29.7%) 157 (34.1%)  
## 38 as.factor(APH)   
## 39 0 386 (97.5%) 58 (90.6%) 444 (96.5%)  
## 40 1 10 (2.5%) 6 (9.4%) 16 (3.5%)

## Convert variables to factor

new\_data %>% mutate\_at(c('Advanced\_age', 'HDP', 'PROM', 'Preterm\_d', 'medical\_illness', 'APH', 'abortion', 'number\_ANC\_cat', 'IUFD', 'ANC', 'mode\_delivery\_last', 'parity\_cat', 'outcome'), as.factor)

## # A tibble: 460 × 23  
## participant\_id age gravidity parity abortion IUFD Preterm\_d instrumental\_d  
## <dbl> <dbl> <dbl> <dbl> <fct> <fct> <fct> <dbl>  
## 1 1 35 6 6 0 0 0 0  
## 2 2 22 2 2 0 1 0 0  
## 3 3 30 5 5 0 0 0 0  
## 4 4 32 6 6 0 0 0 0  
## 5 5 32 8 8 0 0 0 0  
## 6 6 30 5 5 0 0 0 0  
## 7 7 27 3 2 1 0 0 0  
## 8 8 30 4 3 1 0 0 0  
## 9 9 33 6 4 1 0 0 0  
## 10 10 35 8 8 0 1 0 0  
## # ℹ 450 more rows  
## # ℹ 15 more variables: C\_S <dbl>, ANC <fct>, mode\_delivery\_last <fct>,  
## # DM <dbl+lbl>, PROM <fct>, PTL <dbl+lbl>, APH <fct>, HDP <fct>,  
## # mode\_delivery <dbl+lbl>, medical\_illness <fct>, number\_ANC\_cat <fct>,  
## # residence <dbl+lbl>, outcome <fct>, Advanced\_age <fct>, parity\_cat <fct>

## Table by outcome characteristics

new\_data1 <- new\_data %>%   
 dplyr::select(participant\_id, Advanced\_age, HDP, PROM, Preterm\_d, medical\_illness, APH, abortion, number\_ANC\_cat, IUFD, ANC, mode\_delivery\_last, parity\_cat, outcome)  
  
Table\_1 <- new\_data1 %>%   
 dplyr::select(- participant\_id) %>%   
 tbl\_summary(by= outcome) %>%   
 add\_overall()   
  
print(Table\_1)

## <div id="siczvqievt" style="padding-left:0px;padding-right:0px;padding-top:10px;padding-bottom:10px;overflow-x:auto;overflow-y:auto;width:auto;height:auto;">  
## <style>#siczvqievt table {  
## font-family: system-ui, 'Segoe UI', Roboto, Helvetica, Arial, sans-serif, 'Apple Color Emoji', 'Segoe UI Emoji', 'Segoe UI Symbol', 'Noto Color Emoji';  
## -webkit-font-smoothing: antialiased;  
## -moz-osx-font-smoothing: grayscale;  
## }  
##   
## #siczvqievt thead, #siczvqievt tbody, #siczvqievt tfoot, #siczvqievt tr, #siczvqievt td, #siczvqievt th {  
## border-style: none;  
## }  
##   
## #siczvqievt p {  
## margin: 0;  
## padding: 0;  
## }  
##   
## #siczvqievt .gt\_table {  
## display: table;  
## border-collapse: collapse;  
## line-height: normal;  
## margin-left: auto;  
## margin-right: auto;  
## color: #333333;  
## font-size: 16px;  
## font-weight: normal;  
## font-style: normal;  
## background-color: #FFFFFF;  
## width: auto;  
## border-top-style: solid;  
## border-top-width: 2px;  
## border-top-color: #A8A8A8;  
## border-right-style: none;  
## border-right-width: 2px;  
## border-right-color: #D3D3D3;  
## border-bottom-style: solid;  
## border-bottom-width: 2px;  
## border-bottom-color: #A8A8A8;  
## border-left-style: none;  
## border-left-width: 2px;  
## border-left-color: #D3D3D3;  
## }  
##   
## #siczvqievt .gt\_caption {  
## padding-top: 4px;  
## padding-bottom: 4px;  
## }  
##   
## #siczvqievt .gt\_title {  
## color: #333333;  
## font-size: 125%;  
## font-weight: initial;  
## padding-top: 4px;  
## padding-bottom: 4px;  
## padding-left: 5px;  
## padding-right: 5px;  
## border-bottom-color: #FFFFFF;  
## border-bottom-width: 0;  
## }  
##   
## #siczvqievt .gt\_subtitle {  
## color: #333333;  
## font-size: 85%;  
## font-weight: initial;  
## padding-top: 3px;  
## padding-bottom: 5px;  
## padding-left: 5px;  
## padding-right: 5px;  
## border-top-color: #FFFFFF;  
## border-top-width: 0;  
## }  
##   
## #siczvqievt .gt\_heading {  
## background-color: #FFFFFF;  
## text-align: center;  
## border-bottom-color: #FFFFFF;  
## border-left-style: none;  
## border-left-width: 1px;  
## border-left-color: #D3D3D3;  
## border-right-style: none;  
## border-right-width: 1px;  
## border-right-color: #D3D3D3;  
## }  
##   
## #siczvqievt .gt\_bottom\_border {  
## border-bottom-style: solid;  
## border-bottom-width: 2px;  
## border-bottom-color: #D3D3D3;  
## }  
##   
## #siczvqievt .gt\_col\_headings {  
## border-top-style: solid;  
## border-top-width: 2px;  
## border-top-color: #D3D3D3;  
## border-bottom-style: solid;  
## border-bottom-width: 2px;  
## border-bottom-color: #D3D3D3;  
## border-left-style: none;  
## border-left-width: 1px;  
## border-left-color: #D3D3D3;  
## border-right-style: none;  
## border-right-width: 1px;  
## border-right-color: #D3D3D3;  
## }  
##   
## #siczvqievt .gt\_col\_heading {  
## color: #333333;  
## background-color: #FFFFFF;  
## font-size: 100%;  
## font-weight: normal;  
## text-transform: inherit;  
## border-left-style: none;  
## border-left-width: 1px;  
## border-left-color: #D3D3D3;  
## border-right-style: none;  
## border-right-width: 1px;  
## border-right-color: #D3D3D3;  
## vertical-align: bottom;  
## padding-top: 5px;  
## padding-bottom: 6px;  
## padding-left: 5px;  
## padding-right: 5px;  
## overflow-x: hidden;  
## }  
##   
## #siczvqievt .gt\_column\_spanner\_outer {  
## color: #333333;  
## background-color: #FFFFFF;  
## font-size: 100%;  
## font-weight: normal;  
## text-transform: inherit;  
## padding-top: 0;  
## padding-bottom: 0;  
## padding-left: 4px;  
## padding-right: 4px;  
## }  
##   
## #siczvqievt .gt\_column\_spanner\_outer:first-child {  
## padding-left: 0;  
## }  
##   
## #siczvqievt .gt\_column\_spanner\_outer:last-child {  
## padding-right: 0;  
## }  
##   
## #siczvqievt .gt\_column\_spanner {  
## border-bottom-style: solid;  
## border-bottom-width: 2px;  
## border-bottom-color: #D3D3D3;  
## vertical-align: bottom;  
## padding-top: 5px;  
## padding-bottom: 5px;  
## overflow-x: hidden;  
## display: inline-block;  
## width: 100%;  
## }  
##   
## #siczvqievt .gt\_spanner\_row {  
## border-bottom-style: hidden;  
## }  
##   
## #siczvqievt .gt\_group\_heading {  
## padding-top: 8px;  
## padding-bottom: 8px;  
## padding-left: 5px;  
## padding-right: 5px;  
## color: #333333;  
## background-color: #FFFFFF;  
## font-size: 100%;  
## font-weight: initial;  
## text-transform: inherit;  
## border-top-style: solid;  
## border-top-width: 2px;  
## border-top-color: #D3D3D3;  
## border-bottom-style: solid;  
## border-bottom-width: 2px;  
## border-bottom-color: #D3D3D3;  
## border-left-style: none;  
## border-left-width: 1px;  
## border-left-color: #D3D3D3;  
## border-right-style: none;  
## border-right-width: 1px;  
## border-right-color: #D3D3D3;  
## vertical-align: middle;  
## text-align: left;  
## }  
##   
## #siczvqievt .gt\_empty\_group\_heading {  
## padding: 0.5px;  
## color: #333333;  
## background-color: #FFFFFF;  
## font-size: 100%;  
## font-weight: initial;  
## border-top-style: solid;  
## border-top-width: 2px;  
## border-top-color: #D3D3D3;  
## border-bottom-style: solid;  
## border-bottom-width: 2px;  
## border-bottom-color: #D3D3D3;  
## vertical-align: middle;  
## }  
##   
## #siczvqievt .gt\_from\_md > :first-child {  
## margin-top: 0;  
## }  
##   
## #siczvqievt .gt\_from\_md > :last-child {  
## margin-bottom: 0;  
## }  
##   
## #siczvqievt .gt\_row {  
## padding-top: 8px;  
## padding-bottom: 8px;  
## padding-left: 5px;  
## padding-right: 5px;  
## margin: 10px;  
## border-top-style: solid;  
## border-top-width: 1px;  
## border-top-color: #D3D3D3;  
## border-left-style: none;  
## border-left-width: 1px;  
## border-left-color: #D3D3D3;  
## border-right-style: none;  
## border-right-width: 1px;  
## border-right-color: #D3D3D3;  
## vertical-align: middle;  
## overflow-x: hidden;  
## }  
##   
## #siczvqievt .gt\_stub {  
## color: #333333;  
## background-color: #FFFFFF;  
## font-size: 100%;  
## font-weight: initial;  
## text-transform: inherit;  
## border-right-style: solid;  
## border-right-width: 2px;  
## border-right-color: #D3D3D3;  
## padding-left: 5px;  
## padding-right: 5px;  
## }  
##   
## #siczvqievt .gt\_stub\_row\_group {  
## color: #333333;  
## background-color: #FFFFFF;  
## font-size: 100%;  
## font-weight: initial;  
## text-transform: inherit;  
## border-right-style: solid;  
## border-right-width: 2px;  
## border-right-color: #D3D3D3;  
## padding-left: 5px;  
## padding-right: 5px;  
## vertical-align: top;  
## }  
##   
## #siczvqievt .gt\_row\_group\_first td {  
## border-top-width: 2px;  
## }  
##   
## #siczvqievt .gt\_row\_group\_first th {  
## border-top-width: 2px;  
## }  
##   
## #siczvqievt .gt\_summary\_row {  
## color: #333333;  
## background-color: #FFFFFF;  
## text-transform: inherit;  
## padding-top: 8px;  
## padding-bottom: 8px;  
## padding-left: 5px;  
## padding-right: 5px;  
## }  
##   
## #siczvqievt .gt\_first\_summary\_row {  
## border-top-style: solid;  
## border-top-color: #D3D3D3;  
## }  
##   
## #siczvqievt .gt\_first\_summary\_row.thick {  
## border-top-width: 2px;  
## }  
##   
## #siczvqievt .gt\_last\_summary\_row {  
## padding-top: 8px;  
## padding-bottom: 8px;  
## padding-left: 5px;  
## padding-right: 5px;  
## border-bottom-style: solid;  
## border-bottom-width: 2px;  
## border-bottom-color: #D3D3D3;  
## }  
##   
## #siczvqievt .gt\_grand\_summary\_row {  
## color: #333333;  
## background-color: #FFFFFF;  
## text-transform: inherit;  
## padding-top: 8px;  
## padding-bottom: 8px;  
## padding-left: 5px;  
## padding-right: 5px;  
## }  
##   
## #siczvqievt .gt\_first\_grand\_summary\_row {  
## padding-top: 8px;  
## padding-bottom: 8px;  
## padding-left: 5px;  
## padding-right: 5px;  
## border-top-style: double;  
## border-top-width: 6px;  
## border-top-color: #D3D3D3;  
## }  
##   
## #siczvqievt .gt\_last\_grand\_summary\_row\_top {  
## padding-top: 8px;  
## padding-bottom: 8px;  
## padding-left: 5px;  
## padding-right: 5px;  
## border-bottom-style: double;  
## border-bottom-width: 6px;  
## border-bottom-color: #D3D3D3;  
## }  
##   
## #siczvqievt .gt\_striped {  
## background-color: rgba(128, 128, 128, 0.05);  
## }  
##   
## #siczvqievt .gt\_table\_body {  
## border-top-style: solid;  
## border-top-width: 2px;  
## border-top-color: #D3D3D3;  
## border-bottom-style: solid;  
## border-bottom-width: 2px;  
## border-bottom-color: #D3D3D3;  
## }  
##   
## #siczvqievt .gt\_footnotes {  
## color: #333333;  
## background-color: #FFFFFF;  
## border-bottom-style: none;  
## border-bottom-width: 2px;  
## border-bottom-color: #D3D3D3;  
## border-left-style: none;  
## border-left-width: 2px;  
## border-left-color: #D3D3D3;  
## border-right-style: none;  
## border-right-width: 2px;  
## border-right-color: #D3D3D3;  
## }  
##   
## #siczvqievt .gt\_footnote {  
## margin: 0px;  
## font-size: 90%;  
## padding-top: 4px;  
## padding-bottom: 4px;  
## padding-left: 5px;  
## padding-right: 5px;  
## }  
##   
## #siczvqievt .gt\_sourcenotes {  
## color: #333333;  
## background-color: #FFFFFF;  
## border-bottom-style: none;  
## border-bottom-width: 2px;  
## border-bottom-color: #D3D3D3;  
## border-left-style: none;  
## border-left-width: 2px;  
## border-left-color: #D3D3D3;  
## border-right-style: none;  
## border-right-width: 2px;  
## border-right-color: #D3D3D3;  
## }  
##   
## #siczvqievt .gt\_sourcenote {  
## font-size: 90%;  
## padding-top: 4px;  
## padding-bottom: 4px;  
## padding-left: 5px;  
## padding-right: 5px;  
## }  
##   
## #siczvqievt .gt\_left {  
## text-align: left;  
## }  
##   
## #siczvqievt .gt\_center {  
## text-align: center;  
## }  
##   
## #siczvqievt .gt\_right {  
## text-align: right;  
## font-variant-numeric: tabular-nums;  
## }  
##   
## #siczvqievt .gt\_font\_normal {  
## font-weight: normal;  
## }  
##   
## #siczvqievt .gt\_font\_bold {  
## font-weight: bold;  
## }  
##   
## #siczvqievt .gt\_font\_italic {  
## font-style: italic;  
## }  
##   
## #siczvqievt .gt\_super {  
## font-size: 65%;  
## }  
##   
## #siczvqievt .gt\_footnote\_marks {  
## font-size: 75%;  
## vertical-align: 0.4em;  
## position: initial;  
## }  
##   
## #siczvqievt .gt\_asterisk {  
## font-size: 100%;  
## vertical-align: 0;  
## }  
##   
## #siczvqievt .gt\_indent\_1 {  
## text-indent: 5px;  
## }  
##   
## #siczvqievt .gt\_indent\_2 {  
## text-indent: 10px;  
## }  
##   
## #siczvqievt .gt\_indent\_3 {  
## text-indent: 15px;  
## }  
##   
## #siczvqievt .gt\_indent\_4 {  
## text-indent: 20px;  
## }  
##   
## #siczvqievt .gt\_indent\_5 {  
## text-indent: 25px;  
## }  
## </style>  
## <table class="gt\_table" data-quarto-disable-processing="false" data-quarto-bootstrap="false">  
## <thead>  
##   
## <tr class="gt\_col\_headings">  
## <th class="gt\_col\_heading gt\_columns\_bottom\_border gt\_left" rowspan="1" colspan="1" scope="col" id="&lt;strong&gt;Characteristic&lt;/strong&gt;"><strong>Characteristic</strong></th>  
## <th class="gt\_col\_heading gt\_columns\_bottom\_border gt\_center" rowspan="1" colspan="1" scope="col" id="&lt;strong&gt;Overall&lt;/strong&gt;, N = 460&lt;span class=&quot;gt\_footnote\_marks&quot; style=&quot;white-space:nowrap;font-style:italic;font-weight:normal;&quot;&gt;&lt;sup&gt;1&lt;/sup&gt;&lt;/span&gt;"><strong>Overall</strong>, N = 460<span class="gt\_footnote\_marks" style="white-space:nowrap;font-style:italic;font-weight:normal;"><sup>1</sup></span></th>  
## <th class="gt\_col\_heading gt\_columns\_bottom\_border gt\_center" rowspan="1" colspan="1" scope="col" id="&lt;strong&gt;0&lt;/strong&gt;, N = 396&lt;span class=&quot;gt\_footnote\_marks&quot; style=&quot;white-space:nowrap;font-style:italic;font-weight:normal;&quot;&gt;&lt;sup&gt;1&lt;/sup&gt;&lt;/span&gt;"><strong>0</strong>, N = 396<span class="gt\_footnote\_marks" style="white-space:nowrap;font-style:italic;font-weight:normal;"><sup>1</sup></span></th>  
## <th class="gt\_col\_heading gt\_columns\_bottom\_border gt\_center" rowspan="1" colspan="1" scope="col" id="&lt;strong&gt;1&lt;/strong&gt;, N = 64&lt;span class=&quot;gt\_footnote\_marks&quot; style=&quot;white-space:nowrap;font-style:italic;font-weight:normal;&quot;&gt;&lt;sup&gt;1&lt;/sup&gt;&lt;/span&gt;"><strong>1</strong>, N = 64<span class="gt\_footnote\_marks" style="white-space:nowrap;font-style:italic;font-weight:normal;"><sup>1</sup></span></th>  
## </tr>  
## </thead>  
## <tbody class="gt\_table\_body">  
## <tr><td headers="label" class="gt\_row gt\_left">Advanced\_age</td>  
## <td headers="stat\_0" class="gt\_row gt\_center">77 (17%)</td>  
## <td headers="stat\_1" class="gt\_row gt\_center">66 (17%)</td>  
## <td headers="stat\_2" class="gt\_row gt\_center">11 (17%)</td></tr>  
## <tr><td headers="label" class="gt\_row gt\_left">HDP</td>  
## <td headers="stat\_0" class="gt\_row gt\_center">31 (6.7%)</td>  
## <td headers="stat\_1" class="gt\_row gt\_center">23 (5.8%)</td>  
## <td headers="stat\_2" class="gt\_row gt\_center">8 (13%)</td></tr>  
## <tr><td headers="label" class="gt\_row gt\_left">PROM</td>  
## <td headers="stat\_0" class="gt\_row gt\_center">19 (4.1%)</td>  
## <td headers="stat\_1" class="gt\_row gt\_center">17 (4.3%)</td>  
## <td headers="stat\_2" class="gt\_row gt\_center">2 (3.1%)</td></tr>  
## <tr><td headers="label" class="gt\_row gt\_left">Preterm\_d</td>  
## <td headers="stat\_0" class="gt\_row gt\_center">4 (0.9%)</td>  
## <td headers="stat\_1" class="gt\_row gt\_center">3 (0.8%)</td>  
## <td headers="stat\_2" class="gt\_row gt\_center">1 (1.6%)</td></tr>  
## <tr><td headers="label" class="gt\_row gt\_left">medical\_illness</td>  
## <td headers="stat\_0" class="gt\_row gt\_center">33 (7.2%)</td>  
## <td headers="stat\_1" class="gt\_row gt\_center">26 (6.6%)</td>  
## <td headers="stat\_2" class="gt\_row gt\_center">7 (11%)</td></tr>  
## <tr><td headers="label" class="gt\_row gt\_left">APH</td>  
## <td headers="stat\_0" class="gt\_row gt\_center">16 (3.5%)</td>  
## <td headers="stat\_1" class="gt\_row gt\_center">10 (2.5%)</td>  
## <td headers="stat\_2" class="gt\_row gt\_center">6 (9.4%)</td></tr>  
## <tr><td headers="label" class="gt\_row gt\_left">abortion</td>  
## <td headers="stat\_0" class="gt\_row gt\_center">77 (17%)</td>  
## <td headers="stat\_1" class="gt\_row gt\_center">65 (16%)</td>  
## <td headers="stat\_2" class="gt\_row gt\_center">12 (19%)</td></tr>  
## <tr><td headers="label" class="gt\_row gt\_left">number\_ANC\_cat</td>  
## <td headers="stat\_0" class="gt\_row gt\_center">57 (12%)</td>  
## <td headers="stat\_1" class="gt\_row gt\_center">51 (13%)</td>  
## <td headers="stat\_2" class="gt\_row gt\_center">6 (9.4%)</td></tr>  
## <tr><td headers="label" class="gt\_row gt\_left">IUFD</td>  
## <td headers="stat\_0" class="gt\_row gt\_center">49 (11%)</td>  
## <td headers="stat\_1" class="gt\_row gt\_center">45 (11%)</td>  
## <td headers="stat\_2" class="gt\_row gt\_center">4 (6.3%)</td></tr>  
## <tr><td headers="label" class="gt\_row gt\_left">ANC</td>  
## <td headers="stat\_0" class="gt\_row gt\_center">54 (12%)</td>  
## <td headers="stat\_1" class="gt\_row gt\_center">50 (13%)</td>  
## <td headers="stat\_2" class="gt\_row gt\_center">4 (6.3%)</td></tr>  
## <tr><td headers="label" class="gt\_row gt\_left">mode\_delivery\_last</td>  
## <td headers="stat\_0" class="gt\_row gt\_center">50 (11%)</td>  
## <td headers="stat\_1" class="gt\_row gt\_center">18 (4.5%)</td>  
## <td headers="stat\_2" class="gt\_row gt\_center">32 (50%)</td></tr>  
## <tr><td headers="label" class="gt\_row gt\_left">parity\_cat</td>  
## <td headers="stat\_0" class="gt\_row gt\_center">157 (34%)</td>  
## <td headers="stat\_1" class="gt\_row gt\_center">138 (35%)</td>  
## <td headers="stat\_2" class="gt\_row gt\_center">19 (30%)</td></tr>  
## </tbody>  
##   
## <tfoot class="gt\_footnotes">  
## <tr>  
## <td class="gt\_footnote" colspan="4"><span class="gt\_footnote\_marks" style="white-space:nowrap;font-style:italic;font-weight:normal;"><sup>1</sup></span> n (%)</td>  
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## </tfoot>  
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## </div>

full\_fit <- glm(outcome~ Advanced\_age + abortion + parity\_cat + mode\_delivery\_last + number\_ANC\_cat + medical\_illness + HDP + APH, family= binomial, data = new\_data)  
  
summary(full\_fit)

##   
## Call:  
## glm(formula = outcome ~ Advanced\_age + abortion + parity\_cat +   
## mode\_delivery\_last + number\_ANC\_cat + medical\_illness + HDP +   
## APH, family = binomial, data = new\_data)  
##   
## Coefficients:  
## Estimate Std. Error z value Pr(>|z|)   
## (Intercept) -2.733603 0.257810 -10.603 < 2e-16 \*\*\*  
## Advanced\_age 0.323930 0.466154 0.695 0.48712   
## abortion 0.072189 0.425499 0.170 0.86528   
## parity\_cat -0.007419 0.398222 -0.019 0.98514   
## mode\_delivery\_last 3.163169 0.369046 8.571 < 2e-16 \*\*\*  
## number\_ANC\_cat -0.160411 0.526188 -0.305 0.76048   
## medical\_illness -0.077800 0.609468 -0.128 0.89842   
## HDP 1.053872 0.533479 1.975 0.04821 \*   
## APH 1.711313 0.638148 2.682 0.00733 \*\*   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## (Dispersion parameter for binomial family taken to be 1)  
##   
## Null deviance: 371.11 on 459 degrees of freedom  
## Residual deviance: 278.66 on 451 degrees of freedom  
## AIC: 296.66  
##   
## Number of Fisher Scoring iterations: 5

## OR for full model  
OR\_full <- exp(cbind(OR= coef(full\_fit), confint(full\_fit)))

## Waiting for profiling to be done...

round(OR\_full, digits = 3)

## OR 2.5 % 97.5 %  
## (Intercept) 0.065 0.038 0.105  
## Advanced\_age 1.383 0.537 3.374  
## abortion 1.075 0.449 2.404  
## parity\_cat 0.993 0.446 2.145  
## mode\_delivery\_last 23.645 11.668 49.866  
## number\_ANC\_cat 0.852 0.278 2.244  
## medical\_illness 0.925 0.258 2.849  
## HDP 2.869 0.946 7.817  
## APH 5.536 1.493 18.845

## model reduction  
  
stepAIC(full\_fit)

## Start: AIC=296.66  
## outcome ~ Advanced\_age + abortion + parity\_cat + mode\_delivery\_last +   
## number\_ANC\_cat + medical\_illness + HDP + APH  
##   
## Df Deviance AIC  
## - parity\_cat 1 278.66 294.66  
## - medical\_illness 1 278.68 294.68  
## - abortion 1 278.69 294.69  
## - number\_ANC\_cat 1 278.76 294.76  
## - Advanced\_age 1 279.14 295.14  
## <none> 278.66 296.66  
## - HDP 1 282.15 298.15  
## - APH 1 284.99 300.99  
## - mode\_delivery\_last 1 358.71 374.71  
##   
## Step: AIC=294.66  
## outcome ~ Advanced\_age + abortion + mode\_delivery\_last + number\_ANC\_cat +   
## medical\_illness + HDP + APH  
##   
## Df Deviance AIC  
## - medical\_illness 1 278.68 292.68  
## - abortion 1 278.69 292.69  
## - number\_ANC\_cat 1 278.76 292.76  
## - Advanced\_age 1 279.21 293.21  
## <none> 278.66 294.66  
## - HDP 1 282.16 296.16  
## - APH 1 285.02 299.02  
## - mode\_delivery\_last 1 359.99 373.99  
##   
## Step: AIC=292.68  
## outcome ~ Advanced\_age + abortion + mode\_delivery\_last + number\_ANC\_cat +   
## HDP + APH  
##   
## Df Deviance AIC  
## - abortion 1 278.71 290.71  
## - number\_ANC\_cat 1 278.77 290.77  
## - Advanced\_age 1 279.21 291.21  
## <none> 278.68 292.68  
## - HDP 1 282.34 294.34  
## - APH 1 285.09 297.09  
## - mode\_delivery\_last 1 360.13 372.13  
##   
## Step: AIC=290.71  
## outcome ~ Advanced\_age + mode\_delivery\_last + number\_ANC\_cat +   
## HDP + APH  
##   
## Df Deviance AIC  
## - number\_ANC\_cat 1 278.79 288.79  
## - Advanced\_age 1 279.24 289.24  
## <none> 278.71 290.71  
## - HDP 1 282.39 292.39  
## - APH 1 285.10 295.10  
## - mode\_delivery\_last 1 360.38 370.38  
##   
## Step: AIC=288.79  
## outcome ~ Advanced\_age + mode\_delivery\_last + HDP + APH  
##   
## Df Deviance AIC  
## - Advanced\_age 1 279.29 287.29  
## <none> 278.79 288.79  
## - HDP 1 282.43 290.43  
## - APH 1 285.10 293.10  
## - mode\_delivery\_last 1 361.82 369.82  
##   
## Step: AIC=287.29  
## outcome ~ mode\_delivery\_last + HDP + APH  
##   
## Df Deviance AIC  
## <none> 279.29 287.29  
## - HDP 1 283.00 289.00  
## - APH 1 286.40 292.40  
## - mode\_delivery\_last 1 361.93 367.93

##   
## Call: glm(formula = outcome ~ mode\_delivery\_last + HDP + APH, family = binomial,   
## data = new\_data)  
##   
## Coefficients:  
## (Intercept) mode\_delivery\_last HDP APH   
## -2.686 3.142 1.041 1.754   
##   
## Degrees of Freedom: 459 Total (i.e. Null); 456 Residual  
## Null Deviance: 371.1   
## Residual Deviance: 279.3 AIC: 287.3

## reduced model

red\_model <- full\_fit <- glm(outcome~ HDP + APH + mode\_delivery\_last, family= binomial, data = new\_data)  
  
## ORs and CIs  
OR\_CI <- exp(cbind(OR= coef(red\_model), confint(red\_model)))

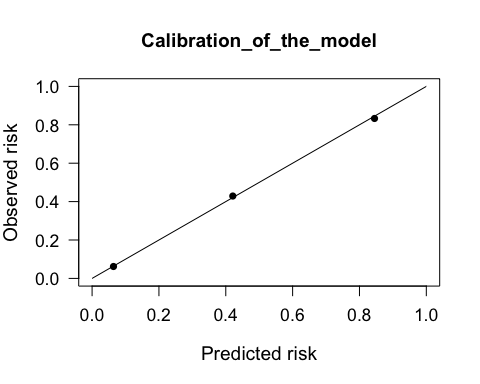
## Waiting for profiling to be done...

round(OR\_CI, digits = 3)

## OR 2.5 % 97.5 %  
## (Intercept) 0.068 0.044 0.100  
## HDP 2.832 0.981 7.395  
## APH 5.776 1.649 18.130  
## mode\_delivery\_last 23.157 11.646 47.765

## model performance/calibration

predicted\_probabilities <- predict(red\_model, type = "response")  
calibration\_data <- data.frame(Outcome = new\_data$outcome, Predicted\_Risks = predicted\_probabilities)  
predRisk <- predRisk(red\_model)  
plotCalibration(calibration\_data, 1, predRisk, 10,plottitle = "Calibration\_of\_the\_model")



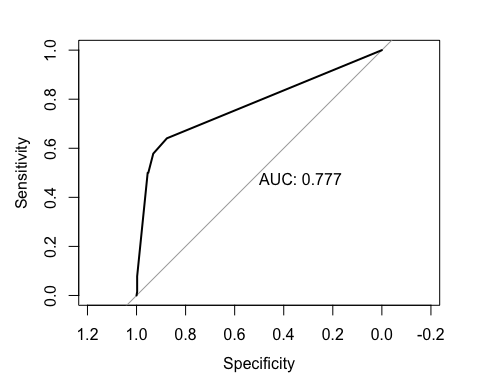
## $Table\_HLtest  
## total meanpred meanobs predicted observed  
## 0.0638 370 0.064 0.062 23.60 23  
## [0.1617,0.817) 84 0.421 0.429 35.33 36  
## [0.8171,0.901] 6 0.845 0.833 5.07 5  
##   
## $Chi\_square  
## [1] 0.044  
##   
## $df  
## [1] 8  
##   
## $p\_value  
## [1] 1

## Model performance/descrimination plot

predsred = predict(red\_model,type="response")  
plot.roc(new\_data$outcome, predsred,print.auc=TRUE)

## Setting levels: control = 0, case = 1

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## Internal validation using bootstraping

# load packages  
library(boot)  
library(pROC)  
  
# Step 2: Define your prognostic model  
## Assuming you want to build a logistic regression model  
model <- glm(outcome ~ HDP + APH + mode\_delivery\_last, family = binomial, data = new\_data)  
  
# Step 3: Define a function to compute the AUC  
auc <- function(new\_data, indices) {  
 d <- new\_data[indices, ]  
 model\_fit <- glm(outcome ~ HDP + mode\_delivery\_last, family = binomial, data = d)  
 predicted <- predict(model\_fit, newdata = d, type = "response")  
 observed <- d$outcome  
 return(pROC::auc(pROC::roc(observed, predicted)))  
}  
# Step 4: Perform bootstrap resampling  
boot\_results <- boot(data = new\_data, statistic = auc, R = 1000)

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## Setting levels: control = 0, case = 1

## Setting direction: controls < cases

## Setting levels: control = 0, case = 1

## Setting direction: controls < cases

## Setting levels: control = 0, case = 1

## Setting direction: controls < cases

## Setting levels: control = 0, case = 1

## Setting direction: controls < cases

## Setting levels: control = 0, case = 1

## Setting direction: controls < cases

## Setting levels: control = 0, case = 1

## Setting direction: controls < cases

## Setting levels: control = 0, case = 1

## Setting direction: controls < cases

## Setting levels: control = 0, case = 1

## Setting direction: controls < cases

## Setting levels: control = 0, case = 1

## Setting direction: controls < cases

## Setting levels: control = 0, case = 1

## Setting direction: controls < cases

## Setting levels: control = 0, case = 1

## Setting direction: controls < cases

## Setting levels: control = 0, case = 1

## Setting direction: controls < cases

## Setting levels: control = 0, case = 1

## Setting direction: controls < cases

## Setting levels: control = 0, case = 1

## Setting direction: controls < cases

## Setting levels: control = 0, case = 1

## Setting direction: controls < cases

## Setting levels: control = 0, case = 1

## Setting direction: controls < cases

## Setting levels: control = 0, case = 1

## Setting direction: controls < cases

## Setting levels: control = 0, case = 1

## Setting direction: controls < cases

## Setting levels: control = 0, case = 1

## Setting direction: controls < cases

## Setting levels: control = 0, case = 1

## Setting direction: controls < cases

## Setting levels: control = 0, case = 1

## Setting direction: controls < cases

## Setting levels: control = 0, case = 1

## Setting direction: controls < cases

## Setting levels: control = 0, case = 1

## Setting direction: controls < cases

## Setting levels: control = 0, case = 1

## Setting direction: controls < cases

## Setting levels: control = 0, case = 1

## Setting direction: controls < cases

## Setting levels: control = 0, case = 1

## Setting direction: controls < cases

## Setting levels: control = 0, case = 1

## Setting direction: controls < cases

## Setting levels: control = 0, case = 1

## Setting direction: controls < cases

## Setting levels: control = 0, case = 1

## Setting direction: controls < cases

## Setting levels: control = 0, case = 1

## Setting direction: controls < cases

## Setting levels: control = 0, case = 1

## Setting direction: controls < cases

## Setting levels: control = 0, case = 1

## Setting direction: controls < cases

## Setting levels: control = 0, case = 1

## Setting direction: controls < cases

## Setting levels: control = 0, case = 1

## Setting direction: controls < cases

## Setting levels: control = 0, case = 1

## Setting direction: controls < cases

## Setting levels: control = 0, case = 1

## Setting direction: controls < cases

## Setting levels: control = 0, case = 1

## Setting direction: controls < cases

## Setting levels: control = 0, case = 1

## Setting direction: controls < cases

# Step 5: Extract the AUC values for each bootstrap sample  
boot\_auc <- boot\_results$t  
print(boot\_auc)

## [,1]  
## [1,] 0.7543330  
## [2,] 0.6847460  
## [3,] 0.7659209  
## [4,] 0.7463953  
## [5,] 0.8246677  
## [6,] 0.7576390  
## [7,] 0.7349951  
## [8,] 0.7658701  
## [9,] 0.7890628  
## [10,] 0.7527292  
## [11,] 0.6513750  
## [12,] 0.7132955  
## [13,] 0.7821824  
## [14,] 0.7207229  
## [15,] 0.7005552  
## [16,] 0.7017203  
## [17,] 0.6897366  
## [18,] 0.6943223  
## [19,] 0.7735559  
## [20,] 0.7164271  
## [21,] 0.7128919  
## [22,] 0.7727014  
## [23,] 0.7272417  
## [24,] 0.7238894  
## [25,] 0.7831070  
## [26,] 0.7788293  
## [27,] 0.7455395  
## [28,] 0.7414228  
## [29,] 0.7262564  
## [30,] 0.7420643  
## [31,] 0.7633560  
## [32,] 0.7357031  
## [33,] 0.7287273  
## [34,] 0.7527425  
## [35,] 0.7663114  
## [36,] 0.7508062  
## [37,] 0.7270430  
## [38,] 0.6959508  
## [39,] 0.6909536  
## [40,] 0.7457854  
## [41,] 0.7902824  
## [42,] 0.7628082  
## [43,] 0.6726374  
## [44,] 0.7969670  
## [45,] 0.7281164  
## [46,] 0.7955208  
## [47,] 0.7938332  
## [48,] 0.8037828  
## [49,] 0.7993040  
## [50,] 0.7341537  
## [51,] 0.7115295  
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## [998,] 0.7243953  
## [999,] 0.7776047  
## [1000,] 0.7096667

## Calculate overoptimsm coefficient

apparent\_performance <- 0.777   
true\_perf <- mean(boot\_auc) # mean of the bootstrap sample  
over\_opt\_coef <- (apparent\_performance - true\_perf) / apparent\_performance # 0.04 --> low chance of overoptimism (less than 0.1)

## Risk\_score calculation

# convert to numeric  
new\_data$HDP\_rs<-as.numeric(new\_data$HDP)  
new\_data$mode\_delivery\_last\_rs<-as.numeric(new\_data$mode\_delivery\_last)  
new\_data$APH\_rs <- as.numeric(new\_data$APH)  
  
# calculate total risk score  
new\_data$Risk\_score<-(1\*new\_data$HDP\_rs)+(3\*new\_data$mode\_delivery\_last\_rs) + (2\*new\_data$APH\_rs)   
cor.test(new\_data$outcome,new\_data$Risk\_score)

##   
## Pearson's product-moment correlation  
##   
## data: new\_data$outcome and new\_data$Risk\_score  
## t = 13.07, df = 458, p-value < 2.2e-16  
## alternative hypothesis: true correlation is not equal to 0  
## 95 percent confidence interval:  
## 0.4512758 0.5847612  
## sample estimates:  
## cor   
## 0.5211989

## # calculate probability of CS for corresponding risks

length(new\_data$participant\_id[new\_data$Risk\_score=="0" & new\_data$outcome=="1"])/ length(new\_data$participant\_id[new\_data$Risk\_score=="0"]) # risk 0.06

## [1] 0.06216216

length(new\_data$participant\_id[new\_data$Risk\_score=="1" & new\_data$outcome=="1"])/ length(new\_data$participant\_id[new\_data$Risk\_score=="1"]) # risk 0.15

## [1] 0.1538462

length(new\_data$participant\_id[new\_data$Risk\_score=="2" & new\_data$outcome=="1"])/ length(new\_data$participant\_id[new\_data$Risk\_score=="2"]) # risk 0.38

## [1] 0.3846154

length(new\_data$participant\_id[new\_data$Risk\_score=="3" & new\_data$outcome=="1"])/ length(new\_data$participant\_id[new\_data$Risk\_score=="3"]) # risk 0.6

## [1] 0.6

length(new\_data$participant\_id[new\_data$Risk\_score=="4" & new\_data$outcome=="1"])/ length(new\_data$participant\_id[new\_data$Risk\_score=="4"]) # risk 1

## [1] 1

length(new\_data$participant\_id[new\_data$Risk\_score=="5" & new\_data$outcome=="1"])/ length(new\_data$participant\_id[new\_data$Risk\_score=="5"]) # risk 0.5

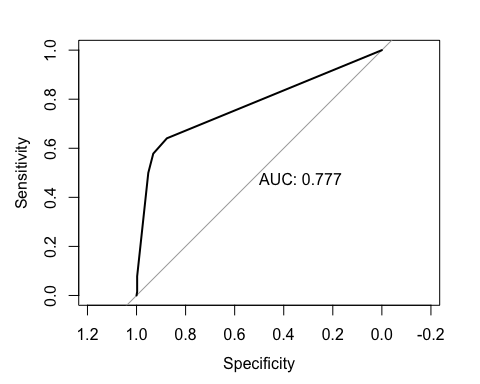
## [1] 0.5

##model with the risk score

risk<-glm(new\_data$outcome~new\_data$Risk\_score,family = binomial)  
predsrisk = predict(risk,type="response")  
plot.roc(new\_data$outcome, predsrisk,print.auc=TRUE)

## Setting levels: control = 0, case = 1

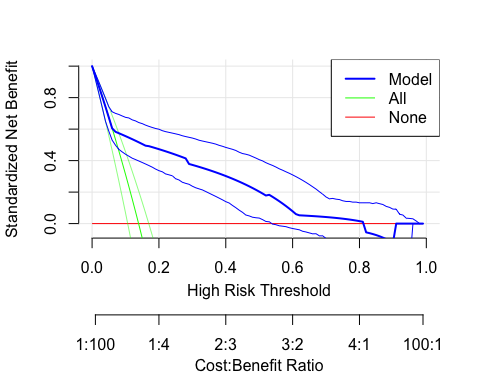
## Setting direction: controls < cases



library(dcurves)  
library(rmda)  
Dcred<-decision\_curve(outcome~ HDP + APH + mode\_delivery\_last, family= binomial, data = new\_data,thresholds = seq(0, 1, by = .01),confidence.intervals = 0.95)

## Note: The data provided is used to both fit a prediction model and to estimate the respective decision curve. This may cause bias in decision curve estimates leading to over-confidence in model performance.

# Define the colors for each line  
line.colors <- c("blue", "green","red")  
plot\_decision\_curve(x=Dcred, curve.names=c("Model", "Intervention for all", "Intervention for none"), cost.benefit.axis = TRUE,col = line.colors)



## Create nomogram for the risk score

library(rms)

## Loading required package: Hmisc

##   
## Attaching package: 'Hmisc'

## The following objects are masked from 'package:table1':  
##   
## label, label<-, units

## The following objects are masked from 'package:dplyr':  
##   
## src, summarize

## The following objects are masked from 'package:base':  
##   
## format.pval, units

## Warning in .recacheSubclasses(def@className, def, env): undefined subclass  
## "ndiMatrix" of class "replValueSp"; definition not updated

##Creating new dataset  
newdata\_nomogram<-new\_data %>%   
 dplyr::select(outcome,HDP\_rs,mode\_delivery\_last\_rs,APH\_rs)  
#Changing the variables to the form that we want to see in the chart  
newdata\_nomogram$HDP <-factor(newdata\_nomogram$HDP\_rs,levels = c(0, 1), labels = c("No","Yes"))  
newdata\_nomogram$Last\_delivery <-factor(newdata\_nomogram$mode\_delivery\_last\_rs, levels = c(0, 1), labels= c("Vaginal","Cesarean"))  
newdata\_nomogram$APH <- factor(newdata\_nomogram$APH\_rs,levels = c(0, 1), labels= c("No","Yes"))  
  
# Fit model  
model.rms <- lrm(outcome ~ HDP + Last\_delivery + APH, data = newdata\_nomogram)  
model.rms

## Logistic Regression Model  
##   
## lrm(formula = outcome ~ HDP + Last\_delivery + APH, data = newdata\_nomogram)  
##   
## Model Likelihood Discrimination Rank Discrim.   
## Ratio Test Indexes Indexes   
## Obs 460 LR chi2 91.82 R2 0.327 C 0.777   
## 0 396 d.f. 3 R2(3,460)0.176 Dxy 0.554   
## 1 64 Pr(> chi2) <0.0001 R2(3,165.3)0.416 gamma 0.838   
## max |deriv| 2e-10 Brier 0.087 tau-a 0.133   
##   
## Coef S.E. Wald Z Pr(>|Z|)  
## Intercept -2.6865 0.2091 -12.85 <0.0001   
## HDP=Yes 1.0409 0.5108 2.04 0.0416   
## Last\_delivery=Cesarean 3.1423 0.3587 8.76 <0.0001   
## APH=Yes 1.7537 0.6017 2.91 0.0036

# plot the nomogram  
par(mar = c(5, 5, 4, 2) + 0.1) # Adjust the margin sizes as needed  
data\_nomogram <- datadist(newdata\_nomogram) # define data distribution  
options(datadist = 'data\_nomogram')  
nomogram <- nomogram(model.rms)  
plot(nomogram(model.rms, fun = plogis, funlabel = "Risk of CS among parous women"))

