Birth Data Report

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### Setup and Load Analysis Functions

Loaded libraries and functions I’ve created to help with basic data analysis and dataset preview.

### Printed Summary of File

textsummary(fname,births)

## [1] " smoking.csv : This file has 869 rows, and 12 columns"  
## [1] "The varible names are id, date, gestation, bwt.oz, parity, mrace, mage, med, mht, mpregwt, inc, smoke"

(Ctrl+F and Replace file names for rest of analysis)

### Explore Data

Explored diminsions of the file and summaries of variables.

### Predictor Variable Transformations and Labeling

-Changed bwt.oz to bwt, mean centered date variable and re-visited converting date variables to strings for interpretation. -Created a new column, “mracetxt” to hold the new race variable names, “White” (categories 0-5), “Mexican”, “Black”, “Asian”, and “Mix”. -Plotted x and y variables for both continuous and categorical variables.

## Outcome Variable and Initial Factorization

#Smoking Status  
#sample size  
n = nrow(births)  
  
#create series of indicator variables for smoking status  
births$smokeY = rep(0, n)  
births$smokeY[births$smoketxt == "Smoker"] = 1  
  
births$smokeN = rep(0, n)  
births$smokeN[births$smoketxt == "Non-Smoker"] = 1  
  
  
#create series of indicator variables for mother's race  
births$mracetxtW = rep(0, n)  
births$mracetxtW[births$mracetxt == "White"] = 1  
  
births$mracetxtB = rep(0, n)  
births$mracetxtB[births$mracetxt == "Black"] = 1  
  
births$mracetxtA = rep(0, n)  
births$mracetxtA[births$mracetxt == "Asian"] = 1  
  
births$mracetxtME = rep(0, n)  
births$mracetxtME[births$mracetxt == "Mexican"] = 1  
  
births$mracetxtMI = rep(0, n)  
births$mracetxtMI[births$mracetxt == "Mix"] = 1  
  
  
#create series of indicator variables for mother's race  
births$inctxt[births$inc== 0] <- "Under 2500"  
births$inctxt[births$inc== 1] <- "2500-4999"  
births$inctxt[births$inc== 2] <- "5000-7499"  
births$inctxt[births$inc== 3] <- "7500-9999"  
births$inctxt[births$inc== 4] <- "10000-12499"  
births$inctxt[births$inc== 5] <- "12500-14999"  
births$inctxt[births$inc== 6] <- "15000-17499"  
births$inctxt[births$inc== 7] <- "17500-19999"  
births$inctxt[births$inc== 8] <- "20000-22499"  
births$inctxt[births$inc== 9] <- "22500+"

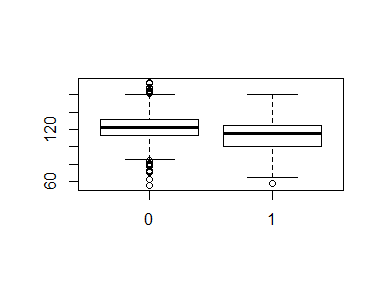
## Initial Modeling

### Model One

Outcome Variable: Birthweight (bwt) Baseline Predictor Variable: -Smoker -White Mother

Other Predictor Variables:

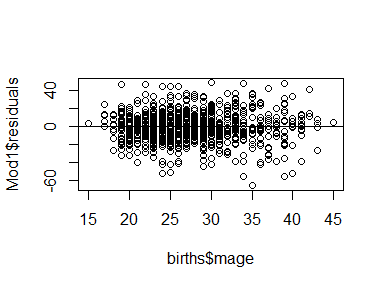
boxplot(bwt~smoke, data=births) #Clearly there is an association, now add other variables



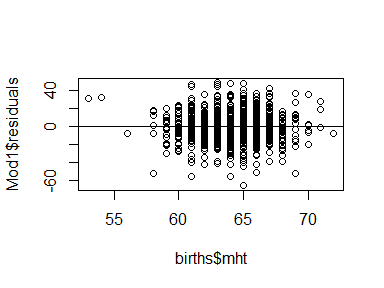
#[1] " smoking.csv : This file has 869 rows, and 12 columns"  
#[1] "The varible names are id, date, gestation, bwt.oz, parity, mrace, mage, med, mht, mpregwt, inc, smoke"  
  
Mod1 <- lm(bwt~mage+ mht + mpregwt + date+ as.factor(medtxt)+ as.factor(inc) + parity + relevel(as.factor(smoke), ref="0") \* relevel(as.factor(mracetxt), ref="White"), data = births)  
summary(Mod1)

##   
## Call:  
## lm(formula = bwt ~ mage + mht + mpregwt + date + as.factor(medtxt) +   
## as.factor(inc) + parity + relevel(as.factor(smoke), ref = "0") \*   
## relevel(as.factor(mracetxt), ref = "White"), data = births)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -66.050 -9.772 -0.282 10.290 48.605   
##   
## Coefficients:  
## Estimate  
## (Intercept) 19.639675  
## mage -0.037103  
## mht 1.046710  
## mpregwt 0.106746  
## date 0.012706  
## as.factor(medtxt)College Grad 2.201113  
## as.factor(medtxt)HS Grad and Trade 1.240843  
## as.factor(medtxt)HS Grad Only 2.742977  
## as.factor(medtxt)HS Grade and Some College 3.174192  
## as.factor(medtxt)Less than 8th Grade -7.161511  
## as.factor(medtxt)Trade School (HSG Unknown) -8.329115  
## as.factor(inc)1 3.030285  
## as.factor(inc)2 4.768628  
## as.factor(inc)3 1.270898  
## as.factor(inc)4 2.089540  
## as.factor(inc)5 1.524099  
## as.factor(inc)6 0.425766  
## as.factor(inc)7 1.575404  
## as.factor(inc)8 2.092621  
## as.factor(inc)9 -2.277853  
## parity 0.769129  
## relevel(as.factor(smoke), ref = "0")1 -9.426709  
## relevel(as.factor(mracetxt), ref = "White")Asian -5.549252  
## relevel(as.factor(mracetxt), ref = "White")Black -10.259062  
## relevel(as.factor(mracetxt), ref = "White")Mexican 0.584158  
## relevel(as.factor(mracetxt), ref = "White")Mix -0.423766  
## relevel(as.factor(smoke), ref = "0")1:relevel(as.factor(mracetxt), ref = "White")Asian -6.852602  
## relevel(as.factor(smoke), ref = "0")1:relevel(as.factor(mracetxt), ref = "White")Black 2.436905  
## relevel(as.factor(smoke), ref = "0")1:relevel(as.factor(mracetxt), ref = "White")Mexican 14.286891  
## relevel(as.factor(smoke), ref = "0")1:relevel(as.factor(mracetxt), ref = "White")Mix -13.461402  
## Std. Error  
## (Intercept) 18.836865  
## mage 0.133895  
## mht 0.270661  
## mpregwt 0.032869  
## date 0.005451  
## as.factor(medtxt)College Grad 2.276832  
## as.factor(medtxt)HS Grad and Trade 2.984423  
## as.factor(medtxt)HS Grad Only 1.864105  
## as.factor(medtxt)HS Grade and Some College 2.033733  
## as.factor(medtxt)Less than 8th Grade 7.863613  
## as.factor(medtxt)Trade School (HSG Unknown) 8.588493  
## as.factor(inc)1 3.582570  
## as.factor(inc)2 3.601134  
## as.factor(inc)3 3.646364  
## as.factor(inc)4 3.727246  
## as.factor(inc)5 3.765742  
## as.factor(inc)6 4.026803  
## as.factor(inc)7 3.729466  
## as.factor(inc)8 5.443364  
## as.factor(inc)9 5.089312  
## parity 0.401197  
## relevel(as.factor(smoke), ref = "0")1 1.368644  
## relevel(as.factor(mracetxt), ref = "White")Asian 3.633842  
## relevel(as.factor(mracetxt), ref = "White")Black 2.111874  
## relevel(as.factor(mracetxt), ref = "White")Mexican 4.008914  
## relevel(as.factor(mracetxt), ref = "White")Mix 4.963197  
## relevel(as.factor(smoke), ref = "0")1:relevel(as.factor(mracetxt), ref = "White")Asian 6.696958  
## relevel(as.factor(smoke), ref = "0")1:relevel(as.factor(mracetxt), ref = "White")Black 2.961633  
## relevel(as.factor(smoke), ref = "0")1:relevel(as.factor(mracetxt), ref = "White")Mexican 8.168438  
## relevel(as.factor(smoke), ref = "0")1:relevel(as.factor(mracetxt), ref = "White")Mix 10.935650  
## t value  
## (Intercept) 1.043  
## mage -0.277  
## mht 3.867  
## mpregwt 3.248  
## date 2.331  
## as.factor(medtxt)College Grad 0.967  
## as.factor(medtxt)HS Grad and Trade 0.416  
## as.factor(medtxt)HS Grad Only 1.471  
## as.factor(medtxt)HS Grade and Some College 1.561  
## as.factor(medtxt)Less than 8th Grade -0.911  
## as.factor(medtxt)Trade School (HSG Unknown) -0.970  
## as.factor(inc)1 0.846  
## as.factor(inc)2 1.324  
## as.factor(inc)3 0.349  
## as.factor(inc)4 0.561  
## as.factor(inc)5 0.405  
## as.factor(inc)6 0.106  
## as.factor(inc)7 0.422  
## as.factor(inc)8 0.384  
## as.factor(inc)9 -0.448  
## parity 1.917  
## relevel(as.factor(smoke), ref = "0")1 -6.888  
## relevel(as.factor(mracetxt), ref = "White")Asian -1.527  
## relevel(as.factor(mracetxt), ref = "White")Black -4.858  
## relevel(as.factor(mracetxt), ref = "White")Mexican 0.146  
## relevel(as.factor(mracetxt), ref = "White")Mix -0.085  
## relevel(as.factor(smoke), ref = "0")1:relevel(as.factor(mracetxt), ref = "White")Asian -1.023  
## relevel(as.factor(smoke), ref = "0")1:relevel(as.factor(mracetxt), ref = "White")Black 0.823  
## relevel(as.factor(smoke), ref = "0")1:relevel(as.factor(mracetxt), ref = "White")Mexican 1.749  
## relevel(as.factor(smoke), ref = "0")1:relevel(as.factor(mracetxt), ref = "White")Mix -1.231  
## Pr(>|t|)  
## (Intercept) 0.297425  
## mage 0.781771  
## mht 0.000119  
## mpregwt 0.001210  
## date 0.019987  
## as.factor(medtxt)College Grad 0.333951  
## as.factor(medtxt)HS Grad and Trade 0.677682  
## as.factor(medtxt)HS Grad Only 0.141539  
## as.factor(medtxt)HS Grade and Some College 0.118955  
## as.factor(medtxt)Less than 8th Grade 0.362707  
## as.factor(medtxt)Trade School (HSG Unknown) 0.332426  
## as.factor(inc)1 0.397883  
## as.factor(inc)2 0.185797  
## as.factor(inc)3 0.727523  
## as.factor(inc)4 0.575212  
## as.factor(inc)5 0.685781  
## as.factor(inc)6 0.915820  
## as.factor(inc)7 0.672826  
## as.factor(inc)8 0.700753  
## as.factor(inc)9 0.654575  
## parity 0.055566  
## relevel(as.factor(smoke), ref = "0")1 1.11e-11  
## relevel(as.factor(mracetxt), ref = "White")Asian 0.127112  
## relevel(as.factor(mracetxt), ref = "White")Black 1.42e-06  
## relevel(as.factor(mracetxt), ref = "White")Mexican 0.884182  
## relevel(as.factor(mracetxt), ref = "White")Mix 0.931978  
## relevel(as.factor(smoke), ref = "0")1:relevel(as.factor(mracetxt), ref = "White")Asian 0.306489  
## relevel(as.factor(smoke), ref = "0")1:relevel(as.factor(mracetxt), ref = "White")Black 0.410841  
## relevel(as.factor(smoke), ref = "0")1:relevel(as.factor(mracetxt), ref = "White")Mexican 0.080650  
## relevel(as.factor(smoke), ref = "0")1:relevel(as.factor(mracetxt), ref = "White")Mix 0.218681  
##   
## (Intercept)   
## mage   
## mht \*\*\*  
## mpregwt \*\*   
## date \*   
## as.factor(medtxt)College Grad   
## as.factor(medtxt)HS Grad and Trade   
## as.factor(medtxt)HS Grad Only   
## as.factor(medtxt)HS Grade and Some College   
## as.factor(medtxt)Less than 8th Grade   
## as.factor(medtxt)Trade School (HSG Unknown)   
## as.factor(inc)1   
## as.factor(inc)2   
## as.factor(inc)3   
## as.factor(inc)4   
## as.factor(inc)5   
## as.factor(inc)6   
## as.factor(inc)7   
## as.factor(inc)8   
## as.factor(inc)9   
## parity .   
## relevel(as.factor(smoke), ref = "0")1 \*\*\*  
## relevel(as.factor(mracetxt), ref = "White")Asian   
## relevel(as.factor(mracetxt), ref = "White")Black \*\*\*  
## relevel(as.factor(mracetxt), ref = "White")Mexican   
## relevel(as.factor(mracetxt), ref = "White")Mix   
## relevel(as.factor(smoke), ref = "0")1:relevel(as.factor(mracetxt), ref = "White")Asian   
## relevel(as.factor(smoke), ref = "0")1:relevel(as.factor(mracetxt), ref = "White")Black   
## relevel(as.factor(smoke), ref = "0")1:relevel(as.factor(mracetxt), ref = "White")Mexican .   
## relevel(as.factor(smoke), ref = "0")1:relevel(as.factor(mracetxt), ref = "White")Mix   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 16.68 on 839 degrees of freedom  
## Multiple R-squared: 0.1745, Adjusted R-squared: 0.146   
## F-statistic: 6.117 on 29 and 839 DF, p-value: < 2.2e-16

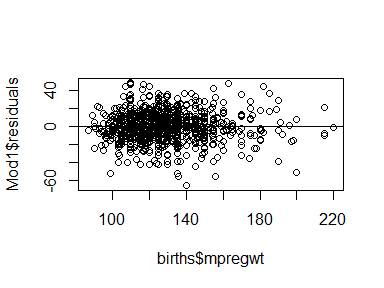
#Model 1 Residuals  
plot(y=Mod1$residuals, x=births$mage)  
abline(0,0)



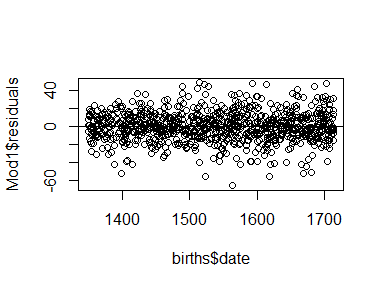
plot(y=Mod1$residuals, x=births$mht)  
abline(0,0)



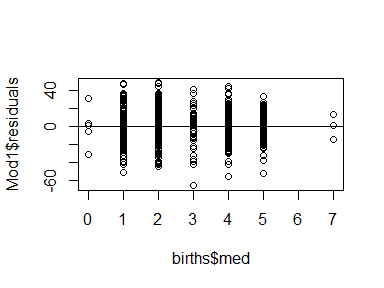
plot(y=Mod1$residuals, x=births$mpregwt)  
abline(0,0)



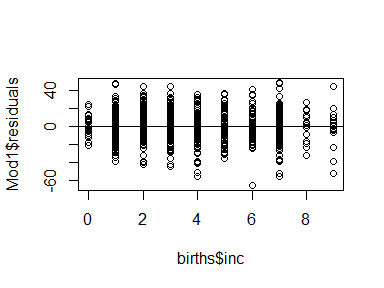
plot(y=Mod1$residuals, x=births$date)  
abline(0,0)



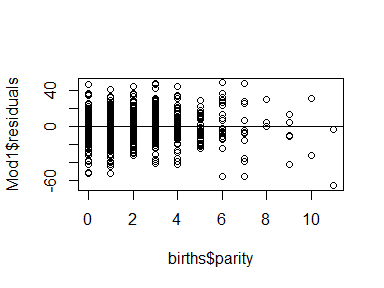
plot(y=Mod1$residuals, x=births$med)  
abline(0,0)



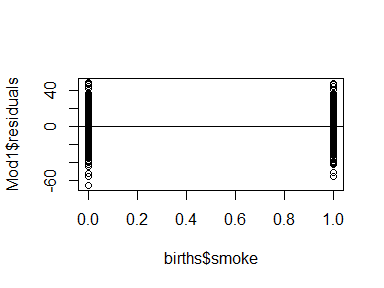
plot(y=Mod1$residuals, x=births$inc)  
abline(0,0)



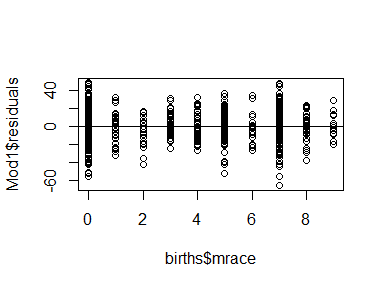
plot(y=Mod1$residuals, x=births$parity)  
abline(0,0)



plot(y=Mod1$residuals, x=births$smoke)  
abline(0,0)

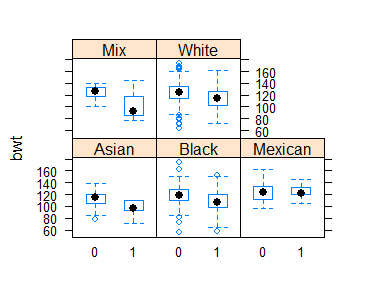


plot(y=Mod1$residuals, x=births$mrace)  
abline(0,0)



## Examine Relationships

bwplot(bwt~as.factor(smoke)|mracetxt, data=births)



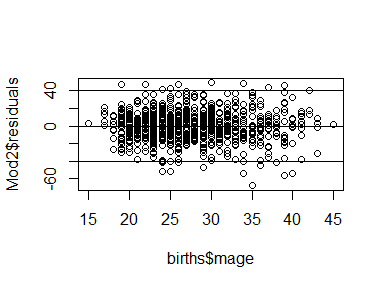
Mod2 <- lm(bwt~mage+ mht + mpregwt + date+ as.factor(medtxt)+ inc + parity + relevel(as.factor(smoke), ref="0") + relevel(as.factor(mracetxt), ref="White"), data = births)  
summary(Mod2)

##   
## Call:  
## lm(formula = bwt ~ mage + mht + mpregwt + date + as.factor(medtxt) +   
## inc + parity + relevel(as.factor(smoke), ref = "0") + relevel(as.factor(mracetxt),   
## ref = "White"), data = births)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -68.175 -9.445 -0.191 10.166 49.182   
##   
## Coefficients:  
## Estimate Std. Error  
## (Intercept) 27.887079 18.427090  
## mage -0.050530 0.132918  
## mht 0.962111 0.266253  
## mpregwt 0.109138 0.032568  
## date 0.013117 0.005401  
## as.factor(medtxt)College Grad 1.964658 2.264516  
## as.factor(medtxt)HS Grad and Trade 0.871366 2.956234  
## as.factor(medtxt)HS Grad Only 2.484884 1.845920  
## as.factor(medtxt)HS Grade and Some College 2.890181 2.016266  
## as.factor(medtxt)Less than 8th Grade -5.418450 7.734040  
## as.factor(medtxt)Trade School (HSG Unknown) -9.164947 8.552821  
## inc -0.373686 0.274472  
## parity 0.848020 0.395645  
## relevel(as.factor(smoke), ref = "0")1 -8.945536 1.175374  
## relevel(as.factor(mracetxt), ref = "White")Asian -7.348415 3.089365  
## relevel(as.factor(mracetxt), ref = "White")Black -9.218776 1.565356  
## relevel(as.factor(mracetxt), ref = "White")Mexican 3.707986 3.496041  
## relevel(as.factor(mracetxt), ref = "White")Mix -2.805243 4.408036  
## t value Pr(>|t|)   
## (Intercept) 1.513 0.13056   
## mage -0.380 0.70392   
## mht 3.614 0.00032 \*\*\*  
## mpregwt 3.351 0.00084 \*\*\*  
## date 2.429 0.01536 \*   
## as.factor(medtxt)College Grad 0.868 0.38587   
## as.factor(medtxt)HS Grad and Trade 0.295 0.76825   
## as.factor(medtxt)HS Grad Only 1.346 0.17861   
## as.factor(medtxt)HS Grade and Some College 1.433 0.15210   
## as.factor(medtxt)Less than 8th Grade -0.701 0.48375   
## as.factor(medtxt)Trade School (HSG Unknown) -1.072 0.28422   
## inc -1.361 0.17372   
## parity 2.143 0.03236 \*   
## relevel(as.factor(smoke), ref = "0")1 -7.611 7.23e-14 \*\*\*  
## relevel(as.factor(mracetxt), ref = "White")Asian -2.379 0.01760 \*   
## relevel(as.factor(mracetxt), ref = "White")Black -5.889 5.58e-09 \*\*\*  
## relevel(as.factor(mracetxt), ref = "White")Mexican 1.061 0.28916   
## relevel(as.factor(mracetxt), ref = "White")Mix -0.636 0.52469   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 16.67 on 851 degrees of freedom  
## Multiple R-squared: 0.1637, Adjusted R-squared: 0.147   
## F-statistic: 9.801 on 17 and 851 DF, p-value: < 2.2e-16

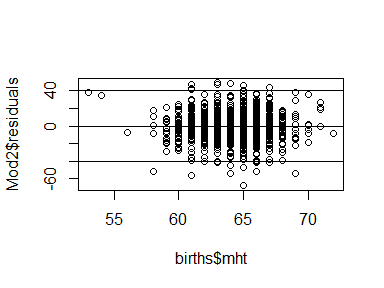
summary(Mod2)

##   
## Call:  
## lm(formula = bwt ~ mage + mht + mpregwt + date + as.factor(medtxt) +   
## inc + parity + relevel(as.factor(smoke), ref = "0") + relevel(as.factor(mracetxt),   
## ref = "White"), data = births)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -68.175 -9.445 -0.191 10.166 49.182   
##   
## Coefficients:  
## Estimate Std. Error  
## (Intercept) 27.887079 18.427090  
## mage -0.050530 0.132918  
## mht 0.962111 0.266253  
## mpregwt 0.109138 0.032568  
## date 0.013117 0.005401  
## as.factor(medtxt)College Grad 1.964658 2.264516  
## as.factor(medtxt)HS Grad and Trade 0.871366 2.956234  
## as.factor(medtxt)HS Grad Only 2.484884 1.845920  
## as.factor(medtxt)HS Grade and Some College 2.890181 2.016266  
## as.factor(medtxt)Less than 8th Grade -5.418450 7.734040  
## as.factor(medtxt)Trade School (HSG Unknown) -9.164947 8.552821  
## inc -0.373686 0.274472  
## parity 0.848020 0.395645  
## relevel(as.factor(smoke), ref = "0")1 -8.945536 1.175374  
## relevel(as.factor(mracetxt), ref = "White")Asian -7.348415 3.089365  
## relevel(as.factor(mracetxt), ref = "White")Black -9.218776 1.565356  
## relevel(as.factor(mracetxt), ref = "White")Mexican 3.707986 3.496041  
## relevel(as.factor(mracetxt), ref = "White")Mix -2.805243 4.408036  
## t value Pr(>|t|)   
## (Intercept) 1.513 0.13056   
## mage -0.380 0.70392   
## mht 3.614 0.00032 \*\*\*  
## mpregwt 3.351 0.00084 \*\*\*  
## date 2.429 0.01536 \*   
## as.factor(medtxt)College Grad 0.868 0.38587   
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## as.factor(medtxt)HS Grad Only 1.346 0.17861   
## as.factor(medtxt)HS Grade and Some College 1.433 0.15210   
## as.factor(medtxt)Less than 8th Grade -0.701 0.48375   
## as.factor(medtxt)Trade School (HSG Unknown) -1.072 0.28422   
## inc -1.361 0.17372   
## parity 2.143 0.03236 \*   
## relevel(as.factor(smoke), ref = "0")1 -7.611 7.23e-14 \*\*\*  
## relevel(as.factor(mracetxt), ref = "White")Asian -2.379 0.01760 \*   
## relevel(as.factor(mracetxt), ref = "White")Black -5.889 5.58e-09 \*\*\*  
## relevel(as.factor(mracetxt), ref = "White")Mexican 1.061 0.28916   
## relevel(as.factor(mracetxt), ref = "White")Mix -0.636 0.52469   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 16.67 on 851 degrees of freedom  
## Multiple R-squared: 0.1637, Adjusted R-squared: 0.147   
## F-statistic: 9.801 on 17 and 851 DF, p-value: < 2.2e-16

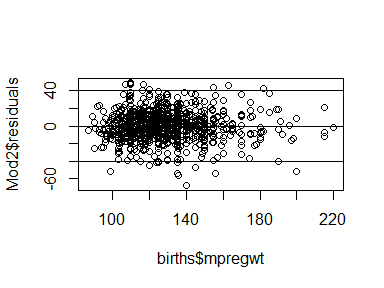
#Model 2 Residuals  
plot(y=Mod2$residuals, x=births$mage)  
abline(0,0)  
abline(40,0)  
abline(-40,0)



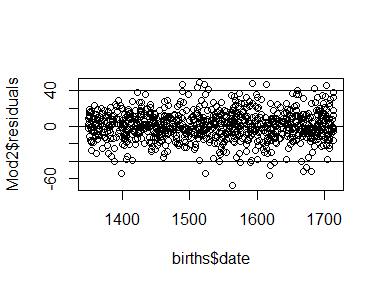
plot(y=Mod2$residuals, x=births$mht)  
abline(0,0)  
abline(40,0)  
abline(-40,0)



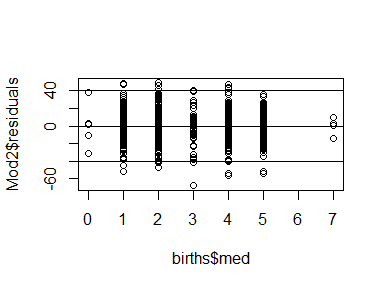
plot(y=Mod2$residuals, x=births$mpregwt)  
abline(0,0)  
abline(40,0)  
abline(-40,0)



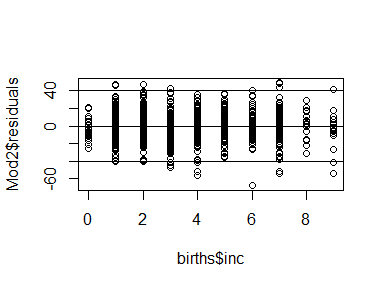
plot(y=Mod2$residuals, x=births$date)  
abline(0,0)  
abline(40,0)  
abline(-40,0)



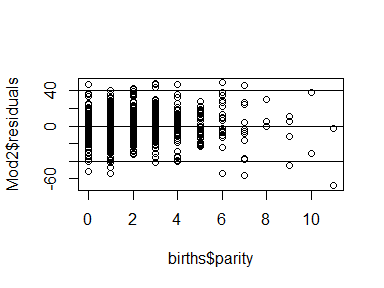
plot(y=Mod2$residuals, x=births$med)  
abline(0,0)  
abline(40,0)  
abline(-40,0)



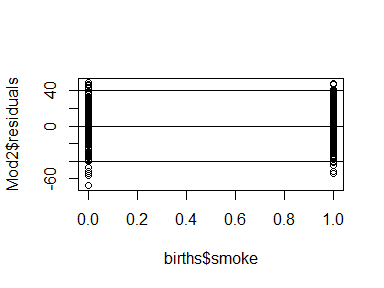
plot(y=Mod2$residuals, x=births$inc)  
abline(0,0)  
abline(40,0)  
abline(-40,0)



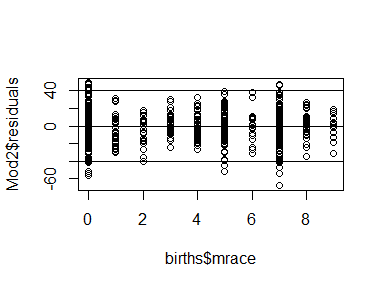
plot(y=Mod2$residuals, x=births$parity)  
abline(0,0)  
abline(40,0)  
abline(-40,0)



plot(y=Mod2$residuals, x=births$smoke)  
abline(0,0)  
abline(40,0)  
abline(-40,0)



plot(y=Mod2$residuals, x=births$mrace)  
abline(0,0)  
abline(40,0)  
abline(-40,0)



## Are they different? Nested F-test

summary(Mod1)

##   
## Call:  
## lm(formula = bwt ~ mage + mht + mpregwt + date + as.factor(medtxt) +   
## as.factor(inc) + parity + relevel(as.factor(smoke), ref = "0") \*   
## relevel(as.factor(mracetxt), ref = "White"), data = births)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -66.050 -9.772 -0.282 10.290 48.605   
##   
## Coefficients:  
## Estimate  
## (Intercept) 19.639675  
## mage -0.037103  
## mht 1.046710  
## mpregwt 0.106746  
## date 0.012706  
## as.factor(medtxt)College Grad 2.201113  
## as.factor(medtxt)HS Grad and Trade 1.240843  
## as.factor(medtxt)HS Grad Only 2.742977  
## as.factor(medtxt)HS Grade and Some College 3.174192  
## as.factor(medtxt)Less than 8th Grade -7.161511  
## as.factor(medtxt)Trade School (HSG Unknown) -8.329115  
## as.factor(inc)1 3.030285  
## as.factor(inc)2 4.768628  
## as.factor(inc)3 1.270898  
## as.factor(inc)4 2.089540  
## as.factor(inc)5 1.524099  
## as.factor(inc)6 0.425766  
## as.factor(inc)7 1.575404  
## as.factor(inc)8 2.092621  
## as.factor(inc)9 -2.277853  
## parity 0.769129  
## relevel(as.factor(smoke), ref = "0")1 -9.426709  
## relevel(as.factor(mracetxt), ref = "White")Asian -5.549252  
## relevel(as.factor(mracetxt), ref = "White")Black -10.259062  
## relevel(as.factor(mracetxt), ref = "White")Mexican 0.584158  
## relevel(as.factor(mracetxt), ref = "White")Mix -0.423766  
## relevel(as.factor(smoke), ref = "0")1:relevel(as.factor(mracetxt), ref = "White")Asian -6.852602  
## relevel(as.factor(smoke), ref = "0")1:relevel(as.factor(mracetxt), ref = "White")Black 2.436905  
## relevel(as.factor(smoke), ref = "0")1:relevel(as.factor(mracetxt), ref = "White")Mexican 14.286891  
## relevel(as.factor(smoke), ref = "0")1:relevel(as.factor(mracetxt), ref = "White")Mix -13.461402  
## Std. Error  
## (Intercept) 18.836865  
## mage 0.133895  
## mht 0.270661  
## mpregwt 0.032869  
## date 0.005451  
## as.factor(medtxt)College Grad 2.276832  
## as.factor(medtxt)HS Grad and Trade 2.984423  
## as.factor(medtxt)HS Grad Only 1.864105  
## as.factor(medtxt)HS Grade and Some College 2.033733  
## as.factor(medtxt)Less than 8th Grade 7.863613  
## as.factor(medtxt)Trade School (HSG Unknown) 8.588493  
## as.factor(inc)1 3.582570  
## as.factor(inc)2 3.601134  
## as.factor(inc)3 3.646364  
## as.factor(inc)4 3.727246  
## as.factor(inc)5 3.765742  
## as.factor(inc)6 4.026803  
## as.factor(inc)7 3.729466  
## as.factor(inc)8 5.443364  
## as.factor(inc)9 5.089312  
## parity 0.401197  
## relevel(as.factor(smoke), ref = "0")1 1.368644  
## relevel(as.factor(mracetxt), ref = "White")Asian 3.633842  
## relevel(as.factor(mracetxt), ref = "White")Black 2.111874  
## relevel(as.factor(mracetxt), ref = "White")Mexican 4.008914  
## relevel(as.factor(mracetxt), ref = "White")Mix 4.963197  
## relevel(as.factor(smoke), ref = "0")1:relevel(as.factor(mracetxt), ref = "White")Asian 6.696958  
## relevel(as.factor(smoke), ref = "0")1:relevel(as.factor(mracetxt), ref = "White")Black 2.961633  
## relevel(as.factor(smoke), ref = "0")1:relevel(as.factor(mracetxt), ref = "White")Mexican 8.168438  
## relevel(as.factor(smoke), ref = "0")1:relevel(as.factor(mracetxt), ref = "White")Mix 10.935650  
## t value  
## (Intercept) 1.043  
## mage -0.277  
## mht 3.867  
## mpregwt 3.248  
## date 2.331  
## as.factor(medtxt)College Grad 0.967  
## as.factor(medtxt)HS Grad and Trade 0.416  
## as.factor(medtxt)HS Grad Only 1.471  
## as.factor(medtxt)HS Grade and Some College 1.561  
## as.factor(medtxt)Less than 8th Grade -0.911  
## as.factor(medtxt)Trade School (HSG Unknown) -0.970  
## as.factor(inc)1 0.846  
## as.factor(inc)2 1.324  
## as.factor(inc)3 0.349  
## as.factor(inc)4 0.561  
## as.factor(inc)5 0.405  
## as.factor(inc)6 0.106  
## as.factor(inc)7 0.422  
## as.factor(inc)8 0.384  
## as.factor(inc)9 -0.448  
## parity 1.917  
## relevel(as.factor(smoke), ref = "0")1 -6.888  
## relevel(as.factor(mracetxt), ref = "White")Asian -1.527  
## relevel(as.factor(mracetxt), ref = "White")Black -4.858  
## relevel(as.factor(mracetxt), ref = "White")Mexican 0.146  
## relevel(as.factor(mracetxt), ref = "White")Mix -0.085  
## relevel(as.factor(smoke), ref = "0")1:relevel(as.factor(mracetxt), ref = "White")Asian -1.023  
## relevel(as.factor(smoke), ref = "0")1:relevel(as.factor(mracetxt), ref = "White")Black 0.823  
## relevel(as.factor(smoke), ref = "0")1:relevel(as.factor(mracetxt), ref = "White")Mexican 1.749  
## relevel(as.factor(smoke), ref = "0")1:relevel(as.factor(mracetxt), ref = "White")Mix -1.231  
## Pr(>|t|)  
## (Intercept) 0.297425  
## mage 0.781771  
## mht 0.000119  
## mpregwt 0.001210  
## date 0.019987  
## as.factor(medtxt)College Grad 0.333951  
## as.factor(medtxt)HS Grad and Trade 0.677682  
## as.factor(medtxt)HS Grad Only 0.141539  
## as.factor(medtxt)HS Grade and Some College 0.118955  
## as.factor(medtxt)Less than 8th Grade 0.362707  
## as.factor(medtxt)Trade School (HSG Unknown) 0.332426  
## as.factor(inc)1 0.397883  
## as.factor(inc)2 0.185797  
## as.factor(inc)3 0.727523  
## as.factor(inc)4 0.575212  
## as.factor(inc)5 0.685781  
## as.factor(inc)6 0.915820  
## as.factor(inc)7 0.672826  
## as.factor(inc)8 0.700753  
## as.factor(inc)9 0.654575  
## parity 0.055566  
## relevel(as.factor(smoke), ref = "0")1 1.11e-11  
## relevel(as.factor(mracetxt), ref = "White")Asian 0.127112  
## relevel(as.factor(mracetxt), ref = "White")Black 1.42e-06  
## relevel(as.factor(mracetxt), ref = "White")Mexican 0.884182  
## relevel(as.factor(mracetxt), ref = "White")Mix 0.931978  
## relevel(as.factor(smoke), ref = "0")1:relevel(as.factor(mracetxt), ref = "White")Asian 0.306489  
## relevel(as.factor(smoke), ref = "0")1:relevel(as.factor(mracetxt), ref = "White")Black 0.410841  
## relevel(as.factor(smoke), ref = "0")1:relevel(as.factor(mracetxt), ref = "White")Mexican 0.080650  
## relevel(as.factor(smoke), ref = "0")1:relevel(as.factor(mracetxt), ref = "White")Mix 0.218681  
##   
## (Intercept)   
## mage   
## mht \*\*\*  
## mpregwt \*\*   
## date \*   
## as.factor(medtxt)College Grad   
## as.factor(medtxt)HS Grad and Trade   
## as.factor(medtxt)HS Grad Only   
## as.factor(medtxt)HS Grade and Some College   
## as.factor(medtxt)Less than 8th Grade   
## as.factor(medtxt)Trade School (HSG Unknown)   
## as.factor(inc)1   
## as.factor(inc)2   
## as.factor(inc)3   
## as.factor(inc)4   
## as.factor(inc)5   
## as.factor(inc)6   
## as.factor(inc)7   
## as.factor(inc)8   
## as.factor(inc)9   
## parity .   
## relevel(as.factor(smoke), ref = "0")1 \*\*\*  
## relevel(as.factor(mracetxt), ref = "White")Asian   
## relevel(as.factor(mracetxt), ref = "White")Black \*\*\*  
## relevel(as.factor(mracetxt), ref = "White")Mexican   
## relevel(as.factor(mracetxt), ref = "White")Mix   
## relevel(as.factor(smoke), ref = "0")1:relevel(as.factor(mracetxt), ref = "White")Asian   
## relevel(as.factor(smoke), ref = "0")1:relevel(as.factor(mracetxt), ref = "White")Black   
## relevel(as.factor(smoke), ref = "0")1:relevel(as.factor(mracetxt), ref = "White")Mexican .   
## relevel(as.factor(smoke), ref = "0")1:relevel(as.factor(mracetxt), ref = "White")Mix   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 16.68 on 839 degrees of freedom  
## Multiple R-squared: 0.1745, Adjusted R-squared: 0.146   
## F-statistic: 6.117 on 29 and 839 DF, p-value: < 2.2e-16

summary(Mod2)

##   
## Call:  
## lm(formula = bwt ~ mage + mht + mpregwt + date + as.factor(medtxt) +   
## inc + parity + relevel(as.factor(smoke), ref = "0") + relevel(as.factor(mracetxt),   
## ref = "White"), data = births)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -68.175 -9.445 -0.191 10.166 49.182   
##   
## Coefficients:  
## Estimate Std. Error  
## (Intercept) 27.887079 18.427090  
## mage -0.050530 0.132918  
## mht 0.962111 0.266253  
## mpregwt 0.109138 0.032568  
## date 0.013117 0.005401  
## as.factor(medtxt)College Grad 1.964658 2.264516  
## as.factor(medtxt)HS Grad and Trade 0.871366 2.956234  
## as.factor(medtxt)HS Grad Only 2.484884 1.845920  
## as.factor(medtxt)HS Grade and Some College 2.890181 2.016266  
## as.factor(medtxt)Less than 8th Grade -5.418450 7.734040  
## as.factor(medtxt)Trade School (HSG Unknown) -9.164947 8.552821  
## inc -0.373686 0.274472  
## parity 0.848020 0.395645  
## relevel(as.factor(smoke), ref = "0")1 -8.945536 1.175374  
## relevel(as.factor(mracetxt), ref = "White")Asian -7.348415 3.089365  
## relevel(as.factor(mracetxt), ref = "White")Black -9.218776 1.565356  
## relevel(as.factor(mracetxt), ref = "White")Mexican 3.707986 3.496041  
## relevel(as.factor(mracetxt), ref = "White")Mix -2.805243 4.408036  
## t value Pr(>|t|)   
## (Intercept) 1.513 0.13056   
## mage -0.380 0.70392   
## mht 3.614 0.00032 \*\*\*  
## mpregwt 3.351 0.00084 \*\*\*  
## date 2.429 0.01536 \*   
## as.factor(medtxt)College Grad 0.868 0.38587   
## as.factor(medtxt)HS Grad and Trade 0.295 0.76825   
## as.factor(medtxt)HS Grad Only 1.346 0.17861   
## as.factor(medtxt)HS Grade and Some College 1.433 0.15210   
## as.factor(medtxt)Less than 8th Grade -0.701 0.48375   
## as.factor(medtxt)Trade School (HSG Unknown) -1.072 0.28422   
## inc -1.361 0.17372   
## parity 2.143 0.03236 \*   
## relevel(as.factor(smoke), ref = "0")1 -7.611 7.23e-14 \*\*\*  
## relevel(as.factor(mracetxt), ref = "White")Asian -2.379 0.01760 \*   
## relevel(as.factor(mracetxt), ref = "White")Black -5.889 5.58e-09 \*\*\*  
## relevel(as.factor(mracetxt), ref = "White")Mexican 1.061 0.28916   
## relevel(as.factor(mracetxt), ref = "White")Mix -0.636 0.52469   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 16.67 on 851 degrees of freedom  
## Multiple R-squared: 0.1637, Adjusted R-squared: 0.147   
## F-statistic: 9.801 on 17 and 851 DF, p-value: < 2.2e-16

anova(Mod1,Mod2)

## Analysis of Variance Table  
##   
## Model 1: bwt ~ mage + mht + mpregwt + date + as.factor(medtxt) + as.factor(inc) +   
## parity + relevel(as.factor(smoke), ref = "0") \* relevel(as.factor(mracetxt),   
## ref = "White")  
## Model 2: bwt ~ mage + mht + mpregwt + date + as.factor(medtxt) + inc +   
## parity + relevel(as.factor(smoke), ref = "0") + relevel(as.factor(mracetxt),   
## ref = "White")  
## Res.Df RSS Df Sum of Sq F Pr(>F)  
## 1 839 233460   
## 2 851 236514 -12 -3054.3 0.9147 0.5315

cor(births$mage,births$parity)

## [1] 0.5236904