

Team Project Multivariate Analysis

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Team members

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Introduction data set

We have selected the CRASH-2 data set provided by Vanderbilt School of Biostatistics for our project. It describes the outcome of a randomized controlled trial and economic valuation of the effects of tranexamic acid on death, vascular occlusive events and transfusion requirement in bleeding trauma patients. Tranexamic acid reduces bleeding in trauma patients undergoing surgery, but is an expensive treatment option. The trial's objective was to assess the effects and cost effectiveness of an early administration of this medication.

Participants of the study were adults with, or at risk of, significant bleeding within 8 hours of injury. Sample randomization was determined by the allocation of an eight digit sequence randomly generated by a computer. Patients and staff were masked to treatment allocation of the tranexamic acid.

We have adjusted the original data set to remove a number of variables that were not relevant to our investigation. We have removed variables regarding the exact surgical procedures administered to patients, various IDs, and details on the patient outcome. We removed the health outcome columns because of complications regarding missing data, where the boolean structure of the columns relating to specific outcomes, like stroke or pulmonary embolism, left a large number of cases with missing values. Instead, we added a boolean variable for a general outcome of survival to assess the efficacy of the procedure, rather than looking at particular health outcomes in post-surgery for living patients.

We will be using variables regarding the sex, age, and injury of the patient as well as certain bio metrics, like blood pressure, respiratory and heart rates, details on surgical blood transfusion, and a boolean variable on the survival of the patient. Our selection provides us with a balance of continuous and categorical variables, many of which are boolean, with minimal complications due to missing data.

Summary variables in the data set

The variables in this dataset are the following:

- entryid: (Numerical) Unique Numbers for Entry Forms
- sex: (Boolean) The sex of the patient (Male/Female)
- age : (Numerical) Age of the patient(Years)
- injurytime: (Numerical) Hours since injury (Hours)
- injurytype: (Categorical) Type of injury {Blunt, Penetrating, Blunt and Penetrating}

- sbp: (Numerical) Systolic Blood Pressure (mmHg)
- rr: (Numerical) Respiratory Rate (rate per minute)
- cc: (Numerical) Central Capillary Refill Time (seconds)
- hr: (Numerical) Heart Rate (rate per minute)
- ndaysicu: (Numerical) Number of days in ICU (days)
- btransf: (Boolean) Blood Products Transfusion
- ncell: (Numerical) Number of Units of Red Cell Products Transfused
- nplasma: (Numerical) Number of Units of Fresh Frozen Plasma Transfused
- nplatelets: (Numerical) Number of Units of Platelets Transfused
- ncryo: (Numerical) Number of Units of Cryoprecipitate Transfused
- bvii: (Boolean) Recombinant Factor VIIa Given
- Death: (Boolean) Indicator if patient survived after the procedure

A summary of data type is the following

variable	type_variable	sub_type_variable
entryid	Quantitative	Continuous
sex	Qualitative	Nominal
age	Quantitative	Continuous
injurytime	Quantitative	Continuous
injurytype	Qualitative	Nominal
sbp	Quantitative	Continuous
rr	Quantitative	Continuous
cc	Quantitative	Continuous
hr	Quantitative	Continuous
ndaysicu	Quantitative	Discrete
btransf	Qualitative	Nominal
ncell	Quantitative	Discrete
nplasma	Quantitative	Discrete
nplatelets	Quantitative	Discrete
ncryo	Quantitative	Discrete
bvii	Qualitative	Nominal
death	Qualitative	Nominal

Summary and Graphical display

A review of the structure of the dataset is the following:

```
## 'data.frame': 9497 obs. of 18 variables:
## $ entryid : int 1 3 4 6 7 8 9 11 12 14 ...
## $ sex : Factor w/ 2 levels "male","female": 1 1 1 1 1 1 1 1 1 2 ...
## $ age : int 50 30 40 19 27 16 29 41 56 37 ...
## $ injurytime: num 1 1 2 3 0.5 1 1 0.5 0.5 8 ...
## $ injurytype: Factor w/ 3 levels "blunt","penetrating",...: 1 1 2 2 2 2 1 2 1 2 ...
## $ sbp : int 75 70 60 90 90 90 116 120 60 104 ...
## $ rr : int 28 26 20 30 26 28 15 15 9 23 ...
## $ cc : int 5 6 5 5 5 2 3 3 3 5 ...
## $ hr : int 120 130 120 90 96 118 118 70 100 92 ...
## $ ndaysicu : num 0 6 2 9 7 0 7 7 23 2 ...
## $ btransf : Factor w/ 2 levels "0","1": 2 2 2 2 2 2 2 2 2 2 ...
## $ ncell : num 1 2 4 2 1 1 16 8 4 4 ...
## $ nplasma : int 0 0 0 0 0 0 9 11 9 0 ...
## $ nplatelets: int 0 0 0 0 0 0 22 10 0 0 ...
## $ ncryo : int 0 0 0 0 0 0 0 0 0 0 ...
## $ bvii : Factor w/ 2 levels "0","1": 1 1 1 1 1 1 1 1 1 1 ...
## $ death : Factor w/ 2 levels "0","1": 2 1 2 2 1 1 1 1 1 1 ...
## $ bloading : Factor w/ 2 levels "0","1": 2 2 2 2 2 2 2 2 2 2 ...
```

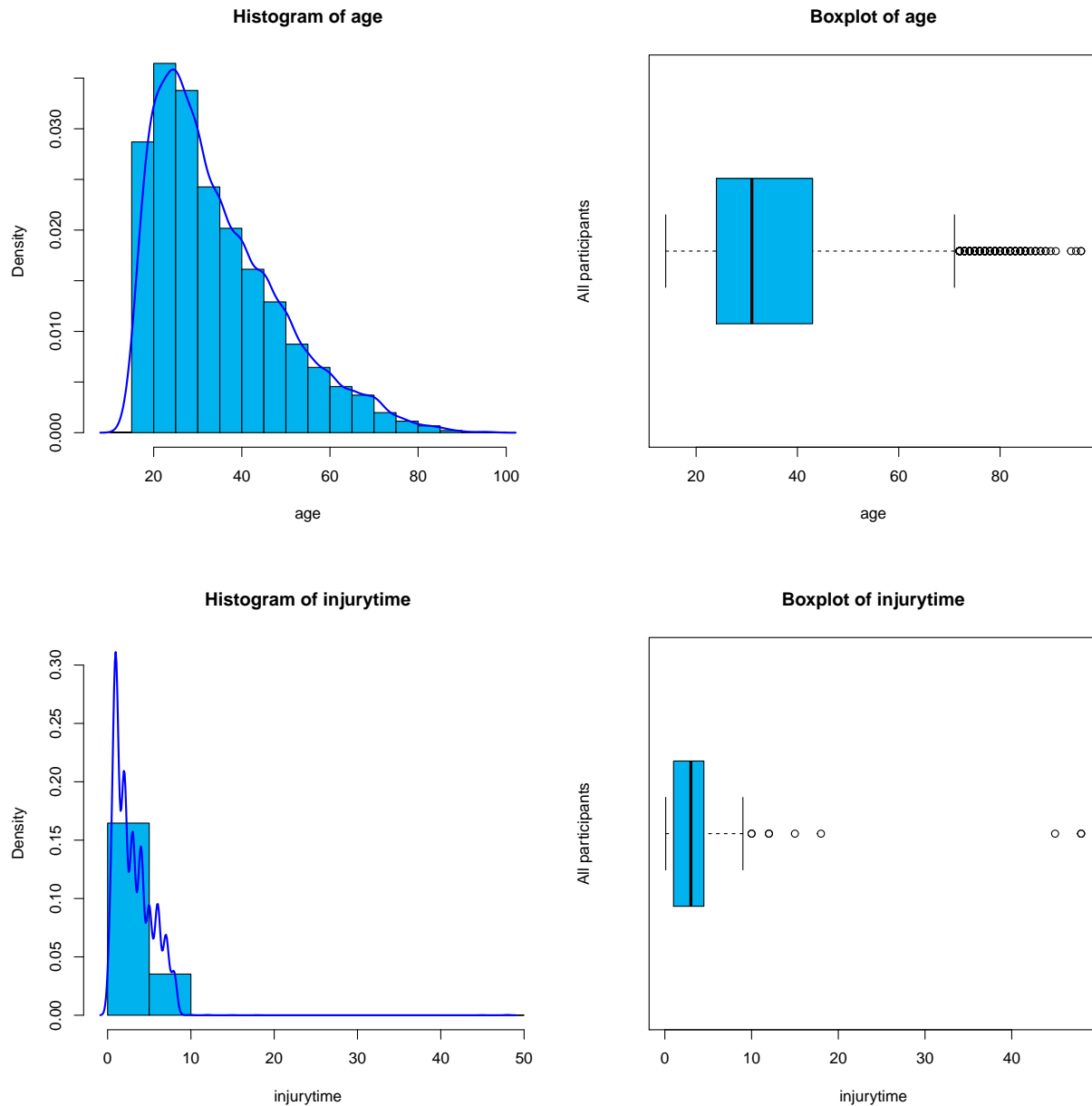
A summary of the values in the data set are:

```
##      entryid      sex      age      injurytime
## Min.   : 1      male :7906   Min.   :14.0   Min.   : 0.10
## 1st Qu.: 4720   female:1591   1st Qu.:24.0   1st Qu.: 1.00
## Median : 9333                      Median :31.0   Median : 3.00
## Mean   : 9657                      Mean   :34.7   Mean   : 3.09
## 3rd Qu.:14598                      3rd Qu.:43.0   3rd Qu.: 4.50
## Max.   :20270                      Max.   :96.0   Max.   :48.00
##
##      injurytype      sbp      rr      cc
## blunt              :5211   Min.   : 4.0   Min.   : 2.0   Min.   : 1.00
## penetrating        :2937   1st Qu.: 80.0   1st Qu.:20.0   1st Qu.: 2.00
## blunt and penetrating:1349   Median : 90.0   Median :22.0   Median : 3.00
##                      Mean   : 93.1   Mean   :23.5   Mean   : 3.44
##                      3rd Qu.:104.0   3rd Qu.:28.0   3rd Qu.: 4.00
##                      Max.   :225.0   Max.   :91.0   Max.   :20.00
##
##      hr      ndaysicu      btransf      ncell      nplasma
## Min.   : 3      Min.   : 0.00   0: 12      Min.   : 0.00   Min.   : 0.00
## 1st Qu.: 96      1st Qu.: 0.00   1:9485     1st Qu.: 2.00   1st Qu.: 0.00
## Median :110      Median : 1.00                      Median : 3.00   Median : 0.00
## Mean   :108      Mean   : 4.14                      Mean   : 3.91   Mean   : 1.44
## 3rd Qu.:120      3rd Qu.: 5.00                      3rd Qu.: 5.00   3rd Qu.: 1.00
## Max.   :220      Max.   :58.00                      Max.   :60.00   Max.   :60.00
##
##      nplatelets      ncryo      bvii      death      bloading
## Min.   : 0.00      Min.   : 0.00   0:9456     0:7672     0: 39
## 1st Qu.: 0.00      1st Qu.: 0.00   1: 41      1:1825     1:9458
## Median : 0.00      Median : 0.00
## Mean   : 0.54      Mean   : 0.26
## 3rd Qu.: 0.00      3rd Qu.: 0.00
## Max.   :87.00      Max.   :61.00
```

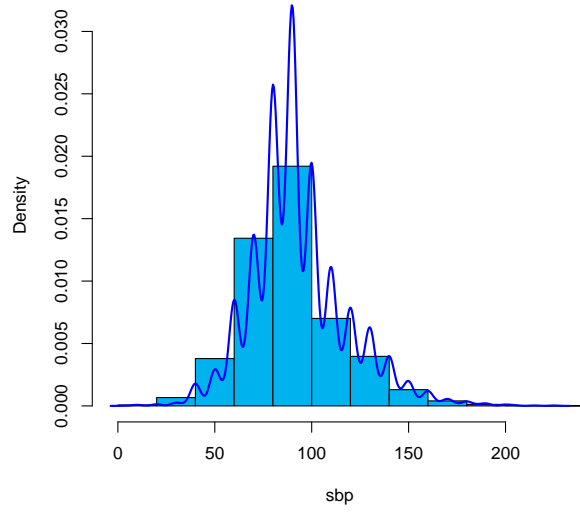
Finally, the list of different values by column is the following:

##	entryid	sex	age	injurytime	injurytype	sbp	rr
##	9497	2	81	78	3	153	58
##	cc	hr	ndaysicu	btransf	ncell	nplasma	nplatelets
##	16	154	47	2	47	45	39
##	ncryo	bvii	death	bloading			
##	28	2	2	2			

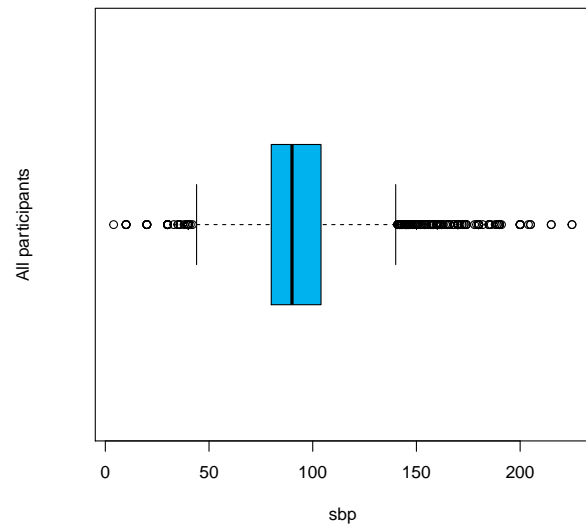
Some visualizations of the quantitative variables are:



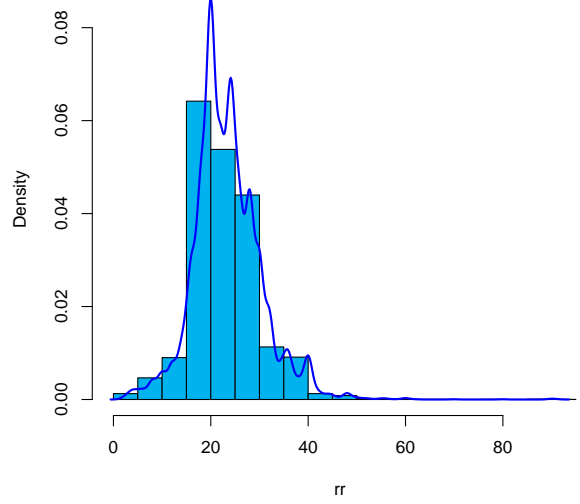
Histogram of sbp



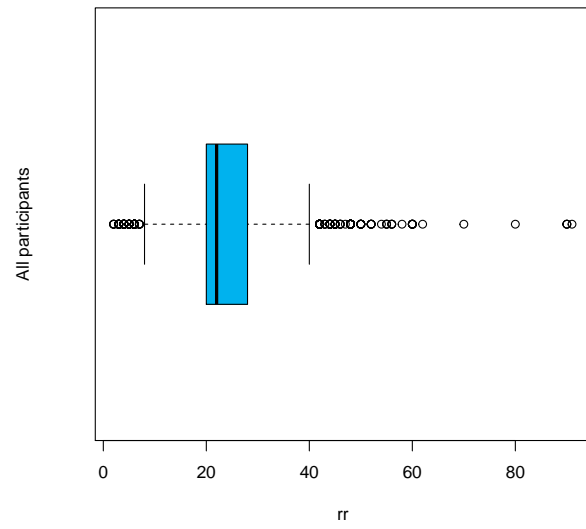
Boxplot of sbp

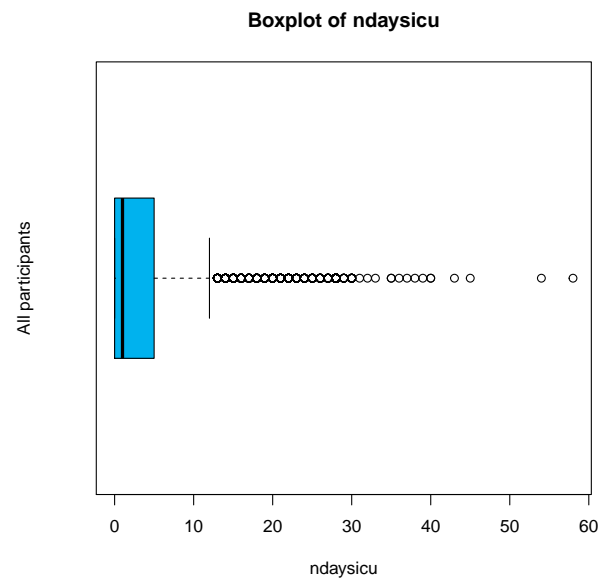
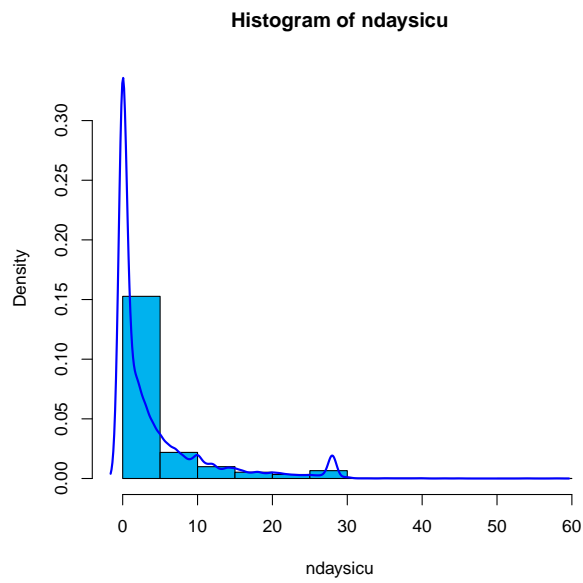
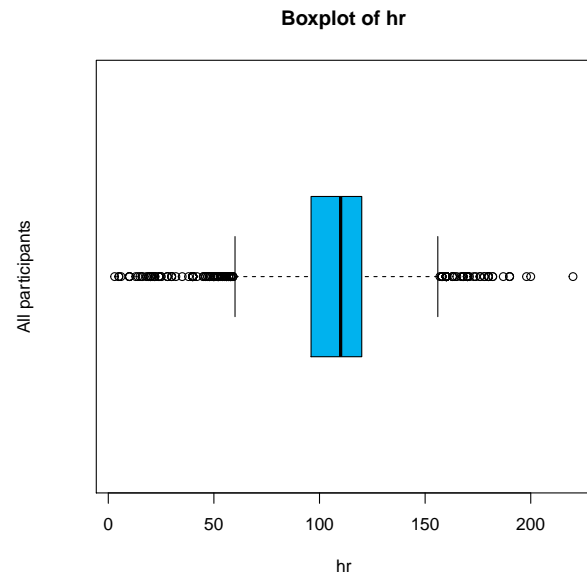
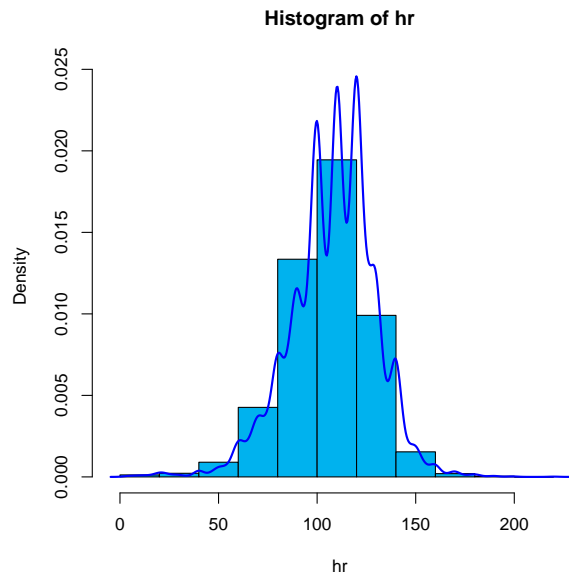


Histogram of rr

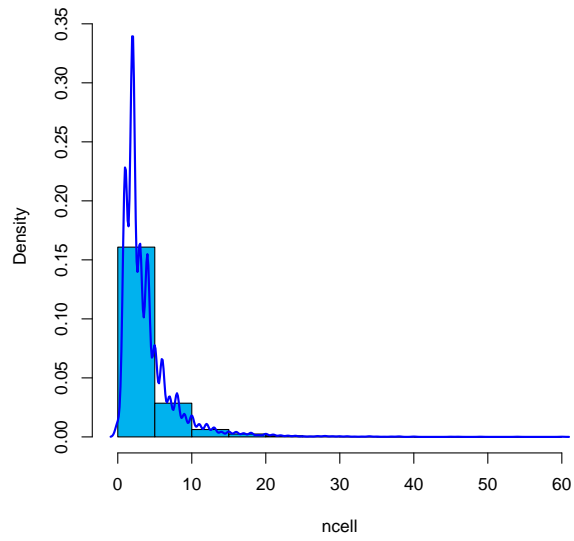


Boxplot of rr

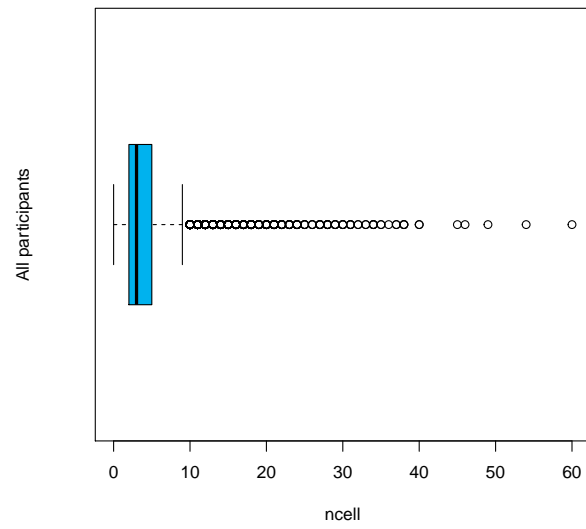




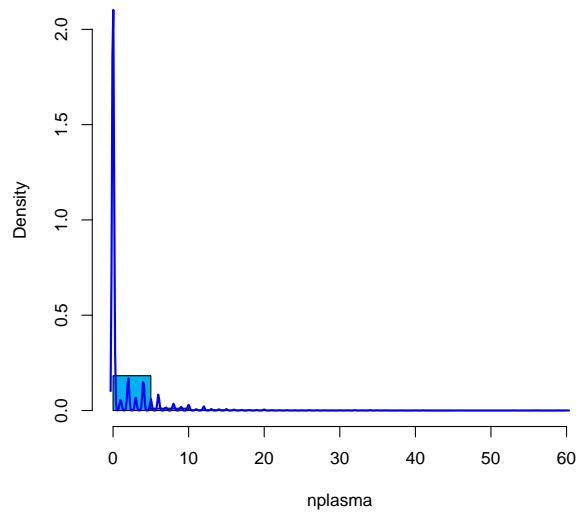
Histogram of ncell



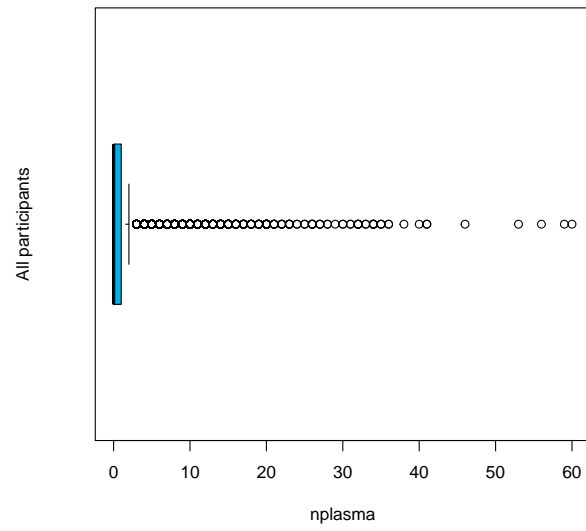
Boxplot of ncell



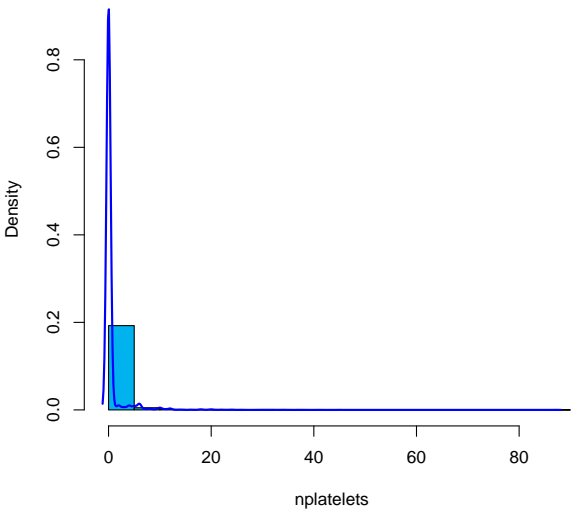
Histogram of nplasma



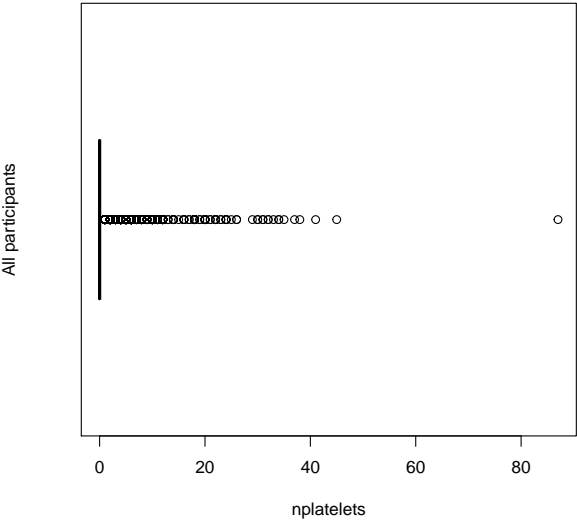
Boxplot of nplasma



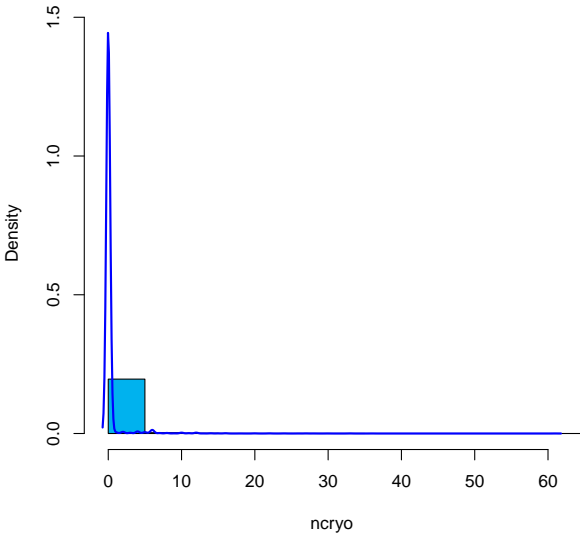
Histogram of nplatelets



Boxplot of nplatelets



Histogram of ncryo



Boxplot of ncryo

