Optimization of the regression CpG

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Contents

```
## set up workspace
library(knitr)
library(tidyverse)
options(stringsAsFactors = F)
options(dplyr.width = Inf)
getwd()
```

```
## [1] "/home/guanshim/Documents/gitlab/ECCHO_github/Code"
```

```
## [1] 588 320
```

```
## [1] 10002 10004 10010 10012 10014 10015
```

```
## [1] 308 320
```

```
## [1] 280 320
```

```
################################################## fix the kable format with lapply ########## add the
################################################## male/female tag ########## function for 1 out of 300
################################################## and other covariates equal length of outcomes and
################################################## covariates
cpg_reg <- function(outcome, data, name, Topn, Gender) {

    ## outcome lm
    outcome_lm = lapply(21:320, function(i) {
        lm = lm(outcome ~ data[, i] + maternal_age + race_4 +
            Bcell + CD4T + CD8T + Gran + Mono + NK + nRBC, data = data)
        coef = round(summary(lm)$coefficients[2, ], 4)
        return(coef)
    })
    outcome_lm = data.frame(matrix(unlist(outcome_lm), ncol = 4,
        byrow = TRUE, dimnames = list(c(colnames(data)[21:320]),
            c("Estimate", "Std.Error", "t.statistic", "p.value"))))

    # adjusted p-value
    outcome_lm = outcome_lm %>% mutate(FDR = p.adjust(p.value,
        "BH", 300), names = colnames(data)[21:320]) %>% select(names,
        everything())
    # sort by p.value
    outcome_lm = outcome_lm[order(outcome_lm$p.value), ]

    ## sample size
    size = length(outcome) - sum(is.na(outcome))

    ## summary table
    kable(head(outcome_lm, Topn), caption = paste("Top10 CpGs for ",
        name, " of ", Gender, " by p.value", " (Sample Size = ",
```

```r
        size, ") ", sep = "", collapse = ""))

}

## test with birthweight_ no log tran outcome, data, name,
## Topn cpg_reg(pfas_male$birth_weight, pfas_male,
## 'birth_weight', 15, 'Male')

## outcomes 'birth_weight', 'ipv3_pp_fm_pct', 'Chol_IPV3',
## 'FFA_IPV3', 'Gluc_IPV3', 'HDL_IPV3', 'Insu_IPV3'
## 'Trig_IPV3', 'Leptin_actual__ng_ml_'
Outcomes <- colnames(pfas_male)[5:13]

# the regression summary table for original outcomes
lapply(Outcomes, function(x) {
    cpg_reg(pfas_male[, x], pfas_male, x, 15, "Male")
})
```

[[1]]

Table 1: Top10 CpGs for birth_weight of Male by p.value (Sample Size = 308)

	names	Estimate	Std.Error	t.statistic	p.value	FDR
49	cg16725984	-223.9782	62.8628	-3.5630	0.0004	0.1200000
67	cg25195288	531.2117	180.0618	2.9502	0.0034	0.4725000
167	cg16495448	-321.1247	116.1410	-2.7650	0.0061	0.4725000
184	cg25137968	338.3636	123.0875	2.7490	0.0063	0.4725000
204	cg15045292	158.0504	59.4286	2.6595	0.0083	0.4980000
71	cg16672637	646.5242	263.2745	2.4557	0.0146	0.5925000
83	cg20741567	505.6544	207.0949	2.4417	0.0152	0.5925000
22	cg00784263	319.4127	131.6031	2.4271	0.0158	0.5925000
117	cg21209948	-118.9226	53.0081	-2.2435	0.0256	0.6804545
160	cg07338658	215.3435	96.2539	2.2372	0.0260	0.6804545
190	cg10832304	-131.9252	59.5469	-2.2155	0.0275	0.6804545
115	cg10436026	-294.5838	134.3338	-2.1929	0.0291	0.6804545
57	cg23206463	-116.4047	55.4694	-2.0985	0.0367	0.6804545
131	cg12271419	-458.9996	223.9282	-2.0498	0.0413	0.6804545
201	cg04591709	379.3098	186.3319	2.0357	0.0427	0.6804545

[[2]]

Table 2: Top10 CpGs for ipv3_pp_fm_pct of Male by p.value (Sample Size = 295)

	names	Estimate	Std.Error	t.statistic	p.value	FDR
190	cg10832304	-1.3755	0.4869	-2.8251	0.0051	0.8400000
112	cg24366087	-2.8077	1.0239	-2.7421	0.0065	0.8400000
139	cg08743751	2.3959	0.9020	2.6561	0.0084	0.8400000
203	cg15066197	-2.6715	1.0984	-2.4322	0.0156	0.8626829
282	cg08732300	1.7887	0.7625	2.3457	0.0197	0.8626829
171	cg09461851	2.8483	1.2552	2.2692	0.0240	0.8626829

	names	Estimate	Std.Error	t.statistic	p.value	FDR
78	cg17878951	-2.6936	1.2183	-2.2109	0.0278	0.8626829
205	cg12149692	-1.6584	0.7524	-2.2042	0.0283	0.8626829
145	cg06404838	-3.1023	1.4108	-2.1990	0.0287	0.8626829
238	cg07676859	1.0072	0.4713	2.1371	0.0335	0.8626829
184	cg25137968	2.1172	1.0226	2.0703	0.0393	0.8626829
106	cg24833819	1.3854	0.6865	2.0179	0.0445	0.8626829
233	cg02887248	-3.6414	1.8062	-2.0160	0.0447	0.8626829
4	cg21853587	3.1614	1.5731	2.0097	0.0454	0.8626829
255	cg00634984	-1.0037	0.5069	-1.9798	0.0487	0.8626829

[[3]]

Table 3: Top10 CpGs for Chol_IPV3 of Male by p.value (Sample Size = 290)

	names	Estimate	Std.Error	t.statistic	p.value	FDR
254	cg22692511	7.2223	2.3323	3.0966	0.0022	0.5040000
271	cg08162803	15.1963	5.2370	2.9017	0.0040	0.5040000
112	cg24366087	-12.9362	4.7274	-2.7364	0.0066	0.5040000
95	cg17850055	-26.7278	9.9250	-2.6930	0.0075	0.5040000
266	cg12857407	10.9809	4.1342	2.6561	0.0084	0.5040000
49	cg16725984	5.9979	2.3273	2.5772	0.0105	0.5250000
279	cg17132124	8.4670	3.5930	2.3565	0.0191	0.8185714
69	cg04168590	20.7551	9.0932	2.2825	0.0232	0.8584615
170	cg19554564	-12.5572	5.7514	-2.1833	0.0299	0.8584615
28	cg12872489	-6.5322	2.9982	-2.1787	0.0302	0.8584615
211	cg00893875	3.2266	1.5349	2.1022	0.0364	0.8584615
58	cg09887862	4.7067	2.2466	2.0950	0.0371	0.8584615
188	cg17500055	-7.2796	3.4775	-2.0934	0.0372	0.8584615
198	cg09825146	-5.6078	2.8646	-1.9576	0.0513	0.9537273
143	cg15486454	-6.6270	3.5936	-1.8441	0.0662	0.9537273

[[4]]

Table 4: Top10 CpGs for FFA_IPV3 of Male by p.value (Sample Size = 268)

	names	Estimate	Std.Error	t.statistic	p.value	FDR
4	cg21853587	-169.3376	63.0974	-2.6837	0.0078	0.7016667
96	cg21215576	82.6143	30.8336	2.6794	0.0079	0.7016667
163	cg26074111	-134.0200	51.9809	-2.5783	0.0105	0.7016667
156	cg13858106	115.1631	47.0377	2.4483	0.0150	0.7016667
148	cg13598480	98.5534	41.1924	2.3925	0.0175	0.7016667
9	cg20510724	172.4090	72.6345	2.3737	0.0184	0.7016667
257	cg16529483	37.4015	15.8850	2.3545	0.0193	0.7016667
54	cg19529074	-97.4207	44.1996	-2.2041	0.0284	0.7016667
166	cg26275850	99.4629	45.7261	2.1752	0.0305	0.7016667
126	cg05390685	-69.3031	31.9189	-2.1712	0.0308	0.7016667
7	cg27354586	-110.6213	51.8697	-2.1327	0.0339	0.7016667
162	cg18602114	-65.3165	30.8481	-2.1174	0.0352	0.7016667

	names	Estimate	Std.Error	t.statistic	p.value	FDR
250	cg20732198	-69.3452	32.9454	-2.1049	0.0363	0.7016667
119	cg00438284	-77.5458	36.8574	-2.1039	0.0364	0.7016667
177	cg25206725	-78.3701	37.7488	-2.0761	0.0389	0.7016667

[[5]]

Table 5: Top10 CpGs for Gluc_IPV3 of Male by p.value (Sample Size = 298)

	names	Estimate	Std.Error	t.statistic	p.value	FDR
145	cg06404838	27.8481	8.4948	3.2783	0.0012	0.3600000
248	cg11196848	-15.3248	5.5395	-2.7665	0.0060	0.9000000
27	cg17519749	11.7052	4.5215	2.5888	0.0101	0.9480000
59	cg20324199	11.6527	5.0313	2.3160	0.0213	0.9480000
150	cg14163408	11.2035	4.8768	2.2973	0.0223	0.9480000
16	cg06873590	-32.3360	14.4880	-2.2319	0.0264	0.9480000
217	cg01816336	-18.4503	8.3155	-2.2188	0.0273	0.9480000
135	cg17171260	-15.1541	6.8867	-2.2005	0.0286	0.9480000
287	cg26781129	11.1141	5.1032	2.1779	0.0302	0.9480000
77	cg23478547	7.9711	3.6905	2.1599	0.0316	0.9480000
95	cg17850055	-27.8733	13.4284	-2.0757	0.0388	0.9750526
153	cg01060409	24.6640	12.0796	2.0418	0.0421	0.9750526
93	cg23054637	23.0425	11.4606	2.0106	0.0453	0.9750526
36	cg11302884	-16.1529	8.0703	-2.0015	0.0463	0.9750526
189	cg13382072	10.1078	5.1841	1.9498	0.0522	0.9750526

[[6]]

Table 6: Top10 CpGs for HDL_IPV3 of Male by p.value (Sample Size = 263)

	names	Estimate	Std.Error	t.statistic	p.value	FDR
49	cg16725984	3.2542	1.0221	3.1839	0.0016	0.4000
42	cg15355952	-6.1054	2.0229	-3.0181	0.0028	0.4000
236	cg04061372	1.9260	0.6637	2.9022	0.0040	0.4000
271	cg08162803	6.2363	2.3198	2.6883	0.0077	0.5775
211	cg00893875	1.7387	0.7042	2.4690	0.0142	0.7380
281	cg22946159	-7.9944	3.3218	-2.4067	0.0168	0.7380
290	cg00798281	-3.7706	1.5943	-2.3651	0.0188	0.7380
286	cg03989507	4.3550	1.8841	2.3115	0.0216	0.7380
26	cg03452190	6.5512	2.8815	2.2736	0.0238	0.7380
145	cg06404838	-6.5192	2.8836	-2.2608	0.0246	0.7380
120	cg22700790	2.8506	1.2842	2.2198	0.0273	0.7425
230	cg22950210	3.5533	1.6832	2.1110	0.0358	0.7425
52	cg19549232	4.5904	2.1774	2.1082	0.0360	0.7425
294	cg04262934	7.7888	3.7174	2.0952	0.0372	0.7425
188	cg17500055	-3.2273	1.5540	-2.0768	0.0388	0.7425

[[7]]

Table 7: Top10 CpGs for Insu_IPV3 of Male by p.value (Sample Size = 285)

	names	Estimate	Std.Error	t.statistic	p.value	FDR
169	cg17501712	9.6030	2.9405	3.2658	0.0012	0.3600000
233	cg02887248	-12.1056	4.9070	-2.4670	0.0142	0.9769751
61	cg04569429	5.3313	2.1663	2.4610	0.0145	0.9769751
242	cg06922635	4.9204	2.0773	2.3687	0.0185	0.9769751
141	cg04476891	5.9849	2.5923	2.3087	0.0217	0.9769751
199	cg21261158	-9.0981	4.1012	-2.2184	0.0274	0.9769751
195	cg23785275	-1.4674	0.7066	-2.0767	0.0388	0.9769751
191	cg25138412	-3.2933	1.6012	-2.0568	0.0407	0.9769751
259	cg06407657	-4.7457	2.3817	-1.9926	0.0473	0.9769751
171	cg09461851	6.9436	3.5456	1.9584	0.0512	0.9769751
86	cg02648057	-3.4881	1.7875	-1.9514	0.0520	0.9769751
20	cg00210042	7.3624	3.7862	1.9445	0.0529	0.9769751
19	cg00128386	-8.2703	4.3246	-1.9124	0.0569	0.9769751
27	cg17519749	3.8344	2.0763	1.8467	0.0659	0.9769751
58	cg09887862	2.4654	1.3877	1.7767	0.0767	0.9769751

[[8]]

Table 8: Top10 CpGs for Trig_IPV3 of Male by p.value (Sample Size = 287)

	names	Estimate	Std.Error	t.statistic	p.value	FDR
291	cg09630142	-28.1212	8.7979	-3.1963	0.0016	0.4800000
19	cg00128386	46.6354	18.9656	2.4589	0.0146	0.9521495
221	cg19682786	-33.4938	14.5417	-2.3033	0.0220	0.9521495
277	cg05227616	-27.3524	12.4619	-2.1949	0.0290	0.9521495
259	cg06407657	-22.5993	10.4359	-2.1655	0.0312	0.9521495
160	cg07338658	-20.6099	9.5478	-2.1586	0.0317	0.9521495
197	cg14349977	-13.8979	6.4997	-2.1382	0.0334	0.9521495
72	cg16659510	-33.1245	15.6720	-2.1136	0.0355	0.9521495
50	cg27124293	16.2506	7.7557	2.0953	0.0371	0.9521495
170	cg19554564	29.3659	15.3315	1.9154	0.0565	0.9521495
95	cg17850055	-50.5667	26.5950	-1.9014	0.0583	0.9521495
198	cg09825146	-14.4595	7.6284	-1.8955	0.0591	0.9521495
297	cg01607625	-30.0297	16.2658	-1.8462	0.0659	0.9521495
285	cg27535677	-15.9716	8.7706	-1.8210	0.0697	0.9521495
118	cg26400491	-11.1671	6.2129	-1.7974	0.0734	0.9521495

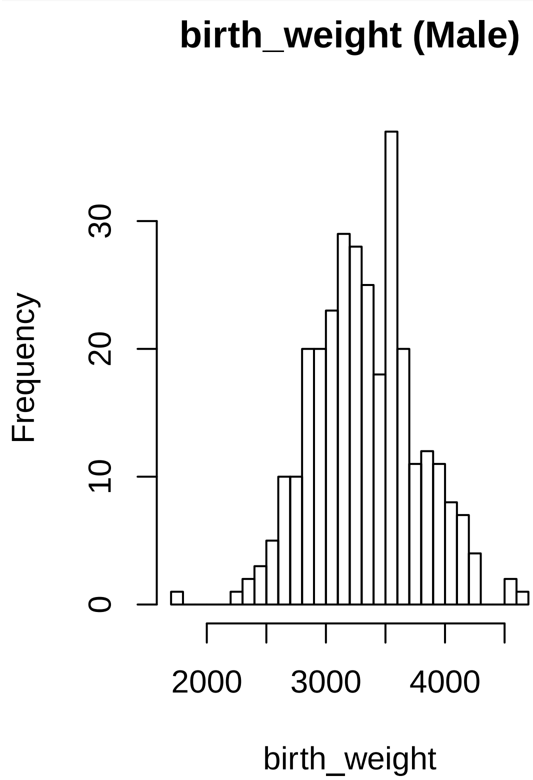
[[9]]

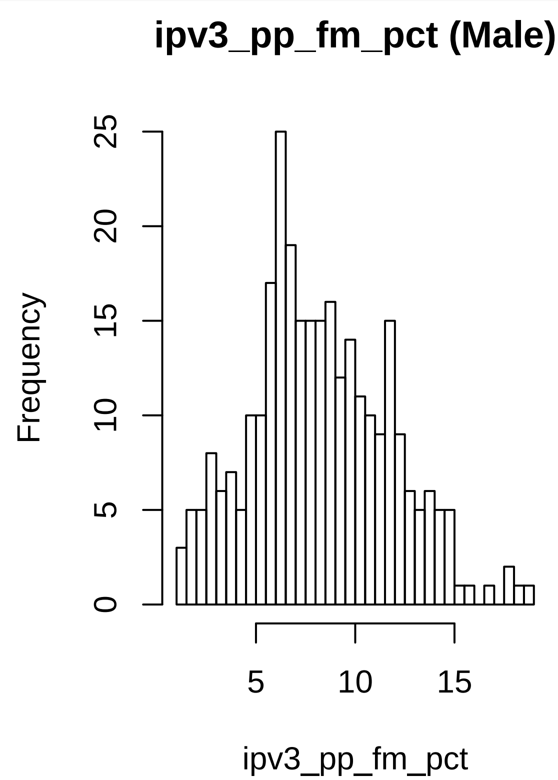
Table 9: Top10 CpGs for Leptin_actual_*ng_ml* of Male by p.value (Sample Size = 254)

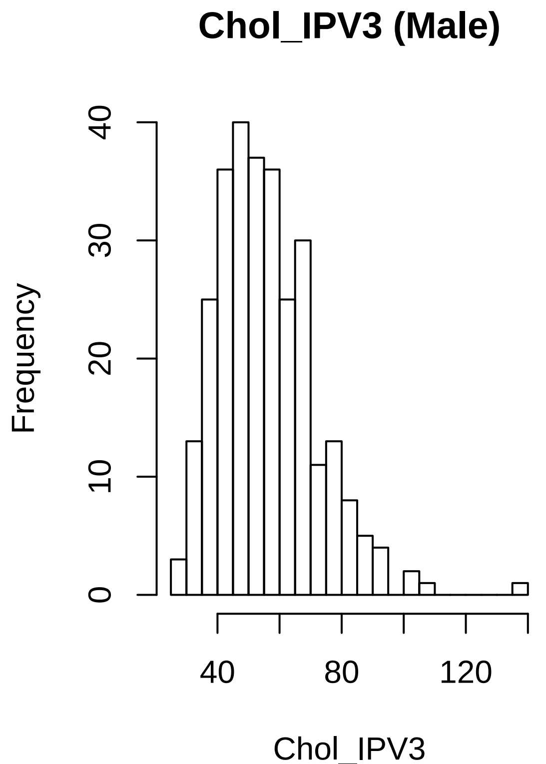
	names	Estimate	Std.Error	t.statistic	p.value	FDR
49	cg16725984	-6.6381	1.9729	-3.3647	0.0009	0.2550000
22	cg00784263	12.8922	4.0607	3.1749	0.0017	0.2550000
134	cg05906144	7.7035	2.7746	2.7765	0.0059	0.5233333

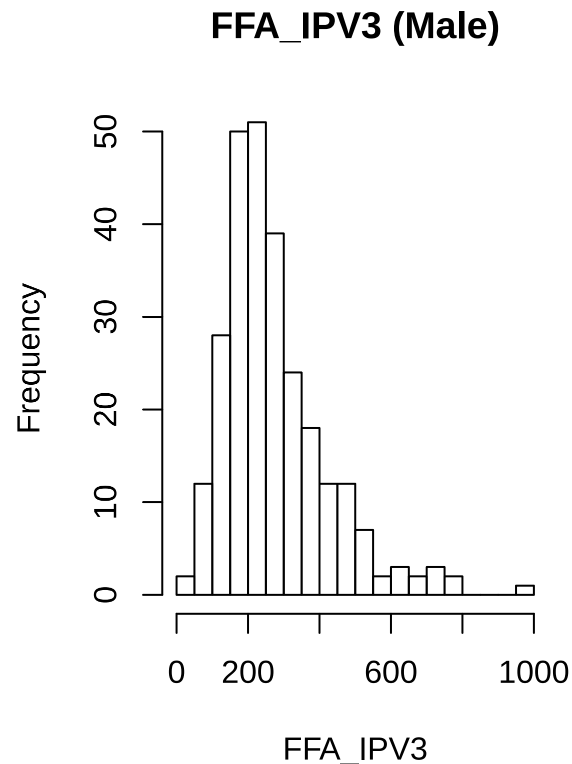
	names	Estimate	Std.Error	t.statistic	p.value	FDR
19	cg00128386	-16.7190	6.2751	-2.6643	0.0082	0.5233333
209	cg24280832	9.1099	3.5388	2.5742	0.0106	0.5233333
85	cg23572459	-15.7889	6.4071	-2.4643	0.0144	0.5233333
135	cg17171260	-10.7783	4.4176	-2.4399	0.0154	0.5233333
116	cg21183455	5.2322	2.1486	2.4351	0.0156	0.5233333
104	cg10119082	-5.3893	2.2145	-2.4336	0.0157	0.5233333
260	cg17284440	-18.5351	7.9487	-2.3319	0.0205	0.6150000
42	cg15355952	8.4318	3.9161	2.1531	0.0323	0.7961538
185	cg07716131	11.4685	5.3443	2.1459	0.0329	0.7961538
214	cg20505445	-5.4479	2.5617	-2.1267	0.0345	0.7961538
182	cg17372941	-12.3407	5.9268	-2.0822	0.0384	0.8006250
126	cg05390685	-6.8460	3.3218	-2.0609	0.0404	0.8006250

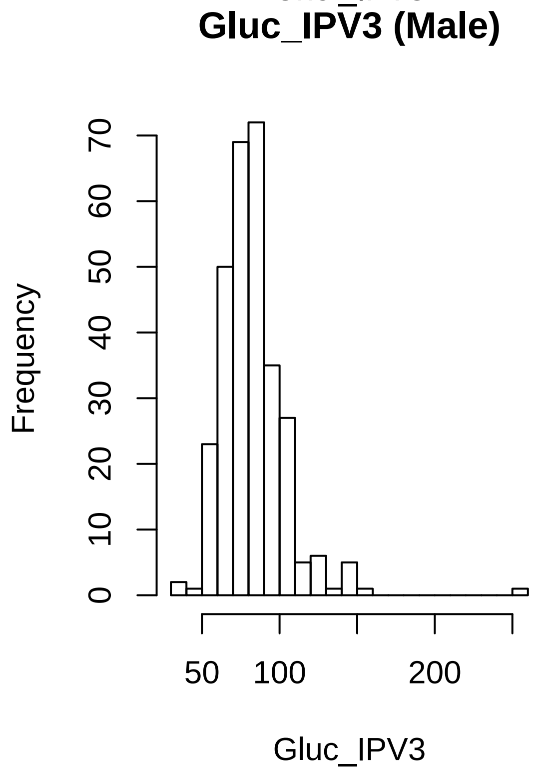
```r
## raw outcomes
par(mfrow = c(1, 2))
lapply(Outcomes, function(x) {
    hist(pfas_male[, x], freq = TRUE, breaks = 30, main = paste(x,
        " (Male)", sep = ""), xlab = x)
})
```

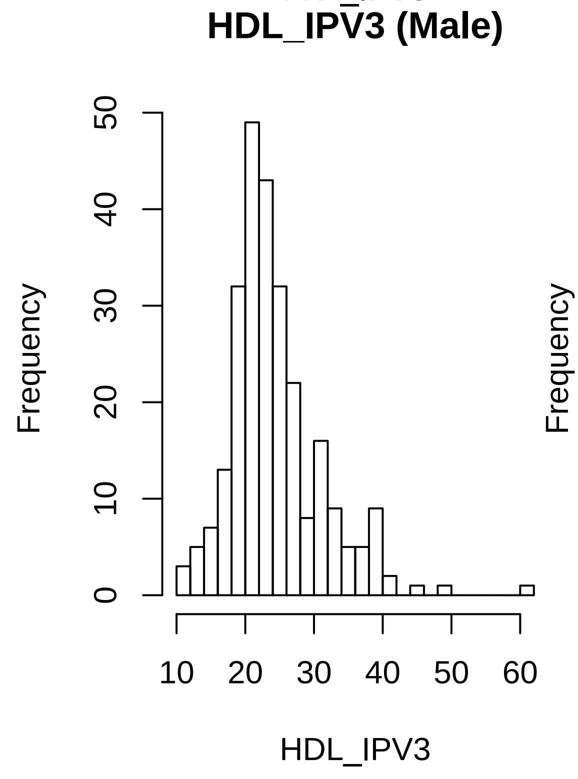


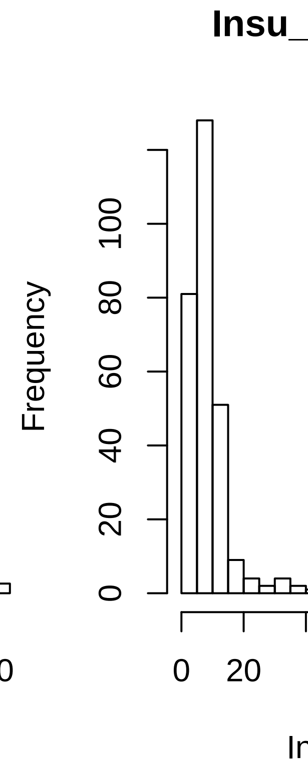












[[1]] $breaks [1] 1700 1800 1900 2000 2100 2200 2300 2400 2500 2600 2700 2800 2900 3000 [15] 3100 3200 3300 3400 3500 3600 3700 3800 3900 4000 4100 4200 4300 4400 [29] 4500 4600 4700

$counts [1] 1 0 0 0 0 1 2 3 5 10 10 20 20 23 29 28 25 18 37 20 11 12 11 [24] 8 7 4 0 0 2 1

$density [1] 3.246753e-05 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 [6] 3.246753e-05 6.493506e-05 9.740260e-05 1.623377e-04 3.246753e-04 [11] 3.246753e-04 6.493506e-04 6.493506e-04

7.467532e-04 9.415584e-04 [16] 9.090909e-04 8.116883e-04 5.844156e-04 1.201299e-03 6.493506e-04 [21] 3.571429e-04 3.896104e-04 3.571429e-04 2.597403e-04 2.272727e-04 [26] 1.298701e-04 0.000000e+00 0.000000e+00 6.493506e-05 3.246753e-05

$mids [1] 1750 1850 1950 2050 2150 2250 2350 2450 2550 2650 2750 2850 2950 3050 [15] 3150 3250 3350 3450 3550 3650 3750 3850 3950 4050 4150 4250 4350 4450 [29] 4550 4650

$xname [1] "pfas_male[, x]"

$equidist [1] TRUE

attr(,"class") [1] "histogram"

[[2]] $breaks [1] 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 [15] 8.0 8.5 9.0 9.5 10.0 10.5 11.0 11.5 12.0 12.5 13.0 13.5 14.0 14.5 [29] 15.0 15.5 16.0 16.5 17.0 17.5 18.0 18.5 19.0

$counts [1] 3 5 5 8 6 7 5 10 10 17 25 19 15 15 15 16 12 14 11 10 9 15 9 [24] 6 5 6 5 5 1 1 0 1 0 2 1 1

$density [1] 0.020338983 0.033898305 0.033898305 0.054237288 0.040677966 [6] 0.047457627 0.033898305 0.067796610 0.067796610 0.115254237 [11] 0.169491525 0.128813559 0.101694915 0.101694915 0.101694915 [16] 0.108474576 0.081355932 0.094915254 0.074576271 0.067796610 [21] 0.061016949 0.101694915 0.061016949 0.040677966 0.033898305 [26] 0.040677966 0.033898305 0.033898305 0.006779661 0.006779661 [31] 0.000000000 0.006779661 0.000000000 0.013559322 0.006779661 [36] 0.006779661

$mids [1] 1.25 1.75 2.25 2.75 3.25 3.75 4.25 4.75 5.25 5.75 6.25 [12] 6.75 7.25 7.75 8.25 8.75 9.25 9.75 10.25 10.75 11.25 11.75 [23] 12.25 12.75 13.25 13.75 14.25 14.75 15.25 15.75 16.25 16.75 17.25 [34] 17.75 18.25 18.75

$xname [1] "pfas_male[, x]"

$equidist [1] TRUE

attr(,"class") [1] "histogram"

[[3]] $breaks [1] 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 [18] 110 115 120 125 130 135 140

$counts [1] 3 13 25 36 40 37 36 25 30 11 13 8 5 4 0 2 1 0 0 0 0 0 1

$density [1] 0.0020689655 0.0089655172 0.0172413793 0.0248275862 0.0275862069 [6] 0.0255172414 0.0248275862 0.0172413793 0.0206896552 0.0075862069 [11] 0.0089655172 0.0055172414 0.0034482759 0.0027586207 0.0000000000 [16] 0.0013793103 0.0006896552 0.0000000000 0.0000000000 0.0000000000 [21] 0.0000000000 0.0000000000 0.0006896552

$mids [1] 27.5 32.5 37.5 42.5 47.5 52.5 57.5 62.5 67.5 72.5 77.5 [12] 82.5 87.5 92.5 97.5 102.5 107.5 112.5 117.5 122.5 127.5 132.5 [23] 137.5

$xname [1] "pfas_male[, x]"

$equidist [1] TRUE

attr(,"class") [1] "histogram"

[[4]] $breaks [1] 0 50 100 150 200 250 300 350 400 450 500 550 600 650 [15] 700 750 800 850 900 950 1000

$counts [1] 2 12 28 50 51 39 24 18 12 12 7 2 3 2 3 2 0 0 0 1

$density [1] 1.492537e-04 8.955224e-04 2.089552e-03 3.731343e-03 3.805970e-03 [6] 2.910448e-03 1.791045e-03 1.343284e-03 8.955224e-04 8.955224e-04 [11] 5.223881e-04 1.492537e-04 2.238806e-04 1.492537e-04 2.238806e-04 [16] 1.492537e-04 0.000000e+00 0.000000e+00 0.000000e+00 7.462687e-05

$mids [1] 25 75 125 175 225 275 325 375 425 475 525 575 625 675 725 775 825 [18] 875 925 975

$xname [1] "pfas_male[, x]"

$equidist [1] TRUE

attr(,"class") [1] "histogram"

[[5]] $breaks [1] 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 [18] 200 210 220 230 240 250 260

$counts [1] 2 1 23 50 69 72 35 27 5 6 1 5 1 0 0 0 0 0 0 0 0 0 1

$density [1] 0.0006711409 0.0003355705 0.0077181208 0.0167785235 0.0231543624 [6] 0.0241610738 0.0117449664 0.0090604027 0.0016778523 0.0020134228 [11] 0.0003355705 0.0016778523 0.0003355705 0.0000000000 0.0000000000 [16] 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 [21] 0.0000000000 0.0000000000 0.0003355705

$mids [1] 35 45 55 65 75 85 95 105 115 125 135 145 155 165 175 185 195 [18] 205 215 225 235 245 255

$xname [1] "pfas_male[, x]"

$equidist [1] TRUE

attr(,"class") [1] "histogram"

[[6]] $breaks [1] 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 [24] 56 58 60 62

$counts [1] 3 5 7 13 32 49 43 32 22 8 16 9 5 5 9 2 0 1 0 1 0 0 0 [24] 0 0 1

$density [1] 0.005703422 0.009505703 0.013307985 0.024714829 0.060836502 [6] 0.093155894 0.081749049 0.060836502 0.041825095 0.015209125 [11] 0.030418251 0.017110266 0.009505703 0.009505703 0.017110266 [16] 0.003802281 0.000000000 0.001901141 0.000000000 0.001901141 [21] 0.000000000 0.000000000 0.000000000 0.000000000 0.000000000 [26] 0.001901141

$mids [1] 11 13 15 17 19 21 23 25 27 29 31 33 35 37 39 41 43 45 47 49 51 53 55 [24] 57 59 61

$xname [1] "pfas_male[, x]"

$equidist [1] TRUE

attr(,"class") [1] "histogram"

[[7]] $breaks [1] 0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 [18] 85 90 95 100 105 110 115

$counts [1] 81 128 51 9 4 2 4 2 1 1 1 0 0 0 0 0 0 [18] 0 0 0 0 0 1

$density [1] 0.0568421053 0.0898245614 0.0357894737 0.0063157895 0.0028070175 [6] 0.0014035088 0.0028070175 0.0014035088 0.0007017544 0.0007017544 [11] 0.0007017544 0.0000000000 0.0000000000 0.0000000000 0.0000000000 [16] 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 [21] 0.0000000000 0.0000000000 0.0007017544

$mids [1] 2.5 7.5 12.5 17.5 22.5 27.5 32.5 37.5 42.5 47.5 52.5 [12] 57.5 62.5 67.5 72.5 77.5 82.5 87.5 92.5 97.5 102.5 107.5 [23] 112.5

$xname [1] "pfas_male[, x]"

$equidist [1] TRUE

attr(,"class") [1] "histogram"

[[8]] $breaks [1] 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300 320 [18] 340 360 380 400 420 440 460 480 500 520 540 560 580 600 620 640 660

$counts [1] 19 139 75 26 15 9 3 0 0 0 0 0 0 0 0 0 0 [18] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1

$density [1] 0.0033101045 0.0242160279 0.0130662021 0.0045296167 0.0026132404 [6] 0.0015679443 0.0005226481 0.0000000000 0.0000000000 0.0000000000 [11] 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 [16] 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 [21] 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 [26] 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 [31] 0.0000000000 0.0000000000 0.0001742160

$mids [1] 10 30 50 70 90 110 130 150 170 190 210 230 250 270 290 310 330 [18] 350 370 390 410 430 450 470 490 510 530 550 570 590 610 630 650

$xname [1] "pfas_male[, x]"

$equidist [1] TRUE

attr(,"class") [1] "histogram"

[[9]] $breaks [1] 0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 [18] 85 90 95 100 105 110 115 120 125 130

$counts [1] 60 81 38 21 18 16 10 4 1 3 0 1 0 0 0 0 0 0 0 0 0 0 0 [24] 0 0 1

$density [1] 0.0472440945 0.0637795276 0.0299212598 0.0165354331 0.0141732283 [6] 0.0125984252 0.0078740157 0.0031496063 0.0007874016 0.0023622047 [11] 0.0000000000 0.0007874016 0.0000000000 0.0000000000 0.0000000000 [16] 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 [21] 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 [26] 0.0007874016

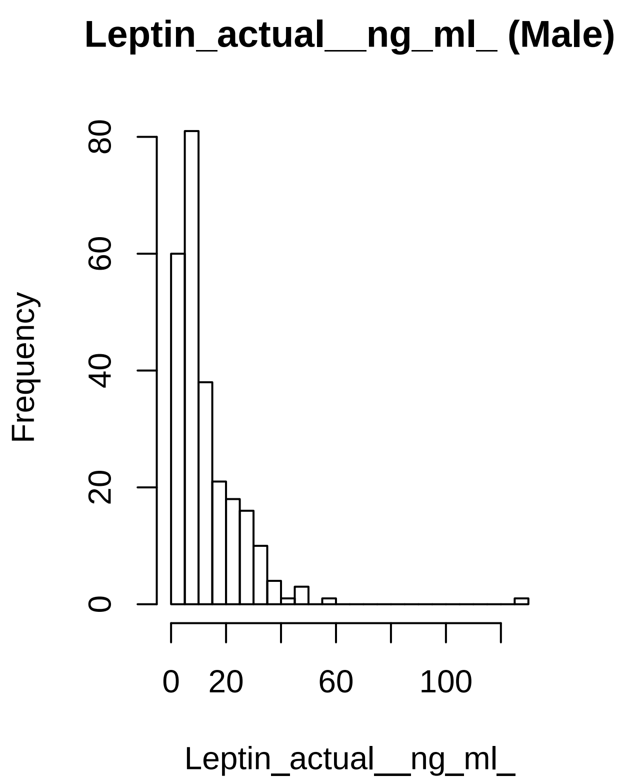
$mids [1] 2.5 7.5 12.5 17.5 22.5 27.5 32.5 37.5 42.5 47.5 52.5 [12] 57.5 62.5 67.5 72.5 77.5 82.5 87.5 92.5 97.5 102.5 107.5 [23] 112.5 117.5 122.5 127.5

$xname [1] "pfas_male[, x]"

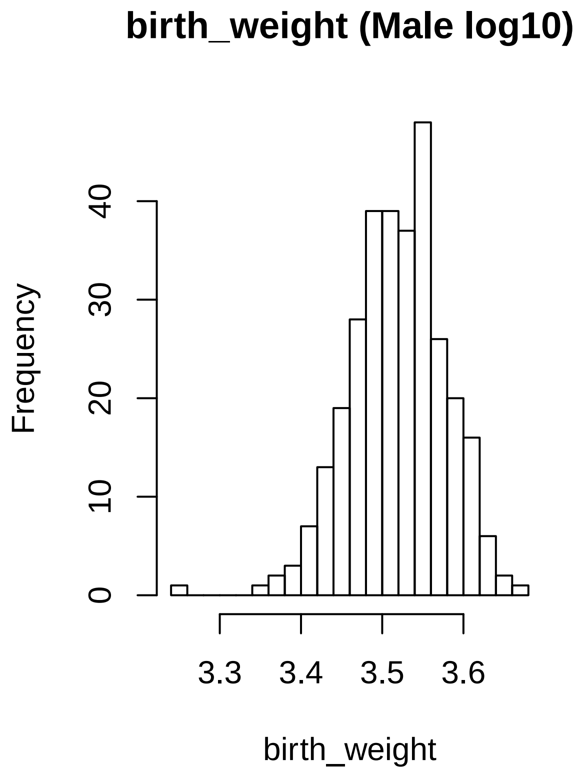
$equidist [1] TRUE

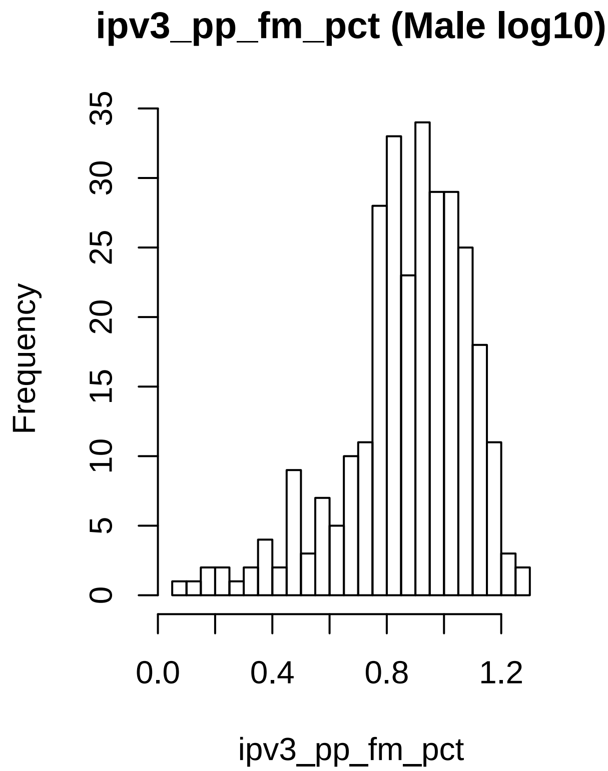
attr(,"class") [1] "histogram"

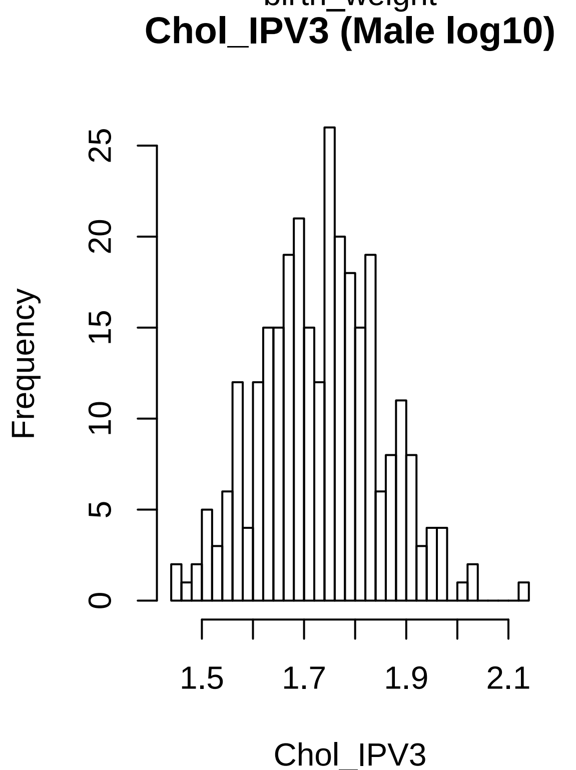
```r
## log10
par(mfrow = c(1, 2))
```

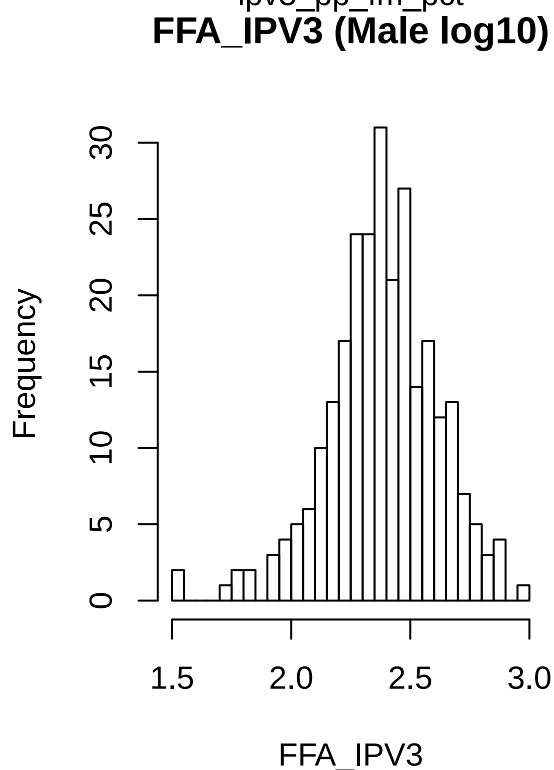


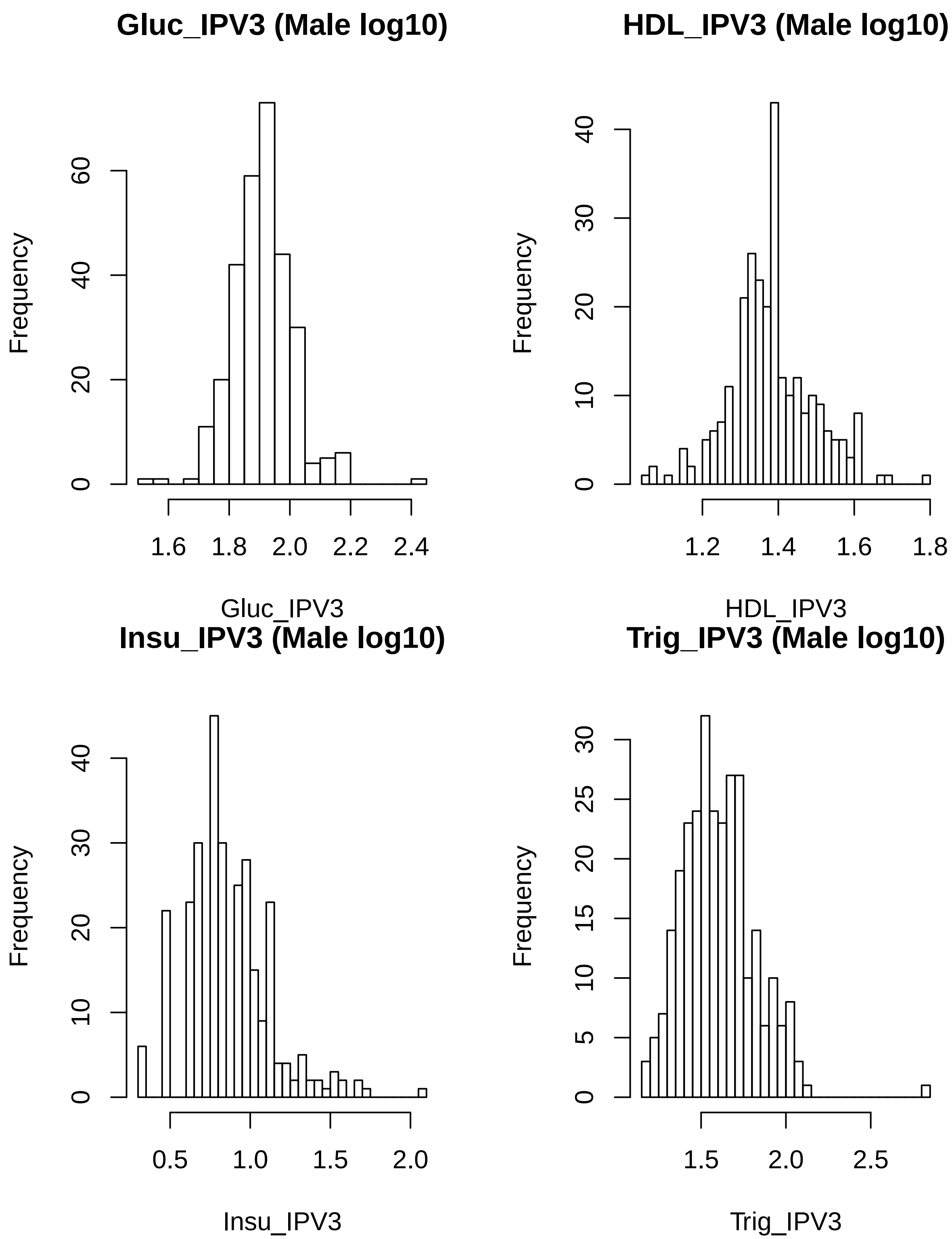

```r
lapply(Outcomes, function(x) {
    hist(log10(pfas_male[, x]), freq = TRUE, breaks = 30, main = paste(x,
        " (Male log10)", sep = ""), xlab = x)
})
```


birth_weight (Male log10)
Frequency
0
10
20
30
40
3.3
3.4
3.5
3.6
birth_weight


ipv3_pp_fm_pct (Male log10)
Frequency
0
5
10
15
20
25
30
35
0.0
0.4
0.8
1.2
ipv3_pp_fm_pct


Chol_IPV3 (Male log10)
Frequency
0
5
10
15
20
25
1.5
1.7
1.9
2.1
Chol_IPV3


FFA_IPV3 (Male log10)
Frequency
0
5
10
15
20
25
30
1.5
2.0
2.5
3.0
FFA_IPV3



[[1]]

$breaks [1] 3.24 3.26 3.28 3.30 3.32 3.34 3.36 3.38 3.40 3.42 3.44 3.46 3.48 3.50 [15] 3.52 3.54 3.56 3.58 3.60 3.62 3.64 3.66 3.68

$counts [1] 1 0 0 0 0 1 2 3 7 13 19 28 39 39 37 48 26 20 16 6 2 1

$density [1] 0.1623377 0.0000000 0.0000000 0.0000000 0.0000000 0.1623377 0.3246753 [8] 0.4870130 1.1363636 2.1103896 3.0844156 4.5454545 6.3311688 6.3311688 [15] 6.0064935 7.7922078 4.2207792 3.2467532 2.5974026

0.9740260 0.3246753 [22] 0.1623377

$mids [1] 3.25 3.27 3.29 3.31 3.33 3.35 3.37 3.39 3.41 3.43 3.45 3.47 3.49 3.51 [15] 3.53 3.55 3.57 3.59 3.61 3.63 3.65 3.67

$xname [1] "log10(pfas_male[, x])"

$equidist [1] TRUE

attr(,"class") [1] "histogram"

[[2]] $breaks [1] 0.05 0.10 0.15 0.20 0.25 0.30 0.35 0.40 0.45 0.50 0.55 0.60 0.65 0.70 [15] 0.75 0.80 0.85 0.90 0.95 1.00 1.05 1.10 1.15 1.20 1.25 1.30

$counts [1] 1 1 2 2 1 2 4 2 9 3 7 5 10 11 28 33 23 34 29 29 25 18 11 [24] 3 2

$density [1] 0.06779661 0.06779661 0.13559322 0.13559322 0.06779661 0.13559322 [7] 0.27118644 0.13559322 0.61016949 0.20338983 0.47457627 0.33898305 [13] 0.67796610 0.74576271 1.89830508 2.23728814 1.55932203 2.30508475 [19] 1.96610169 1.96610169 1.69491525 1.22033898 0.74576271 0.20338983 [25] 0.13559322

$mids [1] 0.075 0.125 0.175 0.225 0.275 0.325 0.375 0.425 0.475 0.525 0.575 [12] 0.625 0.675 0.725 0.775 0.825 0.875 0.925 0.975 1.025 1.075 1.125 [23] 1.175 1.225 1.275

$xname [1] "log10(pfas_male[, x])"

$equidist [1] TRUE

attr(,"class") [1] "histogram"

[[3]] $breaks [1] 1.44 1.46 1.48 1.50 1.52 1.54 1.56 1.58 1.60 1.62 1.64 1.66 1.68 1.70 [15] 1.72 1.74 1.76 1.78 1.80 1.82 1.84 1.86 1.88 1.90 1.92 1.94 1.96 1.98 [29] 2.00 2.02 2.04 2.06 2.08 2.10 2.12 2.14

$counts [1] 2 1 2 5 3 6 12 4 12 15 15 19 21 15 12 26 20 18 15 19 6 8 11 [24] 8 3 4 4 0 1 2 0 0 0 0 1

$density [1] 0.3448276 0.1724138 0.3448276 0.8620690 0.5172414 1.0344828 2.0689655 [8] 0.6896552 2.0689655 2.5862069 2.5862069 3.2758621 3.6206897 2.5862069 [15] 2.0689655 4.4827586 3.4482759 3.1034483 2.5862069 3.2758621 1.0344828 [22] 1.3793103 1.8965517 1.3793103 0.5172414 0.6896552 0.6896552 0.0000000 [29] 0.1724138 0.3448276 0.0000000 0.0000000 0.0000000 0.0000000 0.1724138

$mids [1] 1.45 1.47 1.49 1.51 1.53 1.55 1.57 1.59 1.61 1.63 1.65 1.67 1.69 1.71 [15] 1.73 1.75 1.77 1.79 1.81 1.83 1.85 1.87 1.89 1.91 1.93 1.95 1.97 1.99 [29] 2.01 2.03 2.05 2.07 2.09 2.11 2.13

$xname [1] "log10(pfas_male[, x])"

$equidist [1] TRUE

attr(,"class") [1] "histogram"

[[4]] $breaks [1] 1.50 1.55 1.60 1.65 1.70 1.75 1.80 1.85 1.90 1.95 2.00 2.05 2.10 2.15 [15] 2.20 2.25 2.30 2.35 2.40 2.45 2.50 2.55 2.60 2.65 2.70 2.75 2.80 2.85 [29] 2.90 2.95 3.00

$counts [1] 2 0 0 0 1 2 2 0 3 4 5 6 10 13 17 24 24 31 21 27 14 17 12 [24] 13 7 5 3 4 0 1

$density [1] 0.14925373 0.00000000 0.00000000 0.00000000 0.07462687 0.14925373 [7] 0.14925373 0.00000000 0.22388060 0.29850746 0.37313433 0.44776119 [13] 0.74626866 0.97014925 1.26865672 1.79104478 1.79104478 2.31343284 [19] 1.56716418 2.01492537 1.04477612 1.26865672 0.89552239 0.97014925 [25] 0.52238806 0.37313433 0.22388060 0.29850746 0.00000000 0.07462687

$mids [1] 1.525 1.575 1.625 1.675 1.725 1.775 1.825 1.875 1.925 1.975 2.025 [12] 2.075 2.125 2.175 2.225 2.275 2.325 2.375 2.425 2.475 2.525 2.575 [23] 2.625 2.675 2.725 2.775 2.825 2.875 2.925 2.975

$xname [1] "log10(pfas_male[, x])"

$equidist [1] TRUE

attr(,"class") [1] "histogram"

[[5]] $breaks [1] 1.50 1.55 1.60 1.65 1.70 1.75 1.80 1.85 1.90 1.95 2.00 2.05 2.10 2.15 [15] 2.20 2.25 2.30 2.35 2.40 2.45

$counts [1] 1 1 0 1 11 20 42 59 73 44 30 4 5 6 0 0 0 0 1

$density [1] 0.06711409 0.06711409 0.00000000 0.06711409 0.73825503 1.34228188 [7] 2.81879195 3.95973154 4.89932886 2.95302013 2.01342282 0.26845638 [13] 0.33557047 0.40268456 0.00000000 0.00000000 0.00000000 0.00000000 [19] 0.06711409

$mids [1] 1.525 1.575 1.625 1.675 1.725 1.775 1.825 1.875 1.925 1.975 2.025 [12] 2.075 2.125 2.175 2.225 2.275 2.325 2.375 2.425

$xname [1] "log10(pfas_male[, x])"

$equidist [1] TRUE

attr(,"class") [1] "histogram"

[[6]] $breaks [1] 1.04 1.06 1.08 1.10 1.12 1.14 1.16 1.18 1.20 1.22 1.24 1.26 1.28 1.30 [15] 1.32 1.34 1.36 1.38 1.40 1.42 1.44 1.46 1.48 1.50 1.52 1.54 1.56 1.58 [29] 1.60 1.62 1.64 1.66 1.68 1.70 1.72 1.74 1.76 1.78 1.80

$counts [1] 1 2 0 1 0 4 2 0 5 6 7 11 0 21 26 23 20 43 12 10 12 8 10 [24] 9 6 5 5 3 8 0 0 1 1 0 0 0 0 1

$density [1] 0.1901141 0.3802281 0.0000000 0.1901141 0.0000000 0.7604563 0.3802281 [8] 0.0000000 0.9505703 1.1406844 1.3307985 2.0912548 0.0000000 3.9923954 [15] 4.9429658 4.3726236 3.8022814 8.1749049 2.2813688 1.9011407 2.2813688 [22] 1.5209125 1.9011407 1.7110266 1.1406844 0.9505703 0.9505703 0.5703422 [29] 1.5209125 0.0000000 0.0000000 0.1901141 0.1901141 0.0000000 0.0000000 [36] 0.0000000 0.0000000 0.1901141

$mids [1] 1.05 1.07 1.09 1.11 1.13 1.15 1.17 1.19 1.21 1.23 1.25 1.27 1.29 1.31 [15] 1.33 1.35 1.37 1.39 1.41 1.43 1.45 1.47 1.49 1.51 1.53 1.55 1.57 1.59 [29] 1.61 1.63 1.65 1.67 1.69 1.71 1.73 1.75 1.77 1.79

$xname [1] "log10(pfas_male[, x])"

$equidist [1] TRUE

attr(,"class") [1] "histogram"

[[7]] $breaks [1] 0.30 0.35 0.40 0.45 0.50 0.55 0.60 0.65 0.70 0.75 0.80 0.85 0.90 0.95 [15] 1.00 1.05 1.10 1.15 1.20 1.25 1.30 1.35 1.40 1.45 1.50 1.55 1.60 1.65 [29] 1.70 1.75 1.80 1.85 1.90 1.95 2.00 2.05 2.10

$counts [1] 6 0 0 22 0 0 23 30 0 45 30 0 25 28 15 9 23 4 4 2 5 2 2 [24] 1 3 2 0 2 1 0 0 0 0 0 0 1

$density [1] 0.42105263 0.00000000 0.00000000 1.54385965 0.00000000 0.00000000 [7] 1.61403509 2.10526316 0.00000000 3.15789474 2.10526316 0.00000000 [13] 1.75438596 1.96491228 1.05263158 0.63157895 1.61403509 0.28070175 [19] 0.28070175 0.14035088 0.35087719 0.14035088 0.14035088 0.07017544 [25] 0.21052632 0.14035088 0.00000000 0.14035088 0.07017544 0.00000000 [31] 0.00000000 0.00000000 0.00000000 0.00000000 0.00000000 0.07017544

$mids [1] 0.325 0.375 0.425 0.475 0.525 0.575 0.625 0.675 0.725 0.775 0.825 [12] 0.875 0.925 0.975 1.025 1.075 1.125 1.175 1.225 1.275 1.325 1.375 [23] 1.425 1.475 1.525 1.575 1.625 1.675 1.725 1.775 1.825 1.875 1.925 [34] 1.975 2.025 2.075

$xname [1] "log10(pfas_male[, x])"

$equidist [1] TRUE

attr(,"class") [1] "histogram"

[[8]] $breaks [1] 1.15 1.20 1.25 1.30 1.35 1.40 1.45 1.50 1.55 1.60 1.65 1.70 1.75 1.80 [15] 1.85 1.90 1.95 2.00 2.05 2.10 2.15 2.20 2.25 2.30 2.35 2.40 2.45 2.50 [29] 2.55 2.60 2.65 2.70 2.75 2.80 2.85

$counts [1] 3 5 7 14 19 23 24 32 24 23 27 27 10 14 6 10 6 8 3 1 0 0 0 [24] 0 0 0 0 0 0 0 0 0 0 0 1

$density [1] 0.20905923 0.34843206 0.48780488 0.97560976 1.32404181 1.60278746 [7] 1.67247387 2.22996516 1.67247387 1.60278746 1.88153310 1.88153310 [13] 0.69686411 0.97560976 0.41811847 0.69686411 0.41811847

0.55749129 [19] 0.20905923 0.06968641 0.00000000 0.00000000 0.00000000 0.00000000 [25] 0.00000000 0.00000000 0.00000000 0.00000000 0.00000000 0.00000000 [31] 0.00000000 0.00000000 0.00000000 0.06968641

$mids [1] 1.175 1.225 1.275 1.325 1.375 1.425 1.475 1.525 1.575 1.625 1.675 [12] 1.725 1.775 1.825 1.875 1.925 1.975 2.025 2.075 2.125 2.175 2.225 [23] 2.275 2.325 2.375 2.425 2.475 2.525 2.575 2.625 2.675 2.725 2.775 [34] 2.825

$xname [1] "log10(pfas_male[, x])"

$equidist [1] TRUE

attr(,"class") [1] "histogram"

[[9]] $breaks [1] -0.5 -0.4 -0.3 -0.2 -0.1 0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 [15] 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0 2.1 2.2

$counts [1] 1 0 0 2 2 3 2 4 8 10 13 16 28 20 32 25 18 16 18 19 10 5 1 [24] 0 0 0 1

$density [1] 0.03937008 0.00000000 0.00000000 0.07874016 0.07874016 0.11811024 [7] 0.07874016 0.15748031 0.31496063 0.39370079 0.51181102 0.62992126 [13] 1.10236220 0.78740157 1.25984252 0.98425197 0.70866142 0.62992126 [19] 0.70866142 0.74803150 0.39370079 0.19685039 0.03937008 0.00000000 [25] 0.00000000 0.00000000 0.03937008

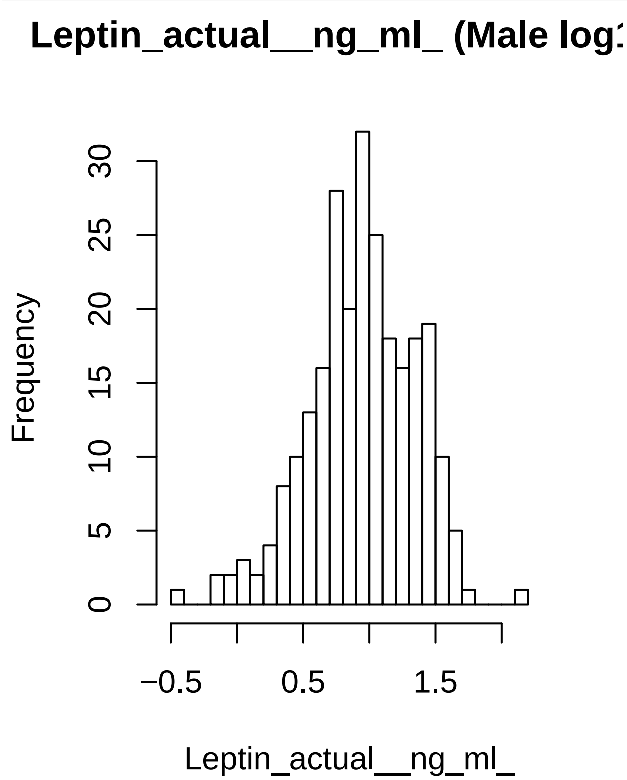
$mids [1] -0.45 -0.35 -0.25 -0.15 -0.05 0.05 0.15 0.25 0.35 0.45 0.55 [12] 0.65 0.75 0.85 0.95 1.05 1.15 1.25 1.35 1.45 1.55 1.65 [23] 1.75 1.85 1.95 2.05 2.15

$xname [1] "log10(pfas_male[, x])"

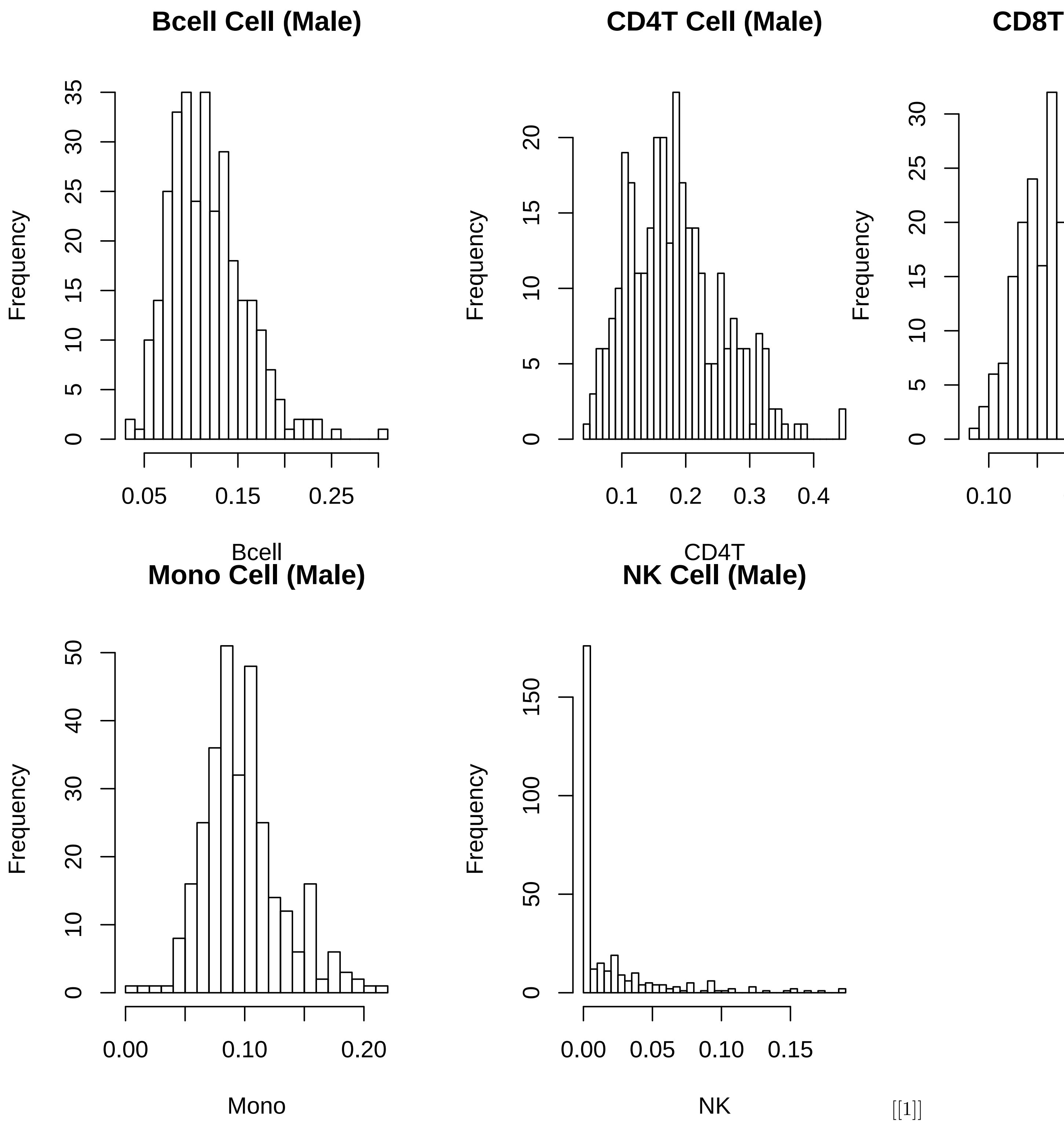
$equidist [1] TRUE

attr(,"class") [1] "histogram"

```r
## check the distribution of cell types
cellnames <- colnames(pfas_male[, 14:20])
par(mfrow = c(1, 2))
```



```r
lapply(cellnames, function(x) {
    hist(pfas_male[, x], freq = TRUE, breaks = 30, main = paste(x,
        " Cell (Male)", sep = ""), xlab = x)
})
```



[[1]]

$breaks [1] 0.03 0.04 0.05 0.06 0.07 0.08 0.09 0.10 0.11 0.12 0.13 0.14 0.15 0.16 [15] 0.17 0.18 0.19 0.20 0.21

0.22 0.23 0.24 0.25 0.26 0.27 0.28 0.29 0.30 [29] 0.31

$counts [1] 2 1 10 14 25 33 35 24 35 23 29 18 14 14 11 7 4 1 2 2 2 0 1 [24] 0 0 0 0 1

$density [1] 0.6493506 0.3246753 3.2467532 4.5454545 8.1168831 10.7142857 [7] 11.3636364 7.7922078 11.3636364 7.4675325 9.4155844 5.8441558 [13] 4.5454545 4.5454545 3.5714286 2.2727273 1.2987013 0.3246753 [19] 0.6493506 0.6493506 0.6493506 0.0000000 0.3246753 0.0000000 [25] 0.0000000 0.0000000 0.0000000 0.3246753

$mids [1] 0.035 0.045 0.055 0.065 0.075 0.085 0.095 0.105 0.115 0.125 0.135 [12] 0.145 0.155 0.165 0.175 0.185 0.195 0.205 0.215 0.225 0.235 0.245 [23] 0.255 0.265 0.275 0.285 0.295 0.305

$xname [1] "pfas_male[, x]"

$equidist [1] TRUE

attr(,"class") [1] "histogram"

[[2]] $breaks [1] 0.04 0.05 0.06 0.07 0.08 0.09 0.10 0.11 0.12 0.13 0.14 0.15 0.16 0.17 [15] 0.18 0.19 0.20 0.21 0.22 0.23 0.24 0.25 0.26 0.27 0.28 0.29 0.30 0.31 [29] 0.32 0.33 0.34 0.35 0.36 0.37 0.38 0.39 0.40 0.41 0.42 0.43 0.44 0.45

$counts [1] 1 3 6 6 8 10 19 17 11 11 14 20 20 13 23 17 14 14 11 5 5 11 6 [24] 8 6 6 1 7 6 2 2 1 0 1 1 0 0 0 0 0 2

$density [1] 0.3246753 0.9740260 1.9480519 1.9480519 2.5974026 3.2467532 6.1688312 [8] 5.5194805 3.5714286 3.5714286 4.5454545 6.4935065 6.4935065 4.2207792 [15] 7.4675325 5.5194805 4.5454545 4.5454545 3.5714286 1.6233766 1.6233766 [22] 3.5714286 1.9480519 2.5974026 1.9480519 1.9480519 0.3246753 2.2727273 [29] 1.9480519 0.6493506 0.6493506 0.3246753 0.0000000 0.3246753 0.3246753 [36] 0.0000000 0.0000000 0.0000000 0.0000000 0.0000000 0.6493506

$mids [1] 0.045 0.055 0.065 0.075 0.085 0.095 0.105 0.115 0.125 0.135 0.145 [12] 0.155 0.165 0.175 0.185 0.195 0.205 0.215 0.225 0.235 0.245 0.255 [23] 0.265 0.275 0.285 0.295 0.305 0.315 0.325 0.335 0.345 0.355 0.365 [34] 0.375 0.385 0.395 0.405 0.415 0.425 0.435 0.445

$xname [1] "pfas_male[, x]"

$equidist [1] TRUE

attr(,"class") [1] "histogram"

[[3]] $breaks [1] 0.08 0.09 0.10 0.11 0.12 0.13 0.14 0.15 0.16 0.17 0.18 0.19 0.20 0.21 [15] 0.22 0.23 0.24 0.25 0.26 0.27 0.28 0.29 0.30 0.31 0.32 0.33 0.34 0.35

$counts [1] 1 3 6 7 15 20 24 16 32 20 20 17 16 20 15 11 12 12 8 7 8 3 6 [24] 2 4 2 1

$density [1] 0.3246753 0.9740260 1.9480519 2.2727273 4.8701299 6.4935065 [7] 7.7922078 5.1948052 10.3896104 6.4935065 6.4935065 5.5194805 [13] 5.1948052 6.4935065 4.8701299 3.5714286 3.8961039 3.8961039 [19] 2.5974026 2.2727273 2.5974026 0.9740260 1.9480519 0.6493506 [25] 1.2987013 0.6493506 0.3246753

$mids [1] 0.085 0.095 0.105 0.115 0.125 0.135 0.145 0.155 0.165 0.175 0.185 [12] 0.195 0.205 0.215 0.225 0.235 0.245 0.255 0.265 0.275 0.285 0.295 [23] 0.305 0.315 0.325 0.335 0.345

$xname [1] "pfas_male[, x]"

$equidist [1] TRUE

attr(,"class") [1] "histogram"

[[4]] $breaks [1] 0.00 0.02 0.04 0.06 0.08 0.10 0.12 0.14 0.16 0.18 0.20 0.22 0.24 0.26 [15] 0.28 0.30 0.32 0.34 0.36 0.38 0.40 0.42 0.44 0.46 0.48 0.50 0.52 0.54 [29] 0.56 0.58 0.60 0.62 0.64 0.66 0.68

$counts [1] 1 2 1 3 0 7 11 15 14 18 6 12 13 21 14 18 15 12 21 16 14 23 10 [24] 6 8 4 5 5 6 2 3 1 0 1

$density [1] 0.1623377 0.3246753 0.1623377 0.4870130 0.0000000 1.1363636 1.7857143 [8] 2.4350649 2.2727273 2.9220779 0.9740260 1.9480519 2.1103896 3.4090909 [15] 2.2727273 2.9220779 2.4350649 1.9480519 3.4090909

2.5974026 2.2727273 [22] 3.7337662 1.6233766 0.9740260 1.2987013 0.6493506 0.8116883 0.8116883 [29] 0.9740260 0.3246753 0.4870130 0.1623377 0.0000000 0.1623377

$mids [1] 0.01 0.03 0.05 0.07 0.09 0.11 0.13 0.15 0.17 0.19 0.21 0.23 0.25 0.27 [15] 0.29 0.31 0.33 0.35 0.37 0.39 0.41 0.43 0.45 0.47 0.49 0.51 0.53 0.55 [29] 0.57 0.59 0.61 0.63 0.65 0.67

$xname [1] "pfas_male[, x]"

$equidist [1] TRUE

attr(,"class") [1] "histogram"

[[5]] $breaks [1] 0.00 0.01 0.02 0.03 0.04 0.05 0.06 0.07 0.08 0.09 0.10 0.11 0.12 0.13 [15] 0.14 0.15 0.16 0.17 0.18 0.19 0.20 0.21 0.22

$counts [1] 1 1 1 1 8 16 25 36 51 32 48 25 14 12 6 16 2 6 3 2 1 1

$density [1] 0.3246753 0.3246753 0.3246753 0.3246753 2.5974026 5.1948052 [7] 8.1168831 11.6883117 16.5584416 10.3896104 15.5844156 8.1168831 [13] 4.5454545 3.8961039 1.9480519 5.1948052 0.6493506 1.9480519 [19] 0.9740260 0.6493506 0.3246753 0.3246753

$mids [1] 0.005 0.015 0.025 0.035 0.045 0.055 0.065 0.075 0.085 0.095 0.105 [12] 0.115 0.125 0.135 0.145 0.155 0.165 0.175 0.185 0.195 0.205 0.215

$xname [1] "pfas_male[, x]"

$equidist [1] TRUE

attr(,"class") [1] "histogram"

[[6]] $breaks [1] 0.000 0.005 0.010 0.015 0.020 0.025 0.030 0.035 0.040 0.045 0.050 [12] 0.055 0.060 0.065 0.070 0.075 0.080 0.085 0.090 0.095 0.100 0.105 [23] 0.110 0.115 0.120 0.125 0.130 0.135 0.140 0.145 0.150 0.155 0.160 [34] 0.165 0.170 0.175 0.180 0.185 0.190

$counts [1] 176 12 15 11 19 9 6 10 4 5 4 4 2 3 1 5 0 [18] 1 6 1 1 2 0 0 3 0 1 0 0 1 2 0 1 0 [35] 1 0 0 2

$density [1] 114.2857143 7.7922078 9.7402597 7.1428571 12.3376623 [6] 5.8441558 3.8961039 6.4935065 2.5974026 3.2467532 [11] 2.5974026 2.5974026 1.2987013 1.9480519 0.6493506 [16] 3.2467532 0.0000000 0.6493506 3.8961039 0.6493506 [21] 0.6493506 1.2987013 0.0000000 0.0000000 1.9480519 [26] 0.0000000 0.6493506 0.0000000 0.0000000 0.6493506 [31] 1.2987013 0.0000000 0.6493506 0.0000000 0.6493506 [36] 0.0000000 0.0000000 1.2987013

$mids [1] 0.0025 0.0075 0.0125 0.0175 0.0225 0.0275 0.0325 0.0375 0.0425 0.0475 [11] 0.0525 0.0575 0.0625 0.0675 0.0725 0.0775 0.0825 0.0875 0.0925 0.0975 [21] 0.1025 0.1075 0.1125 0.1175 0.1225 0.1275 0.1325 0.1375 0.1425 0.1475 [31] 0.1525 0.1575 0.1625 0.1675 0.1725 0.1775 0.1825 0.1875

$xname [1] "pfas_male[, x]"

$equidist [1] TRUE

attr(,"class") [1] "histogram"

[[7]] $breaks [1] 0.02 0.04 0.06 0.08 0.10 0.12 0.14 0.16 0.18 0.20 0.22 0.24 0.26 0.28 [15] 0.30 0.32 0.34 0.36 0.38 0.40 0.42 0.44 0.46

$counts [1] 10 64 70 46 25 18 11 21 9 14 5 2 4 2 1 4 0 1 0 0 0 1

$density [1] 1.6233766 10.3896104 11.3636364 7.4675325 4.0584416 2.9220779 [7] 1.7857143 3.4090909 1.4610390 2.2727273 0.8116883 0.3246753 [13] 0.6493506 0.3246753 0.1623377 0.6493506 0.0000000 0.1623377 [19] 0.0000000 0.0000000 0.0000000 0.1623377

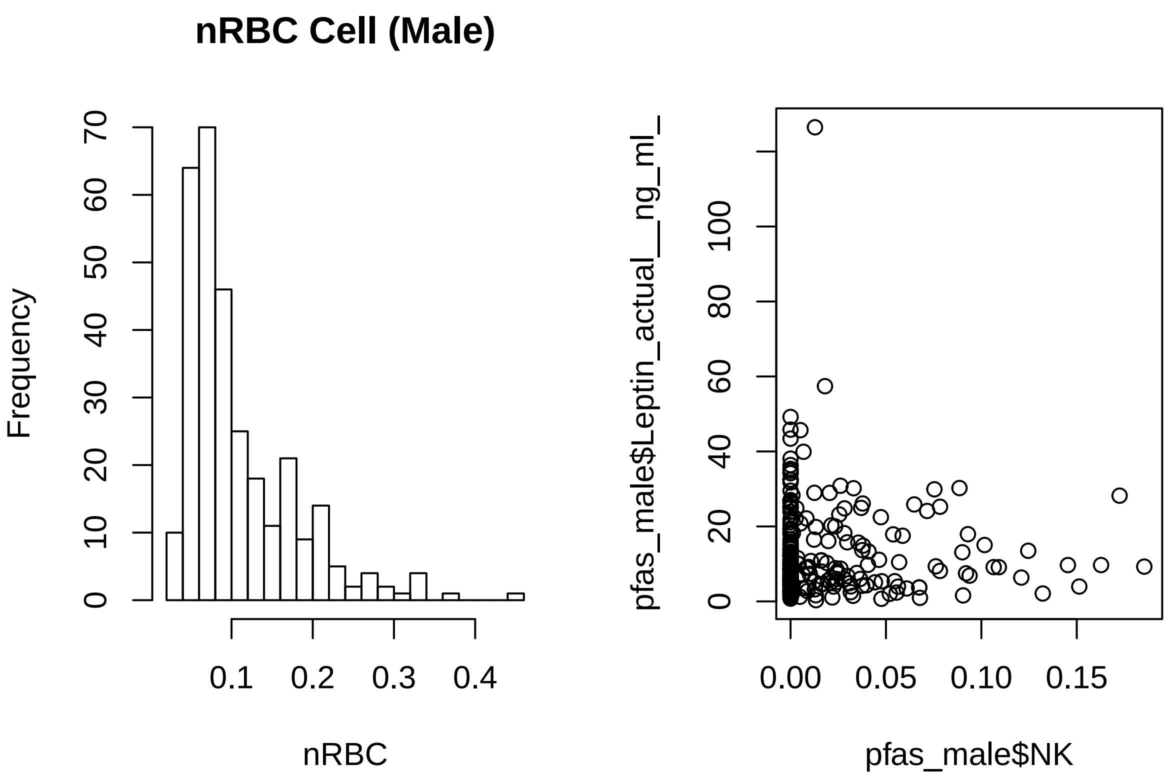
$mids [1] 0.03 0.05 0.07 0.09 0.11 0.13 0.15 0.17 0.19 0.21 0.23 0.25 0.27 0.29 [15] 0.31 0.33 0.35 0.37 0.39 0.41 0.43 0.45

$xname [1] "pfas_male[, x]"

$equidist [1] TRUE

attr(,“class”) [1] “histogram”

```
## check the NK vs outcome, whether there is a dichotomous
## pattern
plot(pfas_male$NK, pfas_male$Leptin_actual__ng_ml_)
```




```
paste("It seems like the slope of this outcome vs NK is 0")
```

[1] “It seems like the slope of this outcome vs NK is 0”

```
## Based on histograms
paste(Outcomes[-c(1, 2)], " should be log10 transformed. ", sep = "")
```

[1] “Chol_IPV3 should be log10 transformed.”
[2] “FFA_IPV3 should be log10 transformed.”
[3] “Gluc_IPV3 should be log10 transformed.”
[4] “HDL_IPV3 should be log10 transformed.”
[5] “Insu_IPV3 should be log10 transformed.”
[6] “Trig_IPV3 should be log10 transformed.”
[7] “Leptin_actual_*ng_ml* should be log10 transformed.”

```
## # the regression summary table for log10 outcomes
lapply(Outcomes[3:9], function(x) {
    cpg_reg(log10(pfas_male[, x]), pfas_male, x, 15, "Male log10")
})
```

[[1]]

Table 10: Top10 CpGs for Chol_IPV3 of Male log10 by p.value (Sample Size = 290)

	names	Estimate	Std.Error	t.statistic	p.value	FDR
254	cg22692511	0.0521	0.0174	2.9882	0.0031	0.5880000
271	cg08162803	0.1084	0.0391	2.7697	0.0060	0.5880000
95	cg17850055	-0.2039	0.0740	-2.7537	0.0063	0.5880000
112	cg24366087	-0.0930	0.0353	-2.6337	0.0089	0.5880000
266	cg12857407	0.0803	0.0309	2.6013	0.0098	0.5880000
69	cg04168590	0.1649	0.0678	2.4322	0.0156	0.7328571
170	cg19554564	-0.1028	0.0429	-2.3986	0.0171	0.7328571
28	cg12872489	-0.0494	0.0224	-2.2082	0.0280	0.9450593
49	cg16725984	0.0380	0.0174	2.1774	0.0303	0.9450593
188	cg17500055	-0.0548	0.0260	-2.1106	0.0357	0.9450593
279	cg17132124	0.0543	0.0269	2.0178	0.0446	0.9450593
211	cg00893875	0.0228	0.0115	1.9871	0.0479	0.9450593
183	cg07105947	-0.0320	0.0162	-1.9805	0.0486	0.9450593
278	cg15565231	0.0986	0.0506	1.9495	0.0522	0.9450593
58	cg09887862	0.0324	0.0168	1.9312	0.0545	0.9450593

[[2]]

Table 11: Top10 CpGs for FFA_IPV3 of Male log10 by p.value (Sample Size = 268)

	names	Estimate	Std.Error	t.statistic	p.value	FDR
96	cg21215576	0.1471	0.0490	3.0009	0.0030	0.7033333
166	cg26275850	0.1911	0.0726	2.6312	0.0090	0.7033333
156	cg13858106	0.1891	0.0750	2.5225	0.0123	0.7033333
163	cg26074111	-0.2017	0.0830	-2.4295	0.0158	0.7033333
4	cg21853587	-0.2427	0.1009	-2.4048	0.0169	0.7033333
148	cg13598480	0.1532	0.0657	2.3314	0.0205	0.7033333
162	cg18602114	-0.1145	0.0491	-2.3321	0.0205	0.7033333
126	cg05390685	-0.1180	0.0508	-2.3206	0.0211	0.7033333
257	cg16529483	0.0588	0.0253	2.3198	0.0211	0.7033333
240	cg16375541	0.2518	0.1152	2.1857	0.0298	0.7414286
113	cg22685502	0.1820	0.0837	2.1740	0.0306	0.7414286
250	cg20732198	-0.1131	0.0525	-2.1526	0.0323	0.7414286
9	cg20510724	0.2494	0.1161	2.1488	0.0326	0.7414286
119	cg00438284	-0.1249	0.0588	-2.1246	0.0346	0.7414286
54	cg19529074	-0.1445	0.0706	-2.0468	0.0417	0.7470000

[[3]]

Table 12: Top10 CpGs for Gluc_IPV3 of Male log10 by p.value (Sample Size = 298)

	names	Estimate	Std.Error	t.statistic	p.value	FDR
145	cg06404838	0.1502	0.0400	3.7533	0.0002	0.060000
16	cg06873590	-0.1780	0.0684	-2.6000	0.0098	0.834000
27	cg17519749	0.0546	0.0214	2.5468	0.0114	0.834000

	names	Estimate	Std.Error	t.statistic	p.value	FDR
248	cg11196848	-0.0664	0.0263	-2.5232	0.0122	0.834000
217	cg01816336	-0.0974	0.0393	-2.4762	0.0139	0.834000
150	cg14163408	0.0543	0.0231	2.3488	0.0195	0.860000
153	cg01060409	0.1307	0.0571	2.2875	0.0229	0.860000
283	cg11144990	0.0717	0.0315	2.2777	0.0235	0.860000
189	cg13382072	0.0545	0.0245	2.2211	0.0271	0.860000
278	cg15565231	-0.0938	0.0434	-2.1594	0.0317	0.860000
59	cg20324199	0.0513	0.0239	2.1475	0.0326	0.860000
135	cg17171260	-0.0694	0.0327	-2.1256	0.0344	0.860000
77	cg23478547	0.0360	0.0175	2.0578	0.0405	0.890625
93	cg23054637	0.1109	0.0543	2.0430	0.0420	0.890625
250	cg20732198	0.0465	0.0233	1.9955	0.0469	0.890625

[[4]]

Table 13: Top10 CpGs for HDL_IPV3 of Male log10 by p.value (Sample Size = 263)

	names	Estimate	Std.Error	t.statistic	p.value	FDR
42	cg15355952	-0.1053	0.0334	-3.1566	0.0018	0.3300000
49	cg16725984	0.0523	0.0169	3.0953	0.0022	0.3300000
236	cg04061372	0.0315	0.0110	2.8744	0.0044	0.4400000
271	cg08162803	0.1055	0.0383	2.7542	0.0063	0.4725000
281	cg22946159	-0.1414	0.0548	-2.5802	0.0104	0.5571429
120	cg22700790	0.0516	0.0212	2.4355	0.0156	0.5571429
230	cg22950210	0.0672	0.0277	2.4238	0.0161	0.5571429
211	cg00893875	0.0281	0.0116	2.4121	0.0166	0.5571429
290	cg00798281	-0.0632	0.0263	-2.4000	0.0171	0.5571429
286	cg03989507	0.0727	0.0311	2.3353	0.0203	0.5571429
145	cg06404838	-0.1087	0.0476	-2.2828	0.0233	0.5571429
296	cg19059839	-0.0322	0.0141	-2.2728	0.0239	0.5571429
170	cg19554564	-0.0974	0.0431	-2.2586	0.0248	0.5571429
26	cg03452190	0.1067	0.0476	2.2400	0.0260	0.5571429
216	cg06230206	-0.0640	0.0292	-2.1896	0.0295	0.5629412

[[5]]

Table 14: Top10 CpGs for Insu_IPV3 of Male log10 by p.value (Sample Size = 285)

	names	Estimate	Std.Error	t.statistic	p.value	FDR
195	cg23785275	-0.0556	0.0194	-2.8653	0.0045	0.75000
36	cg11302884	-0.2737	0.1015	-2.6959	0.0075	0.75000
169	cg17501712	0.2207	0.0819	2.6951	0.0075	0.75000
86	cg02648057	-0.1260	0.0492	-2.5587	0.0110	0.82500
191	cg25138412	-0.1068	0.0442	-2.4169	0.0163	0.97800
19	cg00128386	-0.2761	0.1193	-2.3139	0.0214	0.99625
278	cg15565231	-0.2468	0.1145	-2.1553	0.0320	0.99625
61	cg04569429	0.1292	0.0601	2.1487	0.0325	0.99625
223	cg03786743	-0.1351	0.0632	-2.1356	0.0336	0.99625

	names	Estimate	Std.Error	t.statistic	p.value	FDR
291	cg09630142	0.1203	0.0567	2.1214	0.0348	0.99625
199	cg21261158	-0.2298	0.1137	-2.0213	0.0442	0.99625
233	cg02887248	-0.2659	0.1364	-1.9501	0.0522	0.99625
29	cg06814892	0.1862	0.0964	1.9323	0.0544	0.99625
251	cg00442112	-0.0505	0.0262	-1.9271	0.0550	0.99625
122	cg13344961	0.1590	0.0839	1.8959	0.0590	0.99625

[[6]]

Table 15: Top10 CpGs for Trig_IPV3 of Male log10 by p.value (Sample Size = 287)

	names	Estimate	Std.Error	t.statistic	p.value	FDR
291	cg09630142	-0.1392	0.0440	-3.1634	0.0017	0.5100000
237	cg21380181	-0.1321	0.0473	-2.7913	0.0056	0.6100000
190	cg10832304	0.0784	0.0293	2.6711	0.0080	0.6100000
82	cg18373158	0.1302	0.0507	2.5682	0.0108	0.6100000
197	cg14349977	-0.0827	0.0324	-2.5531	0.0112	0.6100000
121	cg23241335	0.1569	0.0622	2.5218	0.0122	0.6100000
240	cg16375541	0.2540	0.1049	2.4217	0.0161	0.6736364
87	cg10397322	0.1802	0.0773	2.3317	0.0204	0.6736364
103	cg04029532	-0.2042	0.0879	-2.3229	0.0209	0.6736364
77	cg23478547	0.0825	0.0361	2.2852	0.0231	0.6736364
15	cg05564760	0.0898	0.0398	2.2579	0.0247	0.6736364
16	cg06873590	-0.3116	0.1430	-2.1786	0.0302	0.7135714
254	cg22692511	0.0675	0.0313	2.1587	0.0317	0.7135714
198	cg09825146	-0.0815	0.0381	-2.1395	0.0333	0.7135714
49	cg16725984	-0.0638	0.0312	-2.0481	0.0415	0.7994118

[[7]]

Table 16: Top10 CpGs for Leptin_actual_*ng_ml* of Male log10 by p.value (Sample Size = 254)

	names	Estimate	Std.Error	t.statistic	p.value	FDR
49	cg16725984	-0.2968	0.0614	-4.8354	0.0000	0.0000000
209	cg24280832	0.4023	0.1113	3.6151	0.0004	0.0600000
84	cg05524354	0.3002	0.1002	2.9968	0.0030	0.2640000
116	cg21183455	0.1961	0.0681	2.8794	0.0043	0.2640000
42	cg15355952	0.3563	0.1238	2.8775	0.0044	0.2640000
19	cg00128386	-0.5118	0.2001	-2.5577	0.0112	0.5600000
158	cg13973086	0.1817	0.0775	2.3461	0.0198	0.8383784
104	cg10119082	-0.1604	0.0706	-2.2698	0.0241	0.8383784
214	cg20505445	-0.1758	0.0816	-2.1555	0.0321	0.8383784
185	cg07716131	0.3560	0.1703	2.0904	0.0376	0.8383784
143	cg15486454	0.1922	0.0942	2.0408	0.0424	0.8383784
71	cg16672637	0.5533	0.2738	2.0209	0.0444	0.8383784
178	cg10403849	0.1702	0.0847	2.0091	0.0456	0.8383784
133	cg23903244	-0.0627	0.0313	-1.9995	0.0467	0.8383784

	names	Estimate	Std.Error	t.statistic	p.value	FDR
278	cg15565231	-0.3670	0.1875	-1.9570	0.0515	0.8383784

```r
lapply(Outcomes[1:2], function(x) {
    cpg_reg(log10(pfas_male[, x]), pfas_male, x, 15, "Male log10")
})
```

[[1]]

Table 17: Top10 CpGs for birth_weight of Male log10 by p.value (Sample Size = 308)

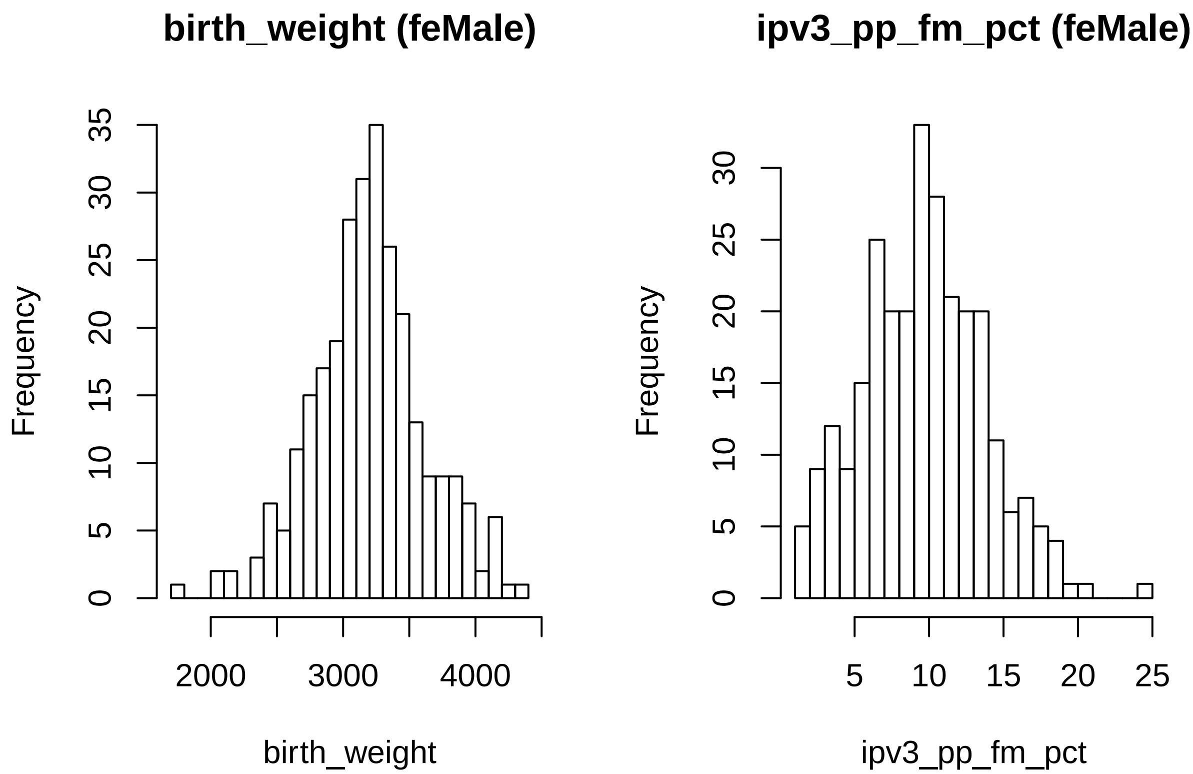
	names	Estimate	Std.Error	t.statistic	p.value	FDR
49	cg16725984	-0.0318	0.0083	-3.8234	0.0002	0.0600000
184	cg25137968	0.0453	0.0163	2.7732	0.0059	0.4680000
204	cg15045292	0.0216	0.0079	2.7389	0.0065	0.4680000
67	cg25195288	0.0642	0.0240	2.6776	0.0078	0.4680000
167	cg16495448	-0.0414	0.0154	-2.6794	0.0078	0.4680000
71	cg16672637	0.0831	0.0350	2.3752	0.0182	0.6980769
117	cg21209948	-0.0165	0.0070	-2.3387	0.0200	0.6980769
196	cg03015672	0.0339	0.0145	2.3288	0.0205	0.6980769
83	cg20741567	0.0630	0.0275	2.2864	0.0229	0.6980769
22	cg00784263	0.0398	0.0175	2.2726	0.0238	0.6980769
115	cg10436026	-0.0389	0.0178	-2.1771	0.0303	0.6980769
160	cg07338658	0.0276	0.0128	2.1589	0.0317	0.6980769
131	cg12271419	-0.0638	0.0297	-2.1466	0.0326	0.6980769
190	cg10832304	-0.0164	0.0079	-2.0684	0.0395	0.6980769
57	cg23206463	-0.0152	0.0074	-2.0670	0.0396	0.6980769

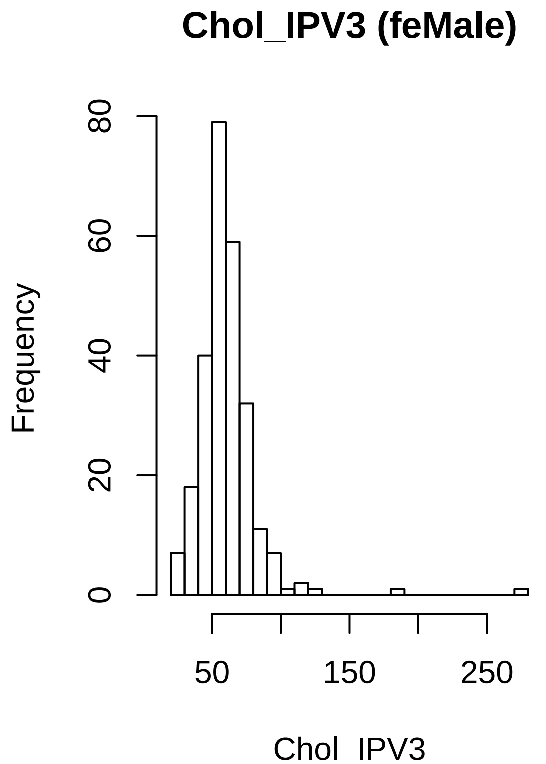
[[2]]

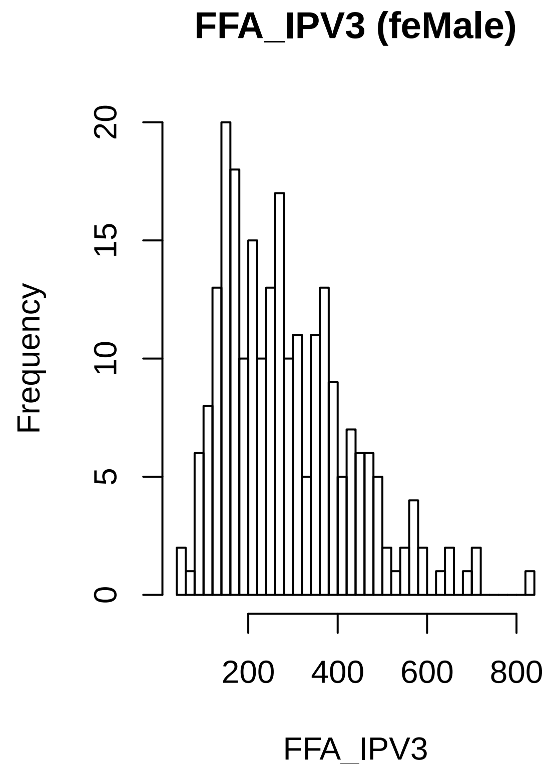
Table 18: Top10 CpGs for ipv3_pp_fm_pct of Male log10 by p.value (Sample Size = 295)

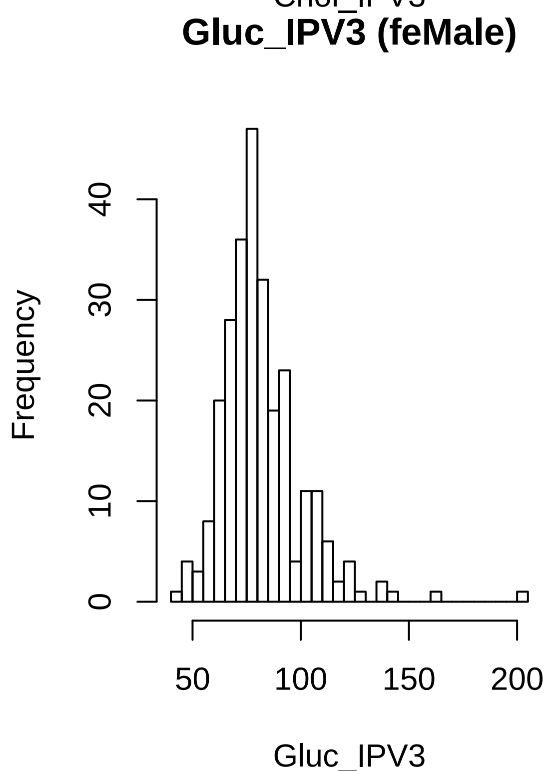
	names	Estimate	Std.Error	t.statistic	p.value	FDR
203	cg15066197	-0.1912	0.0688	-2.7785	0.0058	0.8823529
190	cg10832304	-0.0821	0.0306	-2.6787	0.0078	0.8823529
112	cg24366087	-0.1565	0.0645	-2.4249	0.0159	0.8823529
282	cg08732300	0.1141	0.0479	2.3807	0.0179	0.8823529
4	cg21853587	0.2218	0.0987	2.2474	0.0254	0.8823529
292	cg04804814	0.1903	0.0858	2.2186	0.0273	0.8823529
255	cg00634984	-0.0705	0.0318	-2.2161	0.0275	0.8823529
23	cg22305268	-0.2103	0.0969	-2.1712	0.0307	0.8823529
184	cg25137968	0.1395	0.0642	2.1725	0.0307	0.8823529
139	cg08743751	0.1225	0.0569	2.1519	0.0323	0.8823529
233	cg02887248	-0.2419	0.1134	-2.1327	0.0338	0.8823529
257	cg16529483	-0.0499	0.0246	-2.0235	0.0440	0.8823529
145	cg06404838	-0.1794	0.0888	-2.0203	0.0443	0.8823529
173	cg23506842	0.1186	0.0590	2.0090	0.0455	0.8823529
205	cg12149692	-0.0947	0.0474	-2.0003	0.0464	0.8823529

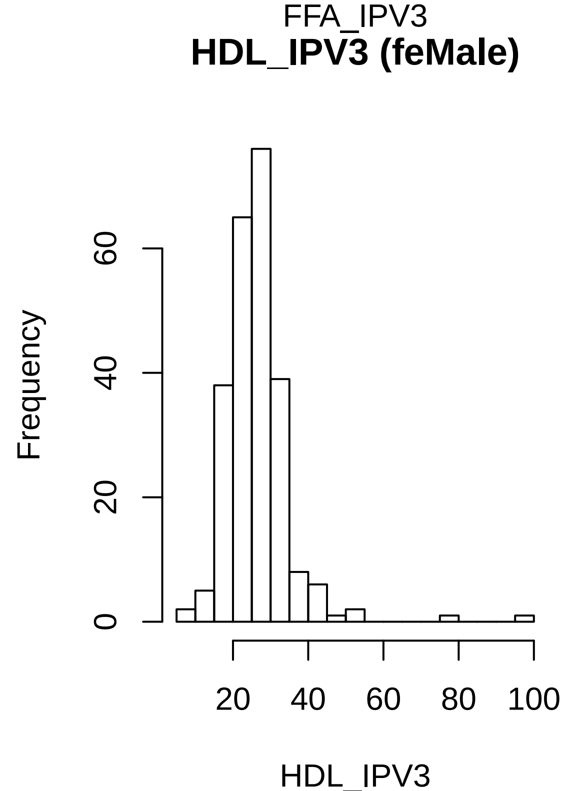
```
## raw outcomes
par(mfrow = c(1, 2))
lapply(Outcomes, function(x) {
    hist(pfas_female[, x], freq = TRUE, breaks = 30, main = paste(x,
        " (feMale)", sep = ""), xlab = x)
})
```

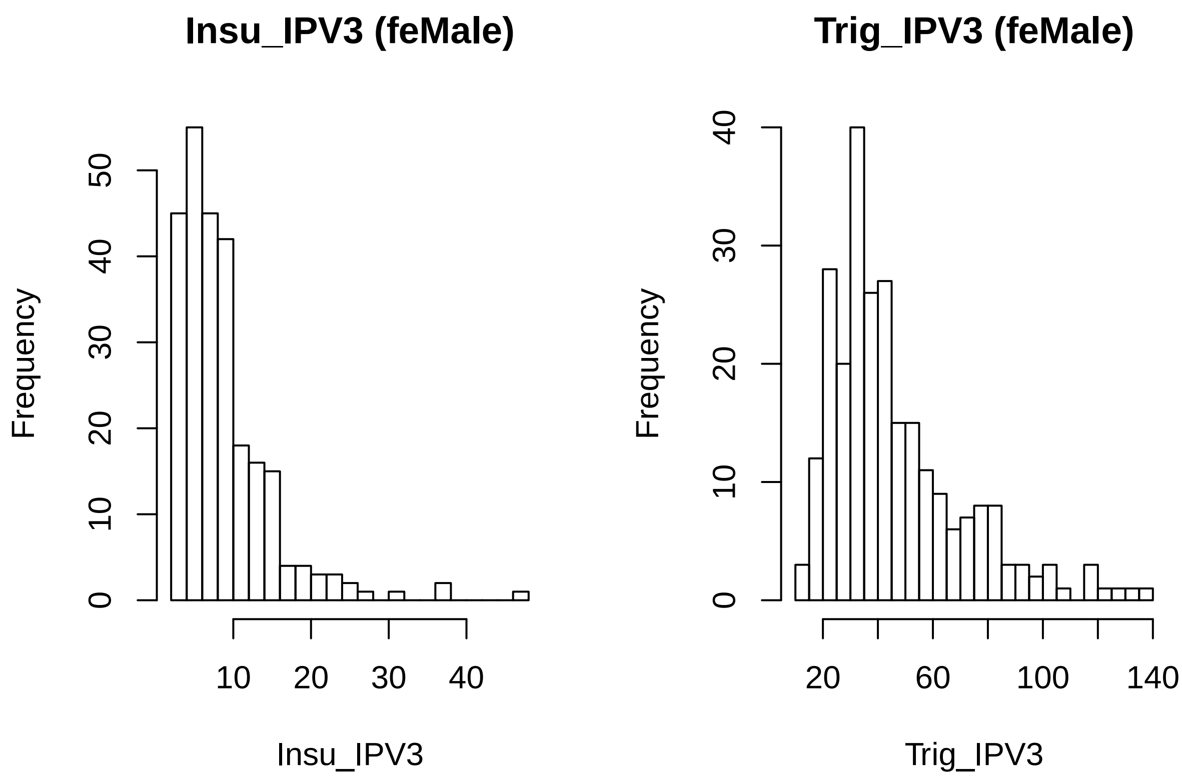



Chol_IPV3 (feMale)
Frequency
0
20
40
60
80
50
150
250
Chol_IPV3


FFA_IPV3 (feMale)
Frequency
0
5
10
15
20
200
400
600
800
FFA_IPV3


Gluc_IPV3 (feMale)
Frequency
0
10
20
30
40
50
100
150
200
Gluc_IPV3


HDL_IPV3 (feMale)
Frequency
0
20
40
60
20
40
60
80
100
HDL_IPV3



[[1]]
$breaks [1] 1700 1800 1900 2000 2100 2200 2300 2400 2500 2600 2700 2800 2900 3000 [15] 3100 3200 3300 3400 3500 3600 3700 3800 3900 4000 4100 4200 4300 4400

$counts [1] 1 0 0 2 2 0 3 7 5 11 15 17 19 28 31 35 26 21 13 9 9 9 7 [24] 2 6 1 1

$density [1] 3.571429e-05 0.000000e+00 0.000000e+00 7.142857e-05 7.142857e-05 [6] 0.000000e+00 1.071429e-04 2.500000e-04 1.785714e-04 3.928571e-04 [11] 5.357143e-04 6.071429e-04 6.785714e-04 1.000000e-03 1.107143e-03 [16] 1.250000e-03 9.285714e-04 7.500000e-04 4.642857e-04 3.214286e-04 [21] 3.214286e-04 3.214286e-04 2.500000e-04 7.142857e-05 2.142857e-04 [26] 3.571429e-05 3.571429e-05

$mids [1] 1750 1850 1950 2050 2150 2250 2350 2450 2550 2650 2750 2850 2950 3050 [15] 3150 3250 3350 3450 3550 3650 3750 3850 3950 4050 4150 4250 4350

$xname [1] “pfas_female[, x]”

$equidist [1] TRUE

attr(,“class”) [1] “histogram”

[[2]] $breaks [1] 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 [24] 24 25

$counts [1] 5 9 12 9 15 25 20 20 33 28 21 20 20 11 6 7 5 4 1 1 0 0 0 [24] 1

$density [1] 0.018315018 0.032967033 0.043956044 0.032967033 0.054945055 [6] 0.091575092 0.073260073 0.073260073 0.120879121 0.102564103 [11] 0.076923077 0.073260073 0.073260073 0.040293040 0.021978022 [16] 0.025641026 0.018315018 0.014652015 0.003663004 0.003663004 [21] 0.000000000 0.000000000 0.000000000 0.003663004

$mids [1] 1.5 2.5 3.5 4.5 5.5 6.5 7.5 8.5 9.5 10.5 11.5 12.5 13.5 14.5 [15] 15.5 16.5 17.5 18.5 19.5 20.5 21.5 22.5 23.5 24.5

$xname [1] “pfas_female[, x]”

$equidist [1] TRUE

attr(,“class”) [1] “histogram”

[[3]] $breaks [1] 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 [18] 190 200 210 220 230 240 250 260 270 280

$counts [1] 7 18 40 79 59 32 11 7 1 2 1 0 0 0 0 0 1 0 0 0 0 0 0 [24] 0 0 1

$density [1] 0.0027027027 0.0069498069 0.0154440154 0.0305019305 0.0227799228 [6] 0.0123552124 0.0042471042 0.0027027027 0.0003861004 0.0007722008 [11] 0.0003861004 0.0000000000 0.0000000000 0.0000000000 0.0000000000 [16] 0.0000000000 0.0003861004 0.0000000000 0.0000000000 0.0000000000 [21] 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 [26] 0.0003861004

$mids [1] 25 35 45 55 65 75 85 95 105 115 125 135 145 155 165 175 185 [18] 195 205 215 225 235 245 255 265 275

$xname [1] "pfas_female[, x]"

$equidist [1] TRUE

attr(,"class") [1] "histogram"

[[4]] $breaks [1] 40 60 80 100 120 140 160 180 200 220 240 260 280 300 320 340 360 [18] 380 400 420 440 460 480 500 520 540 560 580 600 620 640 660 680 700 [35] 720 740 760 780 800 820 840

$counts [1] 2 1 6 8 13 20 18 10 15 10 13 17 10 11 5 11 13 9 5 7 6 6 5 [24] 2 1 2 4 2 0 1 2 0 1 2 0 0 0 0 0 1

$density [1] 0.0004184100 0.0002092050 0.0012552301 0.0016736402 0.0027196653 [6] 0.0041841004 0.0037656904 0.0020920502 0.0031380753 0.0020920502 [11] 0.0027196653 0.0035564854 0.0020920502 0.0023012552 0.0010460251 [16] 0.0023012552 0.0027196653 0.0018828452 0.0010460251 0.0014644351 [21] 0.0012552301 0.0012552301 0.0010460251 0.0004184100 0.0002092050 [26] 0.0004184100 0.0008368201 0.0004184100 0.0000000000 0.0002092050 [31] 0.0004184100 0.0000000000 0.0002092050 0.0004184100 0.0000000000 [36] 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0002092050

$mids [1] 50 70 90 110 130 150 170 190 210 230 250 270 290 310 330 350 370 [18] 390 410 430 450 470 490 510 530 550 570 590 610 630 650 670 690 710 [35] 730 750 770 790 810 830

$xname [1] "pfas_female[, x]"

$equidist [1] TRUE

attr(,"class") [1] "histogram"

[[5]] $breaks [1] 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120 [18] 125 130 135 140 145 150 155 160 165 170 175 180 185 190 195 200 205

$counts [1] 1 4 3 8 20 28 36 47 32 19 23 4 11 11 6 2 4 1 0 2 1 0 0 [24] 0 1 0 0 0 0 0 0 0 1

$density [1] 0.000754717 0.003018868 0.002264151 0.006037736 0.015094340 [6] 0.021132075 0.027169811 0.035471698 0.024150943 0.014339623 [11] 0.017358491 0.003018868 0.008301887 0.008301887 0.004528302 [16] 0.001509434 0.003018868 0.000754717 0.000000000 0.001509434 [21] 0.000754717 0.000000000 0.000000000 0.000000000 0.000754717 [26] 0.000000000 0.000000000 0.000000000 0.000000000 0.000000000 [31] 0.000000000 0.000000000 0.000754717

$mids [1] 42.5 47.5 52.5 57.5 62.5 67.5 72.5 77.5 82.5 87.5 92.5 [12] 97.5 102.5 107.5 112.5 117.5 122.5 127.5 132.5 137.5 142.5 147.5 [23] 152.5 157.5 162.5 167.5 172.5 177.5 182.5 187.5 192.5 197.5 202.5

$xname [1] "pfas_female[, x]"

$equidist [1] TRUE

attr(,"class") [1] "histogram"

[[6]] $breaks [1] 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 [18] 90 95 100

$counts [1] 2 5 38 65 76 39 8 6 1 2 0 0 0 0 1 0 0 0 1

$density [1] 0.0016393443 0.0040983607 0.0311475410 0.0532786885 0.0622950820 [6] 0.0319672131 0.0065573770 0.0049180328 0.0008196721 0.0016393443 [11] 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0008196721 [16] 0.0000000000 0.0000000000 0.0000000000 0.0008196721

$mids [1] 7.5 12.5 17.5 22.5 27.5 32.5 37.5 42.5 47.5 52.5 57.5 62.5 67.5 72.5 [15] 77.5 82.5 87.5 92.5 97.5

$xname [1] "pfas_female[, x]"

$equidist [1] TRUE

attr(,"class") [1] "histogram"

[[7]] $breaks [1] 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 [24] 48

$counts [1] 45 55 45 42 18 16 15 4 4 3 3 2 1 0 1 0 0 2 0 0 0 0 1

$density [1] 0.087548638 0.107003891 0.087548638 0.081712062 0.035019455 [6] 0.031128405 0.029182879 0.007782101 0.007782101 0.005836576 [11] 0.005836576 0.003891051 0.001945525 0.000000000 0.001945525 [16] 0.000000000 0.000000000 0.003891051 0.000000000 0.000000000 [21] 0.000000000 0.000000000 0.001945525

$mids [1] 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31 33 35 37 39 41 43 45 47

$xname [1] "pfas_female[, x]"

$equidist [1] TRUE

attr(,"class") [1] "histogram"

[[8]] $breaks [1] 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 [18] 95 100 105 110 115 120 125 130 135 140

$counts [1] 3 12 28 20 40 26 27 15 15 11 9 6 7 8 8 3 3 2 3 1 0 3 1 [24] 1 1 1

$density [1] 0.0023622047 0.0094488189 0.0220472441 0.0157480315 0.0314960630 [6] 0.0204724409 0.0212598425 0.0118110236 0.0118110236 0.0086614173 [11] 0.0070866142 0.0047244094 0.0055118110 0.0062992126 0.0062992126 [16] 0.0023622047 0.0023622047 0.0015748031 0.0023622047 0.0007874016 [21] 0.0000000000 0.0023622047 0.0007874016 0.0007874016 0.0007874016 [26] 0.0007874016

$mids [1] 12.5 17.5 22.5 27.5 32.5 37.5 42.5 47.5 52.5 57.5 62.5 [12] 67.5 72.5 77.5 82.5 87.5 92.5 97.5 102.5 107.5 112.5 117.5 [23] 122.5 127.5 132.5 137.5

$xname [1] "pfas_female[, x]"

$equidist [1] TRUE

attr(,"class") [1] "histogram"

[[9]] $breaks [1] 0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 [18] 85 90 95 100 105 110 115 120 125 130

$counts [1] 26 49 39 32 20 19 7 14 2 4 5 2 2 0 1 0 2 0 0 1 1 0 1 [24] 0 0 1

$density [1] 0.022807018 0.042982456 0.034210526 0.028070175 0.017543860 [6] 0.016666667 0.006140351 0.012280702 0.001754386 0.003508772 [11] 0.004385965 0.001754386 0.001754386 0.000000000 0.000877193 [16] 0.000000000 0.001754386 0.000000000 0.000000000 0.000877193 [21] 0.000877193 0.000000000 0.000877193 0.000000000 0.000000000 [26] 0.000877193

$mids [1] 2.5 7.5 12.5 17.5 22.5 27.5 32.5 37.5 42.5 47.5 52.5 [12] 57.5 62.5 67.5 72.5 77.5 82.5 87.5 92.5 97.5 102.5 107.5 [23] 112.5 117.5 122.5 127.5

$xname [1] "pfas_female[, x]"

$equidist [1] TRUE

attr(,"class") [1] "histogram"

```r
## log10 of feMale
lapply(Outcomes, function(x) {
    cpg_reg(log10(pfas_female[, x]), pfas_female, x, 15, "Female log10")
})
```

[[1]]

Table 19: Top10 CpGs for birth_weight of Female log10 by p.value (Sample Size = 280)

	names	Estimate	Std.Error	t.statistic	p.value	FDR
49	cg16725984	-0.0357	0.0082	-4.3657	0.0000	0.0000
27	cg17519749	0.0442	0.0121	3.6486	0.0003	0.0450
248	cg11196848	0.0449	0.0142	3.1669	0.0017	0.1700
71	cg16672637	0.0994	0.0343	2.8929	0.0041	0.3075
297	cg01607625	0.0613	0.0219	2.8053	0.0054	0.3240
222	cg27258399	0.0268	0.0101	2.6429	0.0087	0.3900
113	cg22685502	0.0521	0.0202	2.5839	0.0103	0.3900
87	cg10397322	0.0554	0.0216	2.5606	0.0110	0.3900
99	cg19708901	0.0547	0.0215	2.5380	0.0117	0.3900
240	cg16375541	0.0661	0.0273	2.4200	0.0162	0.4860
40	cg03198317	0.0431	0.0193	2.2302	0.0266	0.6060
185	cg07716131	-0.0481	0.0216	-2.2282	0.0267	0.6060
201	cg04591709	0.0584	0.0263	2.2250	0.0269	0.6060
209	cg24280832	0.0287	0.0131	2.1958	0.0290	0.6060
144	cg18537730	0.0326	0.0150	2.1779	0.0303	0.6060

[[2]]

Table 20: Top10 CpGs for ipv3_pp_fm_pct of Female log10 by p.value (Sample Size = 273)

	names	Estimate	Std.Error	t.statistic	p.value	FDR
189	cg13382072	-0.1376	0.0490	-2.8066	0.0054	0.9748986
203	cg15066197	-0.2022	0.0748	-2.7044	0.0073	0.9748986
20	cg00210042	-0.2220	0.0881	-2.5211	0.0123	0.9748986
51	cg15642854	-0.0532	0.0222	-2.3931	0.0174	0.9748986
28	cg12872489	0.1030	0.0442	2.3320	0.0205	0.9748986
5	cg12657739	-0.1434	0.0639	-2.2419	0.0258	0.9748986
33	cg05431942	0.0742	0.0333	2.2293	0.0266	0.9748986
27	cg17519749	0.1039	0.0495	2.1012	0.0366	0.9748986
54	cg19529074	0.1712	0.0867	1.9758	0.0492	0.9748986
44	cg09420412	-0.1052	0.0545	-1.9295	0.0548	0.9748986
292	cg04804814	0.1567	0.0819	1.9148	0.0566	0.9748986
117	cg21209948	0.0950	0.0515	1.8466	0.0659	0.9748986
232	cg03991871	-0.0829	0.0455	-1.8229	0.0695	0.9748986
105	cg20626045	0.1062	0.0597	1.7810	0.0761	0.9748986
46	cg03228555	-0.1235	0.0697	-1.7717	0.0776	0.9748986

[[3]]

Table 21: Top10 CpGs for Chol_IPV3 of Female log10 by p.value (Sample Size = 259)

	names	Estimate	Std.Error	t.statistic	p.value	FDR
64	cg24469114	0.1557	0.0522	2.9850	0.0031	0.3360000
49	cg16725984	0.0572	0.0197	2.9034	0.0040	0.3360000
72	cg16659510	-0.1441	0.0499	-2.8864	0.0042	0.3360000
60	cg26381452	0.0495	0.0174	2.8528	0.0047	0.3360000
142	cg21501241	-0.1371	0.0491	-2.7929	0.0056	0.3360000
235	cg25017403	0.0627	0.0231	2.7190	0.0070	0.3428571
11	cg02233835	-0.1196	0.0448	-2.6717	0.0080	0.3428571
267	cg22138002	-0.0928	0.0364	-2.5505	0.0114	0.4166667
193	cg01541565	-0.0881	0.0350	-2.5151	0.0125	0.4166667
45	cg16422816	0.1512	0.0620	2.4388	0.0154	0.4375000
300	cg27166921	-0.1089	0.0455	-2.3949	0.0174	0.4375000
297	cg01607625	-0.1285	0.0538	-2.3914	0.0175	0.4375000
209	cg24280832	-0.0722	0.0308	-2.3450	0.0198	0.4564286
224	cg14604000	-0.0850	0.0367	-2.3182	0.0213	0.4564286
257	cg16529483	0.0577	0.0269	2.1456	0.0329	0.6388235

[[4]]

Table 22: Top10 CpGs for FFA_IPV3 of Female log10 by p.value (Sample Size = 239)

	names	Estimate	Std.Error	t.statistic	p.value	FDR
167	cg16495448	-0.1659	0.0665	-2.4932	0.0134	0.9515455
171	cg09461851	0.2031	0.0848	2.3959	0.0174	0.9515455
14	cg09473264	-0.1309	0.0560	-2.3361	0.0204	0.9515455
20	cg00210042	0.2126	0.0938	2.2671	0.0243	0.9515455
281	cg22946159	0.2345	0.1047	2.2400	0.0261	0.9515455
268	cg05119480	0.1389	0.0624	2.2244	0.0271	0.9515455
272	cg17269633	-0.1229	0.0574	-2.1404	0.0334	0.9515455
290	cg00798281	-0.1169	0.0549	-2.1306	0.0342	0.9515455
230	cg22950210	-0.1087	0.0527	-2.0641	0.0402	0.9515455
142	cg21501241	0.1854	0.0903	2.0535	0.0412	0.9515455
215	cg11417025	-0.0931	0.0466	-1.9964	0.0471	0.9515455
212	cg02078758	-0.1430	0.0748	-1.9107	0.0573	0.9515455
276	cg15115757	0.0444	0.0237	1.8698	0.0628	0.9515455
123	cg21962013	0.1554	0.0833	1.8652	0.0635	0.9515455
38	cg10533331	0.2086	0.1133	1.8408	0.0670	0.9515455

[[5]]

Table 23: Top10 CpGs for Gluc_IPV3 of Female log10 by p.value (Sample Size = 265)

	names	Estimate	Std.Error	t.statistic	p.value	FDR
168	cg12680424	-0.1797	0.0629	-2.8556	0.0047	0.8034783
260	cg17284440	0.1495	0.0568	2.6324	0.0090	0.8034783
262	cg05888037	-0.1592	0.0614	-2.5917	0.0101	0.8034783

	names	Estimate	Std.Error	t.statistic	p.value	FDR
288	cg10848522	0.0457	0.0197	2.3202	0.0211	0.8034783
6	cg26724375	-0.0679	0.0296	-2.2934	0.0227	0.8034783
167	cg16495448	-0.0599	0.0265	-2.2583	0.0248	0.8034783
173	cg23506842	-0.0584	0.0258	-2.2585	0.0248	0.8034783
216	cg06230206	-0.0546	0.0243	-2.2449	0.0256	0.8034783
285	cg27535677	0.0452	0.0203	2.2287	0.0267	0.8034783
3	cg07551200	-0.1330	0.0615	-2.1638	0.0314	0.8034783
40	cg03198317	0.0695	0.0326	2.1312	0.0340	0.8034783
224	cg14604000	0.0555	0.0263	2.1154	0.0354	0.8034783
17	cg13699963	-0.0859	0.0413	-2.0783	0.0387	0.8034783
188	cg17500055	-0.0438	0.0214	-2.0488	0.0415	0.8034783
30	cg25714096	-0.1073	0.0528	-2.0314	0.0433	0.8034783

[[6]]

Table 24: Top10 CpGs for HDL_IPV3 of Female log10 by p.value (Sample Size = 244)

	names	Estimate	Std.Error	t.statistic	p.value	FDR
113	cg22685502	-0.1266	0.0470	-2.6932	0.0076	0.5945455
291	cg09630142	-0.0830	0.0314	-2.6396	0.0089	0.5945455
11	cg02233835	-0.1158	0.0444	-2.6048	0.0098	0.5945455
185	cg07716131	-0.1296	0.0501	-2.5854	0.0103	0.5945455
222	cg27258399	-0.0606	0.0235	-2.5769	0.0106	0.5945455
277	cg05227616	-0.0937	0.0372	-2.5194	0.0124	0.5945455
147	cg03604367	0.0898	0.0376	2.3909	0.0176	0.5945455
72	cg16659510	-0.1131	0.0486	-2.3272	0.0208	0.5945455
50	cg27124293	0.0554	0.0239	2.3185	0.0213	0.5945455
60	cg26381452	0.0394	0.0170	2.3144	0.0215	0.5945455
235	cg25017403	0.0536	0.0232	2.3100	0.0218	0.5945455
193	cg01541565	-0.0767	0.0343	-2.2343	0.0264	0.6530769
91	cg13771313	-0.0444	0.0201	-2.2064	0.0283	0.6530769
261	cg07638935	0.1368	0.0643	2.1291	0.0343	0.7140000
194	cg16966520	-0.0735	0.0348	-2.1126	0.0357	0.7140000

[[7]]

Table 25: Top10 CpGs for Insu_IPV3 of Female log10 by p.value (Sample Size = 257)

	names	Estimate	Std.Error	t.statistic	p.value	FDR
139	cg08743751	0.3038	0.0706	4.3039	0.0000	0.0000000
254	cg22692511	0.1903	0.0379	5.0208	0.0000	0.0000000
88	cg19667731	-0.2838	0.0892	-3.1819	0.0017	0.1700000
237	cg21380181	-0.1687	0.0625	-2.7019	0.0074	0.5040000
239	cg01969701	0.1485	0.0559	2.6565	0.0084	0.5040000
77	cg23478547	-0.1187	0.0460	-2.5793	0.0105	0.5228571
236	cg04061372	-0.0638	0.0253	-2.5263	0.0122	0.5228571
295	cg09114153	0.1837	0.0745	2.4637	0.0144	0.5400000
28	cg12872489	0.1180	0.0498	2.3706	0.0185	0.6166667

	names	Estimate	Std.Error	t.statistic	p.value	FDR
205	cg12149692	-0.1381	0.0611	-2.2625	0.0245	0.7254545
82	cg18373158	0.1368	0.0613	2.2310	0.0266	0.7254545
262	cg05888037	-0.3541	0.1672	-2.1184	0.0352	0.8800000
299	cg17217478	-0.0441	0.0217	-2.0304	0.0434	0.9157576
130	cg10922264	-0.1301	0.0671	-1.9379	0.0538	0.9157576
20	cg00210042	-0.1985	0.1033	-1.9228	0.0557	0.9157576

[[8]]

Table 26: Top10 CpGs for Trig_IPV3 of Female log10 by p.value (Sample Size = 254)

	names	Estimate	Std.Error	t.statistic	p.value	FDR
109	cg22120094	-0.1016	0.0415	-2.4465	0.0151	0.8519048
58	cg09887862	0.0730	0.0305	2.3921	0.0175	0.8519048
172	cg07812715	-0.2085	0.0880	-2.3686	0.0186	0.8519048
297	cg01607625	-0.2029	0.0867	-2.3396	0.0201	0.8519048
13	cg21451869	-0.1872	0.0804	-2.3264	0.0208	0.8519048
155	cg15727287	0.0840	0.0367	2.2874	0.0230	0.8519048
154	cg06243084	0.1900	0.0839	2.2647	0.0244	0.8519048
298	cg14801692	0.0668	0.0308	2.1669	0.0312	0.8519048
17	cg13699963	-0.2031	0.0941	-2.1585	0.0319	0.8519048
116	cg21183455	0.0739	0.0369	2.0038	0.0462	0.8519048
169	cg17501712	-0.1503	0.0761	-1.9753	0.0494	0.8519048
183	cg07105947	-0.0500	0.0257	-1.9490	0.0525	0.8519048
140	cg24408706	-0.1837	0.0947	-1.9403	0.0535	0.8519048
38	cg10533331	0.1912	0.1007	1.8974	0.0590	0.8519048
150	cg14163408	0.0976	0.0520	1.8770	0.0617	0.8519048

[[9]]

Table 27: Top10 CpGs for Leptin_actual_*ng_ml* of Female log10 by p.value (Sample Size = 228)

	names	Estimate	Std.Error	t.statistic	p.value	FDR
62	cg04523661	-0.4140	0.1311	-3.1584	0.0018	0.3000000
204	cg15045292	0.1846	0.0589	3.1322	0.0020	0.3000000
126	cg05390685	-0.2410	0.0814	-2.9598	0.0034	0.3400000
232	cg03991871	-0.2242	0.0804	-2.7890	0.0058	0.3660000
45	cg16422816	-0.4719	0.1703	-2.7704	0.0061	0.3660000
144	cg18537730	0.2819	0.1065	2.6471	0.0087	0.4157143
82	cg18373158	0.2451	0.0939	2.6104	0.0097	0.4157143
199	cg21261158	0.4638	0.1885	2.4606	0.0147	0.4800000
49	cg16725984	-0.1483	0.0614	-2.4150	0.0166	0.4800000
44	cg09420412	-0.2414	0.1004	-2.4055	0.0170	0.4800000
209	cg24280832	0.2239	0.0947	2.3636	0.0190	0.4800000
148	cg13598480	0.3170	0.1343	2.3599	0.0192	0.4800000
60	cg26381452	0.1169	0.0513	2.2793	0.0236	0.5446154
70	cg10438649	0.4503	0.2021	2.2280	0.0269	0.5600000

	names	Estimate	Std.Error	t.statistic	p.value	FDR
237	cg21380181	-0.2145	0.0970	-2.2127	0.0280	0.5600000