

Poids à la naissance des enfants au Burkina-Faso

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```
#install.packages("labelled")
```

```
rm(list = ls())  
library(tidyverse)
```

```
## -- Attaching core tidyverse packages ----- tidyverse 2.0.0 --  
## v dplyr      1.1.4      v readr      2.1.5  
## v forcats    1.0.0      v stringr    1.5.1  
## v ggplot2    3.4.4      v tibble     3.2.1  
## v lubridate  1.9.3      v tidyr      1.3.1  
## v purrr      1.0.2
```

```
## -- Conflicts ----- tidyverse_conflicts() --
```

```
## x dplyr::filter() masks stats::filter()
```

```
## x dplyr::lag()     masks stats::lag()
```

```
## i Use the conflicted package (<http://conflicted.r-lib.org/>) to force all conflicts to become errors
```

```
library(summarytools)
```

```
##
```

```
## Attaching package: 'summarytools'
```

```
##
```

```
## The following object is masked from 'package:tibble':
```

```
##
```

```
##      view
```

```
library(gtsummary)
```

```
library(haven)
```

```
library(labelled)
```

Chargement des données

```
rm(list = ls())
```

```
load("dhs_child_west_africa.rda")
```

```
#data <- data %>% filter(v000=="BF8")
```

Population cible

```
data <- data %>%
  mutate(pop_cible = if_else(is.na(m19), "pas de questions", "questions posées"))

freq(data$pop_cible)
```

```
## Frequencies
## data$pop_cible
## Type: Character
##
##
```

	Freq	% Valid	% Valid Cum.	% Total	% Total Cum.
pas de questions	9772	6.81	6.81	6.81	6.81
questions posées	133750	93.19	100.00	93.19	100.00
<NA>	0			0.00	100.00
Total	143522	100.00	100.00	100.00	100.00

```
ctable(factor(data$midx), data$pop_cible)
```

```
## Cross-Tabulation, Row Proportions
## factor(data$midx) * pop_cible
##
##
```

	pop_cible	pas de questions	questions posées	Total
factor(data\$midx)				
1	7 (0.008%)	92554 (100.0%)	92561 (100.0%)	
2	21 (0.058%)	35978 (99.9%)	35999 (100.0%)	
3	4 (0.082%)	4872 (99.9%)	4876 (100.0%)	
4	0 (0.000%)	312 (100.0%)	312 (100.0%)	
5	0 (0.000%)	31 (100.0%)	31 (100.0%)	
6	0 (0.000%)	3 (100.0%)	3 (100.0%)	
<NA>	9740 (100.000%)	0 (0.0%)	9740 (100.0%)	
Total	9772 (6.809%)	133750 (93.2%)	143522 (100.0%)	

```
freq(data$midx)
```

```
## Frequencies
## data$midx
## Label: index to birth history
## Type: Numeric
##
##
```

	Freq	% Valid	% Valid Cum.	% Total	% Total Cum.
1	92561	69.1879	69.1879	64.4926	64.4926
2	35999	26.9087	96.0966	25.0826	89.5751
3	4876	3.6447	99.7414	3.3974	92.9725
4	312	0.2332	99.9746	0.2174	93.1899
5	31	0.0232	99.9978	0.0216	93.2115
6	3	0.0022	100.0000	0.0021	93.2136

```
##      <NA>      9740      6.7864      100.0000
##      Total 143522 100.0000 100.0000 100.0000 100.0000
```

```
freq(data$m19)
```

```
## Frequencies
## data$m19
## Label: birth weight in kilograms (3 decimals)
## Type: Numeric
##
##      Freq      % Valid      % Valid Cum.      % Total      % Total Cum.
## -----
##      500      57      0.04262      0.04262      0.03972      0.03972
##      600      6      0.00449      0.04710      0.00418      0.04390
##      620      1      0.00075      0.04785      0.00070      0.04459
##      625      1      0.00075      0.04860      0.00070      0.04529
##      700      7      0.00523      0.05383      0.00488      0.05017
##      750      3      0.00224      0.05607      0.00209      0.05226
##      800      7      0.00523      0.06131      0.00488      0.05713
##      820      1      0.00075      0.06206      0.00070      0.05783
##      900      7      0.00523      0.06729      0.00488      0.06271
##      950      1      0.00075      0.06804      0.00070      0.06340
##      998      1      0.00075      0.06879      0.00070      0.06410
##     1000     189      0.14131      0.21009      0.13169      0.19579
##     1040      1      0.00075      0.21084      0.00070      0.19649
##     1100     11      0.00822      0.21907      0.00766      0.20415
##     1150      2      0.00150      0.22056      0.00139      0.20554
##     1160      1      0.00075      0.22131      0.00070      0.20624
##     1176      1      0.00075      0.22206      0.00070      0.20694
##     1200     49      0.03664      0.25869      0.03414      0.24108
##     1250      6      0.00449      0.26318      0.00418      0.24526
##     1300     34      0.02542      0.28860      0.02369      0.26895
##     1310      1      0.00075      0.28935      0.00070      0.26965
##     1400     44      0.03290      0.32224      0.03066      0.30030
##     1420      2      0.00150      0.32374      0.00139      0.30170
##     1440      1      0.00075      0.32449      0.00070      0.30239
##     1450      5      0.00374      0.32822      0.00348      0.30588
##     1470      1      0.00075      0.32897      0.00070      0.30657
##     1500     192      0.14355      0.47252      0.13378      0.44035
##     1520      3      0.00224      0.47477      0.00209      0.44244
##     1540      1      0.00075      0.47551      0.00070      0.44314
##     1550      1      0.00075      0.47626      0.00070      0.44383
##     1580      1      0.00075      0.47701      0.00070      0.44453
##     1600     47      0.03514      0.51215      0.03275      0.47728
##     1610      2      0.00150      0.51364      0.00139      0.47867
##     1630      1      0.00075      0.51439      0.00070      0.47937
##     1640      2      0.00150      0.51589      0.00139      0.48076
##     1650      7      0.00523      0.52112      0.00488      0.48564
##     1660      2      0.00150      0.52262      0.00139      0.48703
##     1670      1      0.00075      0.52336      0.00070      0.48773
##     1680      2      0.00150      0.52486      0.00139      0.48912
##     1700     46      0.03439      0.55925      0.03205      0.52117
##     1705      1      0.00075      0.56000      0.00070      0.52187
##     1720      1      0.00075      0.56075      0.00070      0.52257
```

##	1725	2	0.00150	0.56224	0.00139	0.52396
##	1730	1	0.00075	0.56299	0.00070	0.52466
##	1740	4	0.00299	0.56598	0.00279	0.52745
##	1750	13	0.00972	0.57570	0.00906	0.53650
##	1770	1	0.00075	0.57645	0.00070	0.53720
##	1785	1	0.00075	0.57720	0.00070	0.53790
##	1790	3	0.00224	0.57944	0.00209	0.53999
##	1800	106	0.07925	0.65869	0.07386	0.61384
##	1825	1	0.00075	0.65944	0.00070	0.61454
##	1830	1	0.00075	0.66019	0.00070	0.61524
##	1840	1	0.00075	0.66093	0.00070	0.61593
##	1850	8	0.00598	0.66692	0.00557	0.62151
##	1860	1	0.00075	0.66766	0.00070	0.62220
##	1870	1	0.00075	0.66841	0.00070	0.62290
##	1880	2	0.00150	0.66991	0.00139	0.62429
##	1890	1	0.00075	0.67065	0.00070	0.62499
##	1900	110	0.08224	0.75290	0.07664	0.70163
##	1910	2	0.00150	0.75439	0.00139	0.70303
##	1920	2	0.00150	0.75589	0.00139	0.70442
##	1930	1	0.00075	0.75664	0.00070	0.70512
##	1940	4	0.00299	0.75963	0.00279	0.70791
##	1950	8	0.00598	0.76561	0.00557	0.71348
##	1970	2	0.00150	0.76710	0.00139	0.71487
##	1980	1	0.00075	0.76785	0.00070	0.71557
##	1985	1	0.00075	0.76860	0.00070	0.71627
##	1990	1	0.00075	0.76935	0.00070	0.71696
##	2000	2089	1.56187	2.33121	1.45553	2.17249
##	2005	1	0.00075	2.33196	0.00070	2.17319
##	2008	1	0.00075	2.33271	0.00070	2.17388
##	2010	2	0.00150	2.33421	0.00139	2.17528
##	2020	1	0.00075	2.33495	0.00070	2.17597
##	2025	1	0.00075	2.33570	0.00070	2.17667
##	2030	2	0.00150	2.33720	0.00139	2.17806
##	2040	1	0.00075	2.33794	0.00070	2.17876
##	2048	1	0.00075	2.33869	0.00070	2.17946
##	2050	20	0.01495	2.35364	0.01394	2.19339
##	2052	1	0.00075	2.35439	0.00070	2.19409
##	2055	1	0.00075	2.35514	0.00070	2.19479
##	2065	2	0.00150	2.35664	0.00139	2.19618
##	2070	3	0.00224	2.35888	0.00209	2.19827
##	2075	1	0.00075	2.35963	0.00070	2.19897
##	2080	4	0.00299	2.36262	0.00279	2.20175
##	2083	1	0.00075	2.36336	0.00070	2.20245
##	2085	2	0.00150	2.36486	0.00139	2.20384
##	2090	3	0.00224	2.36710	0.00209	2.20593
##	2094	1	0.00075	2.36785	0.00070	2.20663
##	2095	1	0.00075	2.36860	0.00070	2.20733
##	2100	421	0.31477	2.68336	0.29333	2.50066
##	2110	1	0.00075	2.68411	0.00070	2.50136
##	2115	1	0.00075	2.68486	0.00070	2.50206
##	2120	1	0.00075	2.68561	0.00070	2.50275
##	2125	2	0.00150	2.68710	0.00139	2.50415
##	2130	2	0.00150	2.68860	0.00139	2.50554
##	2145	1	0.00075	2.68935	0.00070	2.50624

##	2150	23	0.01720	2.70654	0.01603	2.52226
##	2152	1	0.00075	2.70729	0.00070	2.52296
##	2155	2	0.00150	2.70879	0.00139	2.52435
##	2160	1	0.00075	2.70953	0.00070	2.52505
##	2170	1	0.00075	2.71028	0.00070	2.52575
##	2175	1	0.00075	2.71103	0.00070	2.52644
##	2180	5	0.00374	2.71477	0.00348	2.52993
##	2200	547	0.40897	3.12374	0.38113	2.91105
##	2210	3	0.00224	3.12598	0.00209	2.91314
##	2220	1	0.00075	3.12673	0.00070	2.91384
##	2225	4	0.00299	3.12972	0.00279	2.91663
##	2230	3	0.00224	3.13196	0.00209	2.91872
##	2235	1	0.00075	3.13271	0.00070	2.91941
##	2240	5	0.00374	3.13645	0.00348	2.92290
##	2250	108	0.08075	3.21720	0.07525	2.99815
##	2252	1	0.00075	3.21794	0.00070	2.99884
##	2255	1	0.00075	3.21869	0.00070	2.99954
##	2256	1	0.00075	3.21944	0.00070	3.00024
##	2260	4	0.00299	3.22243	0.00279	3.00302
##	2270	7	0.00523	3.22766	0.00488	3.00790
##	2275	2	0.00150	3.22916	0.00139	3.00929
##	2280	3	0.00224	3.23140	0.00209	3.01139
##	2285	1	0.00075	3.23215	0.00070	3.01208
##	2290	3	0.00224	3.23439	0.00209	3.01417
##	2300	858	0.64150	3.87589	0.59782	3.61199
##	2310	1	0.00075	3.87664	0.00070	3.61269
##	2320	4	0.00299	3.87963	0.00279	3.61547
##	2325	1	0.00075	3.88037	0.00070	3.61617
##	2330	4	0.00299	3.88336	0.00279	3.61896
##	2340	3	0.00224	3.88561	0.00209	3.62105
##	2345	1	0.00075	3.88636	0.00070	3.62174
##	2346	1	0.00075	3.88710	0.00070	3.62244
##	2347	1	0.00075	3.88785	0.00070	3.62314
##	2350	50	0.03738	3.92523	0.03484	3.65798
##	2355	1	0.00075	3.92598	0.00070	3.65867
##	2360	7	0.00523	3.93121	0.00488	3.66355
##	2365	2	0.00150	3.93271	0.00139	3.66494
##	2370	5	0.00374	3.93645	0.00348	3.66843
##	2380	4	0.00299	3.93944	0.00279	3.67121
##	2390	2	0.00150	3.94093	0.00139	3.67261
##	2395	1	0.00075	3.94168	0.00070	3.67330
##	2400	782	0.58467	4.52636	0.54486	4.21817
##	2410	2	0.00150	4.52785	0.00139	4.21956
##	2415	2	0.00150	4.52935	0.00139	4.22096
##	2420	10	0.00748	4.53682	0.00697	4.22792
##	2430	10	0.00748	4.54430	0.00697	4.23489
##	2440	3	0.00224	4.54654	0.00209	4.23698
##	2450	66	0.04935	4.59589	0.04599	4.28297
##	2460	5	0.00374	4.59963	0.00348	4.28645
##	2465	1	0.00075	4.60037	0.00070	4.28715
##	2470	8	0.00598	4.60636	0.00557	4.29272
##	2475	2	0.00150	4.60785	0.00139	4.29412
##	2480	9	0.00673	4.61458	0.00627	4.30039
##	2485	1	0.00075	4.61533	0.00070	4.30108

##	2490	1	0.00075	4.61607	0.00070	4.30178
##	2500	3732	2.79028	7.40636	2.60030	6.90208
##	2505	2	0.00150	7.40785	0.00139	6.90347
##	2510	7	0.00523	7.41308	0.00488	6.90835
##	2515	2	0.00150	7.41458	0.00139	6.90974
##	2520	15	0.01121	7.42579	0.01045	6.92019
##	2525	2	0.00150	7.42729	0.00139	6.92159
##	2530	11	0.00822	7.43551	0.00766	6.92925
##	2535	1	0.00075	7.43626	0.00070	6.92995
##	2540	10	0.00748	7.44374	0.00697	6.93692
##	2545	1	0.00075	7.44449	0.00070	6.93761
##	2550	87	0.06505	7.50953	0.06062	6.99823
##	2560	12	0.00897	7.51850	0.00836	7.00659
##	2565	1	0.00075	7.51925	0.00070	7.00729
##	2570	9	0.00673	7.52598	0.00627	7.01356
##	2575	1	0.00075	7.52673	0.00070	7.01426
##	2580	8	0.00598	7.53271	0.00557	7.01983
##	2585	5	0.00374	7.53645	0.00348	7.02331
##	2590	3	0.00224	7.53869	0.00209	7.02540
##	2600	1637	1.22393	8.76262	1.14059	8.16600
##	2605	2	0.00150	8.76411	0.00139	8.16739
##	2610	9	0.00673	8.77084	0.00627	8.17366
##	2620	10	0.00748	8.77832	0.00697	8.18063
##	2625	3	0.00224	8.78056	0.00209	8.18272
##	2630	13	0.00972	8.79028	0.00906	8.19178
##	2635	2	0.00150	8.79178	0.00139	8.19317
##	2640	17	0.01271	8.80449	0.01184	8.20501
##	2645	1	0.00075	8.80523	0.00070	8.20571
##	2650	115	0.08598	8.89121	0.08013	8.28584
##	2653	1	0.00075	8.89196	0.00070	8.28653
##	2654	1	0.00075	8.89271	0.00070	8.28723
##	2655	1	0.00075	8.89346	0.00070	8.28793
##	2660	14	0.01047	8.90393	0.00975	8.29768
##	2665	2	0.00150	8.90542	0.00139	8.29908
##	2670	14	0.01047	8.91589	0.00975	8.30883
##	2675	4	0.00299	8.91888	0.00279	8.31162
##	2680	19	0.01421	8.93308	0.01324	8.32486
##	2690	5	0.00374	8.93682	0.00348	8.32834
##	2700	1784	1.33383	10.27065	1.24302	9.57135
##	2705	2	0.00150	10.27215	0.00139	9.57275
##	2706	1	0.00075	10.27290	0.00070	9.57345
##	2710	11	0.00822	10.28112	0.00766	9.58111
##	2715	3	0.00224	10.28336	0.00209	9.58320
##	2720	15	0.01121	10.29458	0.01045	9.59365
##	2725	2	0.00150	10.29607	0.00139	9.59504
##	2730	10	0.00748	10.30355	0.00697	9.60201
##	2735	1	0.00075	10.30430	0.00070	9.60271
##	2740	12	0.00897	10.31327	0.00836	9.61107
##	2750	258	0.19290	10.50617	0.17976	9.79083
##	2760	9	0.00673	10.51290	0.00627	9.79710
##	2765	2	0.00150	10.51439	0.00139	9.79850
##	2770	9	0.00673	10.52112	0.00627	9.80477
##	2775	3	0.00224	10.52336	0.00209	9.80686
##	2779	1	0.00075	10.52411	0.00070	9.80756

##	2780	18	0.01346	10.53757	0.01254	9.82010
##	2785	1	0.00075	10.53832	0.00070	9.82079
##	2790	6	0.00449	10.54280	0.00418	9.82497
##	2800	2925	2.18692	12.72972	2.03802	11.86299
##	2805	2	0.00150	12.73121	0.00139	11.86438
##	2810	7	0.00523	12.73645	0.00488	11.86926
##	2815	3	0.00224	12.73869	0.00209	11.87135
##	2820	18	0.01346	12.75215	0.01254	11.88389
##	2825	5	0.00374	12.75589	0.00348	11.88738
##	2830	13	0.00972	12.76561	0.00906	11.89643
##	2833	1	0.00075	12.76636	0.00070	11.89713
##	2835	3	0.00224	12.76860	0.00209	11.89922
##	2840	12	0.00897	12.77757	0.00836	11.90758
##	2845	1	0.00075	12.77832	0.00070	11.90828
##	2850	161	0.12037	12.89869	0.11218	12.02046
##	2855	2	0.00150	12.90019	0.00139	12.02185
##	2858	1	0.00075	12.90093	0.00070	12.02255
##	2860	13	0.00972	12.91065	0.00906	12.03160
##	2865	1	0.00075	12.91140	0.00070	12.03230
##	2870	15	0.01121	12.92262	0.01045	12.04275
##	2875	6	0.00449	12.92710	0.00418	12.04693
##	2880	12	0.00897	12.93607	0.00836	12.05529
##	2885	2	0.00150	12.93757	0.00139	12.05669
##	2890	6	0.00449	12.94206	0.00418	12.06087
##	2895	2	0.00150	12.94355	0.00139	12.06226
##	2900	2152	1.60897	14.55252	1.49942	13.56168
##	2905	1	0.00075	14.55327	0.00070	13.56238
##	2910	6	0.00449	14.55776	0.00418	13.56656
##	2915	3	0.00224	14.56000	0.00209	13.56865
##	2920	10	0.00748	14.56748	0.00697	13.57562
##	2925	1	0.00075	14.56822	0.00070	13.57632
##	2930	11	0.00822	14.57645	0.00766	13.58398
##	2932	1	0.00075	14.57720	0.00070	13.58468
##	2935	1	0.00075	14.57794	0.00070	13.58537
##	2940	14	0.01047	14.58841	0.00975	13.59513
##	2945	1	0.00075	14.58916	0.00070	13.59583
##	2950	153	0.11439	14.70355	0.10660	13.70243
##	2955	3	0.00224	14.70579	0.00209	13.70452
##	2960	11	0.00822	14.71402	0.00766	13.71218
##	2965	2	0.00150	14.71551	0.00139	13.71358
##	2970	10	0.00748	14.72299	0.00697	13.72054
##	2975	3	0.00224	14.72523	0.00209	13.72263
##	2980	8	0.00598	14.73121	0.00557	13.72821
##	2985	3	0.00224	14.73346	0.00209	13.73030
##	2990	7	0.00523	14.73869	0.00488	13.73518
##	2995	2	0.00150	14.74019	0.00139	13.73657
##	2998	1	0.00075	14.74093	0.00070	13.73727
##	2999	1	0.00075	14.74168	0.00070	13.73796
##	3000	11021	8.24000	22.98168	7.67896	21.41693
##	3004	2	0.00150	22.98318	0.00139	21.41832
##	3005	2	0.00150	22.98467	0.00139	21.41971
##	3006	2	0.00150	22.98617	0.00139	21.42111
##	3008	1	0.00075	22.98692	0.00070	21.42180
##	3009	2	0.00150	22.98841	0.00139	21.42320

##	3010	20	0.01495	23.00336	0.01394	21.43713
##	3015	2	0.00150	23.00486	0.00139	21.43853
##	3016	1	0.00075	23.00561	0.00070	21.43922
##	3019	1	0.00075	23.00636	0.00070	21.43992
##	3020	14	0.01047	23.01682	0.00975	21.44967
##	3025	4	0.00299	23.01981	0.00279	21.45246
##	3030	8	0.00598	23.02579	0.00557	21.45803
##	3035	3	0.00224	23.02804	0.00209	21.46012
##	3040	10	0.00748	23.03551	0.00697	21.46709
##	3042	1	0.00075	23.03626	0.00070	21.46779
##	3045	3	0.00224	23.03850	0.00209	21.46988
##	3048	1	0.00075	23.03925	0.00070	21.47058
##	3050	114	0.08523	23.12449	0.07943	21.55001
##	3055	3	0.00224	23.12673	0.00209	21.55210
##	3060	11	0.00822	23.13495	0.00766	21.55976
##	3063	1	0.00075	23.13570	0.00070	21.56046
##	3070	14	0.01047	23.14617	0.00975	21.57021
##	3075	7	0.00523	23.15140	0.00488	21.57509
##	3080	6	0.00449	23.15589	0.00418	21.57927
##	3083	1	0.00075	23.15664	0.00070	21.57997
##	3085	2	0.00150	23.15813	0.00139	21.58136
##	3090	9	0.00673	23.16486	0.00627	21.58763
##	3095	1	0.00075	23.16561	0.00070	21.58833
##	3099	1	0.00075	23.16636	0.00070	21.58902
##	3100	2520	1.88411	25.05047	1.75583	23.34485
##	3102	2	0.00150	25.05196	0.00139	23.34625
##	3105	2	0.00150	25.05346	0.00139	23.34764
##	3110	22	0.01645	25.06991	0.01533	23.36297
##	3120	30	0.02243	25.09234	0.02090	23.38387
##	3125	9	0.00673	25.09907	0.00627	23.39014
##	3130	6	0.00449	25.10355	0.00418	23.39432
##	3135	2	0.00150	25.10505	0.00139	23.39572
##	3140	12	0.00897	25.11402	0.00836	23.40408
##	3145	2	0.00150	25.11551	0.00139	23.40547
##	3150	170	0.12710	25.24262	0.11845	23.52392
##	3160	13	0.00972	25.25234	0.00906	23.53298
##	3164	1	0.00075	25.25308	0.00070	23.53367
##	3165	1	0.00075	25.25383	0.00070	23.53437
##	3170	7	0.00523	25.25907	0.00488	23.53925
##	3175	3	0.00224	25.26131	0.00209	23.54134
##	3180	15	0.01121	25.27252	0.01045	23.55179
##	3185	2	0.00150	25.27402	0.00139	23.55318
##	3190	6	0.00449	25.27850	0.00418	23.55736
##	3200	3781	2.82692	28.10542	2.63444	26.19180
##	3205	4	0.00299	28.10841	0.00279	26.19459
##	3210	8	0.00598	28.11439	0.00557	26.20016
##	3215	3	0.00224	28.11664	0.00209	26.20225
##	3219	1	0.00075	28.11738	0.00070	26.20295
##	3220	21	0.01570	28.13308	0.01463	26.21758
##	3225	3	0.00224	28.13533	0.00209	26.21967
##	3230	10	0.00748	28.14280	0.00697	26.22664
##	3235	2	0.00150	28.14430	0.00139	26.22803
##	3240	16	0.01196	28.15626	0.01115	26.23918
##	3245	2	0.00150	28.15776	0.00139	26.24058

##	3250	267	0.19963	28.35738	0.18603	26.42661
##	3255	4	0.00299	28.36037	0.00279	26.42940
##	3260	10	0.00748	28.36785	0.00697	26.43637
##	3265	1	0.00075	28.36860	0.00070	26.43706
##	3270	11	0.00822	28.37682	0.00766	26.44473
##	3275	4	0.00299	28.37981	0.00279	26.44751
##	3280	8	0.00598	28.38579	0.00557	26.45309
##	3285	2	0.00150	28.38729	0.00139	26.45448
##	3290	5	0.00374	28.39103	0.00348	26.45796
##	3300	1627	1.21645	29.60748	1.13362	27.59159
##	3306	1	0.00075	29.60822	0.00070	27.59229
##	3310	7	0.00523	29.61346	0.00488	27.59716
##	3315	3	0.00224	29.61570	0.00209	27.59925
##	3318	1	0.00075	29.61645	0.00070	27.59995
##	3320	18	0.01346	29.62991	0.01254	27.61249
##	3325	5	0.00374	29.63364	0.00348	27.61598
##	3330	9	0.00673	29.64037	0.00627	27.62225
##	3333	1	0.00075	29.64112	0.00070	27.62294
##	3335	1	0.00075	29.64187	0.00070	27.62364
##	3340	13	0.00972	29.65159	0.00906	27.63270
##	3345	4	0.00299	29.65458	0.00279	27.63548
##	3350	97	0.07252	29.72710	0.06759	27.70307
##	3354	1	0.00075	29.72785	0.00070	27.70377
##	3355	1	0.00075	29.72860	0.00070	27.70446
##	3360	7	0.00523	29.73383	0.00488	27.70934
##	3365	1	0.00075	29.73458	0.00070	27.71004
##	3370	8	0.00598	29.74056	0.00557	27.71561
##	3375	6	0.00449	29.74505	0.00418	27.71979
##	3380	19	0.01421	29.75925	0.01324	27.73303
##	3385	1	0.00075	29.76000	0.00070	27.73373
##	3390	5	0.00374	29.76374	0.00348	27.73721
##	3399	1	0.00075	29.76449	0.00070	27.73791
##	3400	1872	1.39963	31.16411	1.30433	29.04224
##	3410	7	0.00523	31.16935	0.00488	29.04711
##	3415	1	0.00075	31.17009	0.00070	29.04781
##	3420	10	0.00748	31.17757	0.00697	29.05478
##	3425	2	0.00150	31.17907	0.00139	29.05617
##	3430	13	0.00972	31.18879	0.00906	29.06523
##	3440	4	0.00299	31.19178	0.00279	29.06802
##	3450	108	0.08075	31.27252	0.07525	29.14327
##	3460	9	0.00673	31.27925	0.00627	29.14954
##	3465	2	0.00150	31.28075	0.00139	29.15093
##	3466	1	0.00075	31.28150	0.00070	29.15163
##	3470	5	0.00374	31.28523	0.00348	29.15511
##	3480	11	0.00822	31.29346	0.00766	29.16278
##	3485	1	0.00075	31.29421	0.00070	29.16347
##	3490	3	0.00224	31.29645	0.00209	29.16556
##	3495	1	0.00075	31.29720	0.00070	29.16626
##	3496	1	0.00075	31.29794	0.00070	29.16696
##	3500	4706	3.51850	34.81645	3.27894	32.44590
##	3510	9	0.00673	34.82318	0.00627	32.45217
##	3515	2	0.00150	34.82467	0.00139	32.45356
##	3520	9	0.00673	34.83140	0.00627	32.45983
##	3525	1	0.00075	34.83215	0.00070	32.46053

##	3530	7	0.00523	34.83738	0.00488	32.46541
##	3535	1	0.00075	34.83813	0.00070	32.46610
##	3540	2	0.00150	34.83963	0.00139	32.46750
##	3550	73	0.05458	34.89421	0.05086	32.51836
##	3560	7	0.00523	34.89944	0.00488	32.52324
##	3570	10	0.00748	34.90692	0.00697	32.53020
##	3580	6	0.00449	34.91140	0.00418	32.53438
##	3585	1	0.00075	34.91215	0.00070	32.53508
##	3590	5	0.00374	34.91589	0.00348	32.53857
##	3595	1	0.00075	34.91664	0.00070	32.53926
##	3600	1257	0.93981	35.85645	0.87582	33.41509
##	3608	1	0.00075	35.85720	0.00070	33.41578
##	3610	5	0.00374	35.86093	0.00348	33.41927
##	3620	6	0.00449	35.86542	0.00418	33.42345
##	3625	2	0.00150	35.86692	0.00139	33.42484
##	3630	3	0.00224	35.86916	0.00209	33.42693
##	3640	5	0.00374	35.87290	0.00348	33.43041
##	3650	53	0.03963	35.91252	0.03693	33.46734
##	3660	3	0.00224	35.91477	0.00209	33.46943
##	3665	1	0.00075	35.91551	0.00070	33.47013
##	3670	3	0.00224	35.91776	0.00209	33.47222
##	3675	1	0.00075	35.91850	0.00070	33.47292
##	3680	3	0.00224	35.92075	0.00209	33.47501
##	3685	2	0.00150	35.92224	0.00139	33.47640
##	3690	2	0.00150	35.92374	0.00139	33.47779
##	3700	906	0.67738	36.60112	0.63126	34.10906
##	3705	1	0.00075	36.60187	0.00070	34.10975
##	3708	1	0.00075	36.60262	0.00070	34.11045
##	3710	4	0.00299	36.60561	0.00279	34.11324
##	3715	2	0.00150	36.60710	0.00139	34.11463
##	3720	3	0.00224	36.60935	0.00209	34.11672
##	3725	2	0.00150	36.61084	0.00139	34.11811
##	3727	1	0.00075	36.61159	0.00070	34.11881
##	3730	4	0.00299	36.61458	0.00279	34.12160
##	3740	4	0.00299	36.61757	0.00279	34.12439
##	3745	1	0.00075	36.61832	0.00070	34.12508
##	3750	88	0.06579	36.68411	0.06131	34.18640
##	3760	4	0.00299	36.68710	0.00279	34.18918
##	3765	1	0.00075	36.68785	0.00070	34.18988
##	3770	4	0.00299	36.69084	0.00279	34.19267
##	3775	2	0.00150	36.69234	0.00139	34.19406
##	3780	3	0.00224	36.69458	0.00209	34.19615
##	3790	3	0.00224	36.69682	0.00209	34.19824
##	3795	2	0.00150	36.69832	0.00139	34.19963
##	3800	1243	0.92935	37.62766	0.86607	35.06570
##	3810	2	0.00150	37.62916	0.00139	35.06710
##	3815	1	0.00075	37.62991	0.00070	35.06779
##	3820	3	0.00224	37.63215	0.00209	35.06988
##	3830	2	0.00150	37.63364	0.00139	35.07128
##	3840	2	0.00150	37.63514	0.00139	35.07267
##	3850	50	0.03738	37.67252	0.03484	35.10751
##	3860	2	0.00150	37.67402	0.00139	35.10890
##	3870	2	0.00150	37.67551	0.00139	35.11030
##	3875	1	0.00075	37.67626	0.00070	35.11099

##	3880	2	0.00150	37.67776	0.00139	35.11239
##	3886	1	0.00075	37.67850	0.00070	35.11308
##	3890	4	0.00299	37.68150	0.00279	35.11587
##	3900	651	0.48673	38.16822	0.45359	35.56946
##	3905	1	0.00075	38.16897	0.00070	35.57016
##	3910	3	0.00224	38.17121	0.00209	35.57225
##	3915	1	0.00075	38.17196	0.00070	35.57294
##	3920	1	0.00075	38.17271	0.00070	35.57364
##	3930	1	0.00075	38.17346	0.00070	35.57434
##	3940	3	0.00224	38.17570	0.00209	35.57643
##	3950	25	0.01869	38.19439	0.01742	35.59385
##	3960	3	0.00224	38.19664	0.00209	35.59594
##	3970	1	0.00075	38.19738	0.00070	35.59663
##	3975	1	0.00075	38.19813	0.00070	35.59733
##	3980	1	0.00075	38.19888	0.00070	35.59803
##	3990	4	0.00299	38.20187	0.00279	35.60081
##	3998	1	0.00075	38.20262	0.00070	35.60151
##	4000	2920	2.18318	40.38579	2.03453	37.63604
##	4005	1	0.00075	40.38654	0.00070	37.63674
##	4009	1	0.00075	40.38729	0.00070	37.63744
##	4015	1	0.00075	40.38804	0.00070	37.63813
##	4017	1	0.00075	40.38879	0.00070	37.63883
##	4020	2	0.00150	40.39028	0.00139	37.64022
##	4030	2	0.00150	40.39178	0.00139	37.64162
##	4045	1	0.00075	40.39252	0.00070	37.64231
##	4050	7	0.00523	40.39776	0.00488	37.64719
##	4060	2	0.00150	40.39925	0.00139	37.64858
##	4065	1	0.00075	40.40000	0.00070	37.64928
##	4070	2	0.00150	40.40150	0.00139	37.65067
##	4080	2	0.00150	40.40299	0.00139	37.65207
##	4090	1	0.00075	40.40374	0.00070	37.65276
##	4095	1	0.00075	40.40449	0.00070	37.65346
##	4100	313	0.23402	40.63850	0.21809	37.87155
##	4120	1	0.00075	40.63925	0.00070	37.87224
##	4150	8	0.00598	40.64523	0.00557	37.87782
##	4160	2	0.00150	40.64673	0.00139	37.87921
##	4170	3	0.00224	40.64897	0.00209	37.88130
##	4180	1	0.00075	40.64972	0.00070	37.88200
##	4200	432	0.32299	40.97271	0.30100	38.18300
##	4220	1	0.00075	40.97346	0.00070	38.18369
##	4250	15	0.01121	40.98467	0.01045	38.19414
##	4260	1	0.00075	40.98542	0.00070	38.19484
##	4280	1	0.00075	40.98617	0.00070	38.19554
##	4300	202	0.15103	41.13720	0.14074	38.33628
##	4315	1	0.00075	41.13794	0.00070	38.33698
##	4340	1	0.00075	41.13869	0.00070	38.33768
##	4350	3	0.00224	41.14093	0.00209	38.33977
##	4400	107	0.08000	41.22093	0.07455	38.41432
##	4406	1	0.00075	41.22168	0.00070	38.41502
##	4450	5	0.00374	41.22542	0.00348	38.41850
##	4500	635	0.47477	41.70019	0.44244	38.86094
##	4530	1	0.00075	41.70093	0.00070	38.86164
##	4550	2	0.00150	41.70243	0.00139	38.86303
##	4600	93	0.06953	41.77196	0.06480	38.92783

##	4650	2	0.00150	41.77346	0.00139	38.92922
##	4670	1	0.00075	41.77421	0.00070	38.92992
##	4700	76	0.05682	41.83103	0.05295	38.98287
##	4750	3	0.00224	41.83327	0.00209	38.98496
##	4760	1	0.00075	41.83402	0.00070	38.98566
##	4780	1	0.00075	41.83477	0.00070	38.98636
##	4790	1	0.00075	41.83551	0.00070	38.98705
##	4800	142	0.10617	41.94168	0.09894	39.08599
##	4850	4	0.00299	41.94467	0.00279	39.08878
##	4900	68	0.05084	41.99551	0.04738	39.13616
##	4915	1	0.00075	41.99626	0.00070	39.13686
##	4950	3	0.00224	41.99850	0.00209	39.13895
##	5000	811	0.60636	42.60486	0.56507	39.70402
##	5002	1	0.00075	42.60561	0.00070	39.70471
##	5050	1	0.00075	42.60636	0.00070	39.70541
##	5100	29	0.02168	42.62804	0.02021	39.72562
##	5120	1	0.00075	42.62879	0.00070	39.72631
##	5180	1	0.00075	42.62953	0.00070	39.72701
##	5200	63	0.04710	42.67664	0.04390	39.77091
##	5260	1	0.00075	42.67738	0.00070	39.77160
##	5300	37	0.02766	42.70505	0.02578	39.79738
##	5400	26	0.01944	42.72449	0.01812	39.81550
##	5410	1	0.00075	42.72523	0.00070	39.81620
##	5500	76	0.05682	42.78206	0.05295	39.86915
##	5520	1	0.00075	42.78280	0.00070	39.86985
##	5550	1	0.00075	42.78355	0.00070	39.87054
##	5555	1	0.00075	42.78430	0.00070	39.87124
##	5600	30	0.02243	42.80673	0.02090	39.89214
##	5650	1	0.00075	42.80748	0.00070	39.89284
##	5700	15	0.01121	42.81869	0.01045	39.90329
##	5800	22	0.01645	42.83514	0.01533	39.91862
##	5891	1	0.00075	42.83589	0.00070	39.91932
##	5900	15	0.01121	42.84710	0.01045	39.92977
##	6000	266	0.19888	43.04598	0.18534	40.11510
##	6100	1	0.00075	43.04673	0.00070	40.11580
##	6200	1	0.00075	43.04748	0.00070	40.11650
##	7000	1	0.00075	43.04822	0.00070	40.11719
##	7200	1	0.00075	43.04897	0.00070	40.11789
##	9996	57409	42.92262	85.97159	40.00014	80.11803
##	9998	18727	14.00150	99.97308	13.04817	93.16620
##	9999	36	0.02692	100.00000	0.02508	93.19129
##	<NA>	9772			6.80871	100.00000
##	Total	143522	100.00000	100.00000	100.00000	100.00000

```
data <-
  data %>%
  filter(pop_cible == "questions posées")
```

Analyse descriptive

Avant tout, on commence toujours par décrire la base de donnée afin de la comprendre et de mener des analyses descriptives préliminaires afin d'avoir une première idée du jeu de données

- sur la variable d'intérêt principale

```
freq(data$m19)
```

```
## Frequencies
## data$m19
## Label: birth weight in kilograms (3 decimals)
## Type: Numeric
##
##          Freq    % Valid  % Valid Cum.    % Total  % Total Cum.
## -----
##          500      57    0.04262      0.04262    0.04262    0.04262
##          600       6    0.00449      0.04710    0.00449    0.04710
##          620       1    0.00075      0.04785    0.00075    0.04785
##          625       1    0.00075      0.04860    0.00075    0.04860
##          700       7    0.00523      0.05383    0.00523    0.05383
##          750       3    0.00224      0.05607    0.00224    0.05607
##          800       7    0.00523      0.06131    0.00523    0.06131
##          820       1    0.00075      0.06206    0.00075    0.06206
##          900       7    0.00523      0.06729    0.00523    0.06729
##          950       1    0.00075      0.06804    0.00075    0.06804
##          998       1    0.00075      0.06879    0.00075    0.06879
##         1000     189    0.14131      0.21009    0.14131    0.21009
##         1040       1    0.00075      0.21084    0.00075    0.21084
##         1100      11    0.00822      0.21907    0.00822    0.21907
##         1150       2    0.00150      0.22056    0.00150    0.22056
##         1160       1    0.00075      0.22131    0.00075    0.22131
##         1176       1    0.00075      0.22206    0.00075    0.22206
##         1200      49    0.03664      0.25869    0.03664    0.25869
##         1250       6    0.00449      0.26318    0.00449    0.26318
##         1300      34    0.02542      0.28860    0.02542    0.28860
##         1310       1    0.00075      0.28935    0.00075    0.28935
##         1400      44    0.03290      0.32224    0.03290    0.32224
##         1420       2    0.00150      0.32374    0.00150    0.32374
##         1440       1    0.00075      0.32449    0.00075    0.32449
##         1450       5    0.00374      0.32822    0.00374    0.32822
##         1470       1    0.00075      0.32897    0.00075    0.32897
##         1500     192    0.14355      0.47252    0.14355    0.47252
##         1520       3    0.00224      0.47477    0.00224    0.47477
##         1540       1    0.00075      0.47551    0.00075    0.47551
##         1550       1    0.00075      0.47626    0.00075    0.47626
##         1580       1    0.00075      0.47701    0.00075    0.47701
##         1600      47    0.03514      0.51215    0.03514    0.51215
##         1610       2    0.00150      0.51364    0.00150    0.51364
##         1630       1    0.00075      0.51439    0.00075    0.51439
##         1640       2    0.00150      0.51589    0.00150    0.51589
##         1650       7    0.00523      0.52112    0.00523    0.52112
##         1660       2    0.00150      0.52262    0.00150    0.52262
##         1670       1    0.00075      0.52336    0.00075    0.52336
##         1680       2    0.00150      0.52486    0.00150    0.52486
##         1700      46    0.03439      0.55925    0.03439    0.55925
##         1705       1    0.00075      0.56000    0.00075    0.56000
##         1720       1    0.00075      0.56075    0.00075    0.56075
##         1725       2    0.00150      0.56224    0.00150    0.56224
```

##	1730	1	0.00075	0.56299	0.00075	0.56299
##	1740	4	0.00299	0.56598	0.00299	0.56598
##	1750	13	0.00972	0.57570	0.00972	0.57570
##	1770	1	0.00075	0.57645	0.00075	0.57645
##	1785	1	0.00075	0.57720	0.00075	0.57720
##	1790	3	0.00224	0.57944	0.00224	0.57944
##	1800	106	0.07925	0.65869	0.07925	0.65869
##	1825	1	0.00075	0.65944	0.00075	0.65944
##	1830	1	0.00075	0.66019	0.00075	0.66019
##	1840	1	0.00075	0.66093	0.00075	0.66093
##	1850	8	0.00598	0.66692	0.00598	0.66692
##	1860	1	0.00075	0.66766	0.00075	0.66766
##	1870	1	0.00075	0.66841	0.00075	0.66841
##	1880	2	0.00150	0.66991	0.00150	0.66991
##	1890	1	0.00075	0.67065	0.00075	0.67065
##	1900	110	0.08224	0.75290	0.08224	0.75290
##	1910	2	0.00150	0.75439	0.00150	0.75439
##	1920	2	0.00150	0.75589	0.00150	0.75589
##	1930	1	0.00075	0.75664	0.00075	0.75664
##	1940	4	0.00299	0.75963	0.00299	0.75963
##	1950	8	0.00598	0.76561	0.00598	0.76561
##	1970	2	0.00150	0.76710	0.00150	0.76710
##	1980	1	0.00075	0.76785	0.00075	0.76785
##	1985	1	0.00075	0.76860	0.00075	0.76860
##	1990	1	0.00075	0.76935	0.00075	0.76935
##	2000	2089	1.56187	2.33121	1.56187	2.33121
##	2005	1	0.00075	2.33196	0.00075	2.33196
##	2008	1	0.00075	2.33271	0.00075	2.33271
##	2010	2	0.00150	2.33421	0.00150	2.33421
##	2020	1	0.00075	2.33495	0.00075	2.33495
##	2025	1	0.00075	2.33570	0.00075	2.33570
##	2030	2	0.00150	2.33720	0.00150	2.33720
##	2040	1	0.00075	2.33794	0.00075	2.33794
##	2048	1	0.00075	2.33869	0.00075	2.33869
##	2050	20	0.01495	2.35364	0.01495	2.35364
##	2052	1	0.00075	2.35439	0.00075	2.35439
##	2055	1	0.00075	2.35514	0.00075	2.35514
##	2065	2	0.00150	2.35664	0.00150	2.35664
##	2070	3	0.00224	2.35888	0.00224	2.35888
##	2075	1	0.00075	2.35963	0.00075	2.35963
##	2080	4	0.00299	2.36262	0.00299	2.36262
##	2083	1	0.00075	2.36336	0.00075	2.36336
##	2085	2	0.00150	2.36486	0.00150	2.36486
##	2090	3	0.00224	2.36710	0.00224	2.36710
##	2094	1	0.00075	2.36785	0.00075	2.36785
##	2095	1	0.00075	2.36860	0.00075	2.36860
##	2100	421	0.31477	2.68336	0.31477	2.68336
##	2110	1	0.00075	2.68411	0.00075	2.68411
##	2115	1	0.00075	2.68486	0.00075	2.68486
##	2120	1	0.00075	2.68561	0.00075	2.68561
##	2125	2	0.00150	2.68710	0.00150	2.68710
##	2130	2	0.00150	2.68860	0.00150	2.68860
##	2145	1	0.00075	2.68935	0.00075	2.68935
##	2150	23	0.01720	2.70654	0.01720	2.70654

##	2152	1	0.00075	2.70729	0.00075	2.70729
##	2155	2	0.00150	2.70879	0.00150	2.70879
##	2160	1	0.00075	2.70953	0.00075	2.70953
##	2170	1	0.00075	2.71028	0.00075	2.71028
##	2175	1	0.00075	2.71103	0.00075	2.71103
##	2180	5	0.00374	2.71477	0.00374	2.71477
##	2200	547	0.40897	3.12374	0.40897	3.12374
##	2210	3	0.00224	3.12598	0.00224	3.12598
##	2220	1	0.00075	3.12673	0.00075	3.12673
##	2225	4	0.00299	3.12972	0.00299	3.12972
##	2230	3	0.00224	3.13196	0.00224	3.13196
##	2235	1	0.00075	3.13271	0.00075	3.13271
##	2240	5	0.00374	3.13645	0.00374	3.13645
##	2250	108	0.08075	3.21720	0.08075	3.21720
##	2252	1	0.00075	3.21794	0.00075	3.21794
##	2255	1	0.00075	3.21869	0.00075	3.21869
##	2256	1	0.00075	3.21944	0.00075	3.21944
##	2260	4	0.00299	3.22243	0.00299	3.22243
##	2270	7	0.00523	3.22766	0.00523	3.22766
##	2275	2	0.00150	3.22916	0.00150	3.22916
##	2280	3	0.00224	3.23140	0.00224	3.23140
##	2285	1	0.00075	3.23215	0.00075	3.23215
##	2290	3	0.00224	3.23439	0.00224	3.23439
##	2300	858	0.64150	3.87589	0.64150	3.87589
##	2310	1	0.00075	3.87664	0.00075	3.87664
##	2320	4	0.00299	3.87963	0.00299	3.87963
##	2325	1	0.00075	3.88037	0.00075	3.88037
##	2330	4	0.00299	3.88336	0.00299	3.88336
##	2340	3	0.00224	3.88561	0.00224	3.88561
##	2345	1	0.00075	3.88636	0.00075	3.88636
##	2346	1	0.00075	3.88710	0.00075	3.88710
##	2347	1	0.00075	3.88785	0.00075	3.88785
##	2350	50	0.03738	3.92523	0.03738	3.92523
##	2355	1	0.00075	3.92598	0.00075	3.92598
##	2360	7	0.00523	3.93121	0.00523	3.93121
##	2365	2	0.00150	3.93271	0.00150	3.93271
##	2370	5	0.00374	3.93645	0.00374	3.93645
##	2380	4	0.00299	3.93944	0.00299	3.93944
##	2390	2	0.00150	3.94093	0.00150	3.94093
##	2395	1	0.00075	3.94168	0.00075	3.94168
##	2400	782	0.58467	4.52636	0.58467	4.52636
##	2410	2	0.00150	4.52785	0.00150	4.52785
##	2415	2	0.00150	4.52935	0.00150	4.52935
##	2420	10	0.00748	4.53682	0.00748	4.53682
##	2430	10	0.00748	4.54430	0.00748	4.54430
##	2440	3	0.00224	4.54654	0.00224	4.54654
##	2450	66	0.04935	4.59589	0.04935	4.59589
##	2460	5	0.00374	4.59963	0.00374	4.59963
##	2465	1	0.00075	4.60037	0.00075	4.60037
##	2470	8	0.00598	4.60636	0.00598	4.60636
##	2475	2	0.00150	4.60785	0.00150	4.60785
##	2480	9	0.00673	4.61458	0.00673	4.61458
##	2485	1	0.00075	4.61533	0.00075	4.61533
##	2490	1	0.00075	4.61607	0.00075	4.61607

##	2500	3732	2.79028	7.40636	2.79028	7.40636
##	2505	2	0.00150	7.40785	0.00150	7.40785
##	2510	7	0.00523	7.41308	0.00523	7.41308
##	2515	2	0.00150	7.41458	0.00150	7.41458
##	2520	15	0.01121	7.42579	0.01121	7.42579
##	2525	2	0.00150	7.42729	0.00150	7.42729
##	2530	11	0.00822	7.43551	0.00822	7.43551
##	2535	1	0.00075	7.43626	0.00075	7.43626
##	2540	10	0.00748	7.44374	0.00748	7.44374
##	2545	1	0.00075	7.44449	0.00075	7.44449
##	2550	87	0.06505	7.50953	0.06505	7.50953
##	2560	12	0.00897	7.51850	0.00897	7.51850
##	2565	1	0.00075	7.51925	0.00075	7.51925
##	2570	9	0.00673	7.52598	0.00673	7.52598
##	2575	1	0.00075	7.52673	0.00075	7.52673
##	2580	8	0.00598	7.53271	0.00598	7.53271
##	2585	5	0.00374	7.53645	0.00374	7.53645
##	2590	3	0.00224	7.53869	0.00224	7.53869
##	2600	1637	1.22393	8.76262	1.22393	8.76262
##	2605	2	0.00150	8.76411	0.00150	8.76411
##	2610	9	0.00673	8.77084	0.00673	8.77084
##	2620	10	0.00748	8.77832	0.00748	8.77832
##	2625	3	0.00224	8.78056	0.00224	8.78056
##	2630	13	0.00972	8.79028	0.00972	8.79028
##	2635	2	0.00150	8.79178	0.00150	8.79178
##	2640	17	0.01271	8.80449	0.01271	8.80449
##	2645	1	0.00075	8.80523	0.00075	8.80523
##	2650	115	0.08598	8.89121	0.08598	8.89121
##	2653	1	0.00075	8.89196	0.00075	8.89196
##	2654	1	0.00075	8.89271	0.00075	8.89271
##	2655	1	0.00075	8.89346	0.00075	8.89346
##	2660	14	0.01047	8.90393	0.01047	8.90393
##	2665	2	0.00150	8.90542	0.00150	8.90542
##	2670	14	0.01047	8.91589	0.01047	8.91589
##	2675	4	0.00299	8.91888	0.00299	8.91888
##	2680	19	0.01421	8.93308	0.01421	8.93308
##	2690	5	0.00374	8.93682	0.00374	8.93682
##	2700	1784	1.33383	10.27065	1.33383	10.27065
##	2705	2	0.00150	10.27215	0.00150	10.27215
##	2706	1	0.00075	10.27290	0.00075	10.27290
##	2710	11	0.00822	10.28112	0.00822	10.28112
##	2715	3	0.00224	10.28336	0.00224	10.28336
##	2720	15	0.01121	10.29458	0.01121	10.29458
##	2725	2	0.00150	10.29607	0.00150	10.29607
##	2730	10	0.00748	10.30355	0.00748	10.30355
##	2735	1	0.00075	10.30430	0.00075	10.30430
##	2740	12	0.00897	10.31327	0.00897	10.31327
##	2750	258	0.19290	10.50617	0.19290	10.50617
##	2760	9	0.00673	10.51290	0.00673	10.51290
##	2765	2	0.00150	10.51439	0.00150	10.51439
##	2770	9	0.00673	10.52112	0.00673	10.52112
##	2775	3	0.00224	10.52336	0.00224	10.52336
##	2779	1	0.00075	10.52411	0.00075	10.52411
##	2780	18	0.01346	10.53757	0.01346	10.53757

##	2785	1	0.00075	10.53832	0.00075	10.53832
##	2790	6	0.00449	10.54280	0.00449	10.54280
##	2800	2925	2.18692	12.72972	2.18692	12.72972
##	2805	2	0.00150	12.73121	0.00150	12.73121
##	2810	7	0.00523	12.73645	0.00523	12.73645
##	2815	3	0.00224	12.73869	0.00224	12.73869
##	2820	18	0.01346	12.75215	0.01346	12.75215
##	2825	5	0.00374	12.75589	0.00374	12.75589
##	2830	13	0.00972	12.76561	0.00972	12.76561
##	2833	1	0.00075	12.76636	0.00075	12.76636
##	2835	3	0.00224	12.76860	0.00224	12.76860
##	2840	12	0.00897	12.77757	0.00897	12.77757
##	2845	1	0.00075	12.77832	0.00075	12.77832
##	2850	161	0.12037	12.89869	0.12037	12.89869
##	2855	2	0.00150	12.90019	0.00150	12.90019
##	2858	1	0.00075	12.90093	0.00075	12.90093
##	2860	13	0.00972	12.91065	0.00972	12.91065
##	2865	1	0.00075	12.91140	0.00075	12.91140
##	2870	15	0.01121	12.92262	0.01121	12.92262
##	2875	6	0.00449	12.92710	0.00449	12.92710
##	2880	12	0.00897	12.93607	0.00897	12.93607
##	2885	2	0.00150	12.93757	0.00150	12.93757
##	2890	6	0.00449	12.94206	0.00449	12.94206
##	2895	2	0.00150	12.94355	0.00150	12.94355
##	2900	2152	1.60897	14.55252	1.60897	14.55252
##	2905	1	0.00075	14.55327	0.00075	14.55327
##	2910	6	0.00449	14.55776	0.00449	14.55776
##	2915	3	0.00224	14.56000	0.00224	14.56000
##	2920	10	0.00748	14.56748	0.00748	14.56748
##	2925	1	0.00075	14.56822	0.00075	14.56822
##	2930	11	0.00822	14.57645	0.00822	14.57645
##	2932	1	0.00075	14.57720	0.00075	14.57720
##	2935	1	0.00075	14.57794	0.00075	14.57794
##	2940	14	0.01047	14.58841	0.01047	14.58841
##	2945	1	0.00075	14.58916	0.00075	14.58916
##	2950	153	0.11439	14.70355	0.11439	14.70355
##	2955	3	0.00224	14.70579	0.00224	14.70579
##	2960	11	0.00822	14.71402	0.00822	14.71402
##	2965	2	0.00150	14.71551	0.00150	14.71551
##	2970	10	0.00748	14.72299	0.00748	14.72299
##	2975	3	0.00224	14.72523	0.00224	14.72523
##	2980	8	0.00598	14.73121	0.00598	14.73121
##	2985	3	0.00224	14.73346	0.00224	14.73346
##	2990	7	0.00523	14.73869	0.00523	14.73869
##	2995	2	0.00150	14.74019	0.00150	14.74019
##	2998	1	0.00075	14.74093	0.00075	14.74093
##	2999	1	0.00075	14.74168	0.00075	14.74168
##	3000	11021	8.24000	22.98168	8.24000	22.98168
##	3004	2	0.00150	22.98318	0.00150	22.98318
##	3005	2	0.00150	22.98467	0.00150	22.98467
##	3006	2	0.00150	22.98617	0.00150	22.98617
##	3008	1	0.00075	22.98692	0.00075	22.98692
##	3009	2	0.00150	22.98841	0.00150	22.98841
##	3010	20	0.01495	23.00336	0.01495	23.00336

##	3015	2	0.00150	23.00486	0.00150	23.00486
##	3016	1	0.00075	23.00561	0.00075	23.00561
##	3019	1	0.00075	23.00636	0.00075	23.00636
##	3020	14	0.01047	23.01682	0.01047	23.01682
##	3025	4	0.00299	23.01981	0.00299	23.01981
##	3030	8	0.00598	23.02579	0.00598	23.02579
##	3035	3	0.00224	23.02804	0.00224	23.02804
##	3040	10	0.00748	23.03551	0.00748	23.03551
##	3042	1	0.00075	23.03626	0.00075	23.03626
##	3045	3	0.00224	23.03850	0.00224	23.03850
##	3048	1	0.00075	23.03925	0.00075	23.03925
##	3050	114	0.08523	23.12449	0.08523	23.12449
##	3055	3	0.00224	23.12673	0.00224	23.12673
##	3060	11	0.00822	23.13495	0.00822	23.13495
##	3063	1	0.00075	23.13570	0.00075	23.13570
##	3070	14	0.01047	23.14617	0.01047	23.14617
##	3075	7	0.00523	23.15140	0.00523	23.15140
##	3080	6	0.00449	23.15589	0.00449	23.15589
##	3083	1	0.00075	23.15664	0.00075	23.15664
##	3085	2	0.00150	23.15813	0.00150	23.15813
##	3090	9	0.00673	23.16486	0.00673	23.16486
##	3095	1	0.00075	23.16561	0.00075	23.16561
##	3099	1	0.00075	23.16636	0.00075	23.16636
##	3100	2520	1.88411	25.05047	1.88411	25.05047
##	3102	2	0.00150	25.05196	0.00150	25.05196
##	3105	2	0.00150	25.05346	0.00150	25.05346
##	3110	22	0.01645	25.06991	0.01645	25.06991
##	3120	30	0.02243	25.09234	0.02243	25.09234
##	3125	9	0.00673	25.09907	0.00673	25.09907
##	3130	6	0.00449	25.10355	0.00449	25.10355
##	3135	2	0.00150	25.10505	0.00150	25.10505
##	3140	12	0.00897	25.11402	0.00897	25.11402
##	3145	2	0.00150	25.11551	0.00150	25.11551
##	3150	170	0.12710	25.24262	0.12710	25.24262
##	3160	13	0.00972	25.25234	0.00972	25.25234
##	3164	1	0.00075	25.25308	0.00075	25.25308
##	3165	1	0.00075	25.25383	0.00075	25.25383
##	3170	7	0.00523	25.25907	0.00523	25.25907
##	3175	3	0.00224	25.26131	0.00224	25.26131
##	3180	15	0.01121	25.27252	0.01121	25.27252
##	3185	2	0.00150	25.27402	0.00150	25.27402
##	3190	6	0.00449	25.27850	0.00449	25.27850
##	3200	3781	2.82692	28.10542	2.82692	28.10542
##	3205	4	0.00299	28.10841	0.00299	28.10841
##	3210	8	0.00598	28.11439	0.00598	28.11439
##	3215	3	0.00224	28.11664	0.00224	28.11664
##	3219	1	0.00075	28.11738	0.00075	28.11738
##	3220	21	0.01570	28.13308	0.01570	28.13308
##	3225	3	0.00224	28.13533	0.00224	28.13533
##	3230	10	0.00748	28.14280	0.00748	28.14280
##	3235	2	0.00150	28.14430	0.00150	28.14430
##	3240	16	0.01196	28.15626	0.01196	28.15626
##	3245	2	0.00150	28.15776	0.00150	28.15776
##	3250	267	0.19963	28.35738	0.19963	28.35738

##	3255	4	0.00299	28.36037	0.00299	28.36037
##	3260	10	0.00748	28.36785	0.00748	28.36785
##	3265	1	0.00075	28.36860	0.00075	28.36860
##	3270	11	0.00822	28.37682	0.00822	28.37682
##	3275	4	0.00299	28.37981	0.00299	28.37981
##	3280	8	0.00598	28.38579	0.00598	28.38579
##	3285	2	0.00150	28.38729	0.00150	28.38729
##	3290	5	0.00374	28.39103	0.00374	28.39103
##	3300	1627	1.21645	29.60748	1.21645	29.60748
##	3306	1	0.00075	29.60822	0.00075	29.60822
##	3310	7	0.00523	29.61346	0.00523	29.61346
##	3315	3	0.00224	29.61570	0.00224	29.61570
##	3318	1	0.00075	29.61645	0.00075	29.61645
##	3320	18	0.01346	29.62991	0.01346	29.62991
##	3325	5	0.00374	29.63364	0.00374	29.63364
##	3330	9	0.00673	29.64037	0.00673	29.64037
##	3333	1	0.00075	29.64112	0.00075	29.64112
##	3335	1	0.00075	29.64187	0.00075	29.64187
##	3340	13	0.00972	29.65159	0.00972	29.65159
##	3345	4	0.00299	29.65458	0.00299	29.65458
##	3350	97	0.07252	29.72710	0.07252	29.72710
##	3354	1	0.00075	29.72785	0.00075	29.72785
##	3355	1	0.00075	29.72860	0.00075	29.72860
##	3360	7	0.00523	29.73383	0.00523	29.73383
##	3365	1	0.00075	29.73458	0.00075	29.73458
##	3370	8	0.00598	29.74056	0.00598	29.74056
##	3375	6	0.00449	29.74505	0.00449	29.74505
##	3380	19	0.01421	29.75925	0.01421	29.75925
##	3385	1	0.00075	29.76000	0.00075	29.76000
##	3390	5	0.00374	29.76374	0.00374	29.76374
##	3399	1	0.00075	29.76449	0.00075	29.76449
##	3400	1872	1.39963	31.16411	1.39963	31.16411
##	3410	7	0.00523	31.16935	0.00523	31.16935
##	3415	1	0.00075	31.17009	0.00075	31.17009
##	3420	10	0.00748	31.17757	0.00748	31.17757
##	3425	2	0.00150	31.17907	0.00150	31.17907
##	3430	13	0.00972	31.18879	0.00972	31.18879
##	3440	4	0.00299	31.19178	0.00299	31.19178
##	3450	108	0.08075	31.27252	0.08075	31.27252
##	3460	9	0.00673	31.27925	0.00673	31.27925
##	3465	2	0.00150	31.28075	0.00150	31.28075
##	3466	1	0.00075	31.28150	0.00075	31.28150
##	3470	5	0.00374	31.28523	0.00374	31.28523
##	3480	11	0.00822	31.29346	0.00822	31.29346
##	3485	1	0.00075	31.29421	0.00075	31.29421
##	3490	3	0.00224	31.29645	0.00224	31.29645
##	3495	1	0.00075	31.29720	0.00075	31.29720
##	3496	1	0.00075	31.29794	0.00075	31.29794
##	3500	4706	3.51850	34.81645	3.51850	34.81645
##	3510	9	0.00673	34.82318	0.00673	34.82318
##	3515	2	0.00150	34.82467	0.00150	34.82467
##	3520	9	0.00673	34.83140	0.00673	34.83140
##	3525	1	0.00075	34.83215	0.00075	34.83215
##	3530	7	0.00523	34.83738	0.00523	34.83738

##	3535	1	0.00075	34.83813	0.00075	34.83813
##	3540	2	0.00150	34.83963	0.00150	34.83963
##	3550	73	0.05458	34.89421	0.05458	34.89421
##	3560	7	0.00523	34.89944	0.00523	34.89944
##	3570	10	0.00748	34.90692	0.00748	34.90692
##	3580	6	0.00449	34.91140	0.00449	34.91140
##	3585	1	0.00075	34.91215	0.00075	34.91215
##	3590	5	0.00374	34.91589	0.00374	34.91589
##	3595	1	0.00075	34.91664	0.00075	34.91664
##	3600	1257	0.93981	35.85645	0.93981	35.85645
##	3608	1	0.00075	35.85720	0.00075	35.85720
##	3610	5	0.00374	35.86093	0.00374	35.86093
##	3620	6	0.00449	35.86542	0.00449	35.86542
##	3625	2	0.00150	35.86692	0.00150	35.86692
##	3630	3	0.00224	35.86916	0.00224	35.86916
##	3640	5	0.00374	35.87290	0.00374	35.87290
##	3650	53	0.03963	35.91252	0.03963	35.91252
##	3660	3	0.00224	35.91477	0.00224	35.91477
##	3665	1	0.00075	35.91551	0.00075	35.91551
##	3670	3	0.00224	35.91776	0.00224	35.91776
##	3675	1	0.00075	35.91850	0.00075	35.91850
##	3680	3	0.00224	35.92075	0.00224	35.92075
##	3685	2	0.00150	35.92224	0.00150	35.92224
##	3690	2	0.00150	35.92374	0.00150	35.92374
##	3700	906	0.67738	36.60112	0.67738	36.60112
##	3705	1	0.00075	36.60187	0.00075	36.60187
##	3708	1	0.00075	36.60262	0.00075	36.60262
##	3710	4	0.00299	36.60561	0.00299	36.60561
##	3715	2	0.00150	36.60710	0.00150	36.60710
##	3720	3	0.00224	36.60935	0.00224	36.60935
##	3725	2	0.00150	36.61084	0.00150	36.61084
##	3727	1	0.00075	36.61159	0.00075	36.61159
##	3730	4	0.00299	36.61458	0.00299	36.61458
##	3740	4	0.00299	36.61757	0.00299	36.61757
##	3745	1	0.00075	36.61832	0.00075	36.61832
##	3750	88	0.06579	36.68411	0.06579	36.68411
##	3760	4	0.00299	36.68710	0.00299	36.68710
##	3765	1	0.00075	36.68785	0.00075	36.68785
##	3770	4	0.00299	36.69084	0.00299	36.69084
##	3775	2	0.00150	36.69234	0.00150	36.69234
##	3780	3	0.00224	36.69458	0.00224	36.69458
##	3790	3	0.00224	36.69682	0.00224	36.69682
##	3795	2	0.00150	36.69832	0.00150	36.69832
##	3800	1243	0.92935	37.62766	0.92935	37.62766
##	3810	2	0.00150	37.62916	0.00150	37.62916
##	3815	1	0.00075	37.62991	0.00075	37.62991
##	3820	3	0.00224	37.63215	0.00224	37.63215
##	3830	2	0.00150	37.63364	0.00150	37.63364
##	3840	2	0.00150	37.63514	0.00150	37.63514
##	3850	50	0.03738	37.67252	0.03738	37.67252
##	3860	2	0.00150	37.67402	0.00150	37.67402
##	3870	2	0.00150	37.67551	0.00150	37.67551
##	3875	1	0.00075	37.67626	0.00075	37.67626
##	3880	2	0.00150	37.67776	0.00150	37.67776

##	3886	1	0.00075	37.67850	0.00075	37.67850
##	3890	4	0.00299	37.68150	0.00299	37.68150
##	3900	651	0.48673	38.16822	0.48673	38.16822
##	3905	1	0.00075	38.16897	0.00075	38.16897
##	3910	3	0.00224	38.17121	0.00224	38.17121
##	3915	1	0.00075	38.17196	0.00075	38.17196
##	3920	1	0.00075	38.17271	0.00075	38.17271
##	3930	1	0.00075	38.17346	0.00075	38.17346
##	3940	3	0.00224	38.17570	0.00224	38.17570
##	3950	25	0.01869	38.19439	0.01869	38.19439
##	3960	3	0.00224	38.19664	0.00224	38.19664
##	3970	1	0.00075	38.19738	0.00075	38.19738
##	3975	1	0.00075	38.19813	0.00075	38.19813
##	3980	1	0.00075	38.19888	0.00075	38.19888
##	3990	4	0.00299	38.20187	0.00299	38.20187
##	3998	1	0.00075	38.20262	0.00075	38.20262
##	4000	2920	2.18318	40.38579	2.18318	40.38579
##	4005	1	0.00075	40.38654	0.00075	40.38654
##	4009	1	0.00075	40.38729	0.00075	40.38729
##	4015	1	0.00075	40.38804	0.00075	40.38804
##	4017	1	0.00075	40.38879	0.00075	40.38879
##	4020	2	0.00150	40.39028	0.00150	40.39028
##	4030	2	0.00150	40.39178	0.00150	40.39178
##	4045	1	0.00075	40.39252	0.00075	40.39252
##	4050	7	0.00523	40.39776	0.00523	40.39776
##	4060	2	0.00150	40.39925	0.00150	40.39925
##	4065	1	0.00075	40.40000	0.00075	40.40000
##	4070	2	0.00150	40.40150	0.00150	40.40150
##	4080	2	0.00150	40.40299	0.00150	40.40299
##	4090	1	0.00075	40.40374	0.00075	40.40374
##	4095	1	0.00075	40.40449	0.00075	40.40449
##	4100	313	0.23402	40.63850	0.23402	40.63850
##	4120	1	0.00075	40.63925	0.00075	40.63925
##	4150	8	0.00598	40.64523	0.00598	40.64523
##	4160	2	0.00150	40.64673	0.00150	40.64673
##	4170	3	0.00224	40.64897	0.00224	40.64897
##	4180	1	0.00075	40.64972	0.00075	40.64972
##	4200	432	0.32299	40.97271	0.32299	40.97271
##	4220	1	0.00075	40.97346	0.00075	40.97346
##	4250	15	0.01121	40.98467	0.01121	40.98467
##	4260	1	0.00075	40.98542	0.00075	40.98542
##	4280	1	0.00075	40.98617	0.00075	40.98617
##	4300	202	0.15103	41.13720	0.15103	41.13720
##	4315	1	0.00075	41.13794	0.00075	41.13794
##	4340	1	0.00075	41.13869	0.00075	41.13869
##	4350	3	0.00224	41.14093	0.00224	41.14093
##	4400	107	0.08000	41.22093	0.08000	41.22093
##	4406	1	0.00075	41.22168	0.00075	41.22168
##	4450	5	0.00374	41.22542	0.00374	41.22542
##	4500	635	0.47477	41.70019	0.47477	41.70019
##	4530	1	0.00075	41.70093	0.00075	41.70093
##	4550	2	0.00150	41.70243	0.00150	41.70243
##	4600	93	0.06953	41.77196	0.06953	41.77196
##	4650	2	0.00150	41.77346	0.00150	41.77346

##	4670	1	0.00075	41.77421	0.00075	41.77421
##	4700	76	0.05682	41.83103	0.05682	41.83103
##	4750	3	0.00224	41.83327	0.00224	41.83327
##	4760	1	0.00075	41.83402	0.00075	41.83402
##	4780	1	0.00075	41.83477	0.00075	41.83477
##	4790	1	0.00075	41.83551	0.00075	41.83551
##	4800	142	0.10617	41.94168	0.10617	41.94168
##	4850	4	0.00299	41.94467	0.00299	41.94467
##	4900	68	0.05084	41.99551	0.05084	41.99551
##	4915	1	0.00075	41.99626	0.00075	41.99626
##	4950	3	0.00224	41.99850	0.00224	41.99850
##	5000	811	0.60636	42.60486	0.60636	42.60486
##	5002	1	0.00075	42.60561	0.00075	42.60561
##	5050	1	0.00075	42.60636	0.00075	42.60636
##	5100	29	0.02168	42.62804	0.02168	42.62804
##	5120	1	0.00075	42.62879	0.00075	42.62879
##	5180	1	0.00075	42.62953	0.00075	42.62953
##	5200	63	0.04710	42.67664	0.04710	42.67664
##	5260	1	0.00075	42.67738	0.00075	42.67738
##	5300	37	0.02766	42.70505	0.02766	42.70505
##	5400	26	0.01944	42.72449	0.01944	42.72449
##	5410	1	0.00075	42.72523	0.00075	42.72523
##	5500	76	0.05682	42.78206	0.05682	42.78206
##	5520	1	0.00075	42.78280	0.00075	42.78280
##	5550	1	0.00075	42.78355	0.00075	42.78355
##	5555	1	0.00075	42.78430	0.00075	42.78430
##	5600	30	0.02243	42.80673	0.02243	42.80673
##	5650	1	0.00075	42.80748	0.00075	42.80748
##	5700	15	0.01121	42.81869	0.01121	42.81869
##	5800	22	0.01645	42.83514	0.01645	42.83514
##	5891	1	0.00075	42.83589	0.00075	42.83589
##	5900	15	0.01121	42.84710	0.01121	42.84710
##	6000	266	0.19888	43.04598	0.19888	43.04598
##	6100	1	0.00075	43.04673	0.00075	43.04673
##	6200	1	0.00075	43.04748	0.00075	43.04748
##	7000	1	0.00075	43.04822	0.00075	43.04822
##	7200	1	0.00075	43.04897	0.00075	43.04897
##	9996	57409	42.92262	85.97159	42.92262	85.97159
##	9998	18727	14.00150	99.97308	14.00150	99.97308
##	9999	36	0.02692	100.00000	0.02692	100.00000
##	<NA>	0			0.00000	100.00000
##	Total	133750	100.00000	100.00000	100.00000	100.00000

```
summary(data$m19)
```

##	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
##	500	3100	9996	7039	9996	9999

9996 : Pas pesé 9998 : NSP

On a des valeurs abérantes sur cette variable de poids à la naissance et de missing. En consultant le codebook de dhs, **9996 représente les enfants non pesés** à la naissance et 9999 les enfants de poids non connu. On va les mettre manquantes

Scindé nos bases de données

```
# Base des enfants non pesés
```

```
data_non_pese <- data %>%  
  filter(m19 == 9996)
```

```
data <-  
  data %>%  
  filter(m19 != 9996)
```

```
data <-  
  data %>%  
  mutate(m19 = if_else(m19 == 9998 | m19 == 9999, NA_real_, m19))
```

```
freq(data$m19)
```

```
## Frequencies
```

```
## data$m19
```

```
## Label: birth weight in kilograms (3 decimals)
```

```
## Type: Numeric
```

```
##
```

##		Freq	% Valid	% Valid Cum.	% Total	% Total Cum.
##	-----					-----
##	500	57	0.0990	0.0990	0.0747	0.0747
##	600	6	0.0104	0.1094	0.0079	0.0825
##	620	1	0.0017	0.1112	0.0013	0.0838
##	625	1	0.0017	0.1129	0.0013	0.0851
##	700	7	0.0122	0.1250	0.0092	0.0943
##	750	3	0.0052	0.1303	0.0039	0.0982
##	800	7	0.0122	0.1424	0.0092	0.1074
##	820	1	0.0017	0.1442	0.0013	0.1087
##	900	7	0.0122	0.1563	0.0092	0.1179
##	950	1	0.0017	0.1580	0.0013	0.1192
##	998	1	0.0017	0.1598	0.0013	0.1205
##	1000	189	0.3283	0.4880	0.2476	0.3681
##	1040	1	0.0017	0.4898	0.0013	0.3694
##	1100	11	0.0191	0.5089	0.0144	0.3838
##	1150	2	0.0035	0.5123	0.0026	0.3864
##	1160	1	0.0017	0.5141	0.0013	0.3877
##	1176	1	0.0017	0.5158	0.0013	0.3890
##	1200	49	0.0851	0.6009	0.0642	0.4532
##	1250	6	0.0104	0.6113	0.0079	0.4611
##	1300	34	0.0591	0.6704	0.0445	0.5056
##	1310	1	0.0017	0.6721	0.0013	0.5069
##	1400	44	0.0764	0.7485	0.0576	0.5646
##	1420	2	0.0035	0.7520	0.0026	0.5672
##	1440	1	0.0017	0.7538	0.0013	0.5685
##	1450	5	0.0087	0.7624	0.0065	0.5751
##	1470	1	0.0017	0.7642	0.0013	0.5764
##	1500	192	0.3335	1.0976	0.2515	0.8279
##	1520	3	0.0052	1.1029	0.0039	0.8318
##	1540	1	0.0017	1.1046	0.0013	0.8331

##	1550	1	0.0017	1.1063	0.0013	0.8344
##	1580	1	0.0017	1.1081	0.0013	0.8357
##	1600	47	0.0816	1.1897	0.0616	0.8973
##	1610	2	0.0035	1.1932	0.0026	0.8999
##	1630	1	0.0017	1.1949	0.0013	0.9012
##	1640	2	0.0035	1.1984	0.0026	0.9038
##	1650	7	0.0122	1.2105	0.0092	0.9130
##	1660	2	0.0035	1.2140	0.0026	0.9156
##	1670	1	0.0017	1.2157	0.0013	0.9169
##	1680	2	0.0035	1.2192	0.0026	0.9196
##	1700	46	0.0799	1.2991	0.0603	0.9798
##	1705	1	0.0017	1.3008	0.0013	0.9811
##	1720	1	0.0017	1.3026	0.0013	0.9824
##	1725	2	0.0035	1.3061	0.0026	0.9851
##	1730	1	0.0017	1.3078	0.0013	0.9864
##	1740	4	0.0069	1.3147	0.0052	0.9916
##	1750	13	0.0226	1.3373	0.0170	1.0086
##	1770	1	0.0017	1.3391	0.0013	1.0099
##	1785	1	0.0017	1.3408	0.0013	1.0113
##	1790	3	0.0052	1.3460	0.0039	1.0152
##	1800	106	0.1841	1.5301	0.1389	1.1540
##	1825	1	0.0017	1.5318	0.0013	1.1553
##	1830	1	0.0017	1.5336	0.0013	1.1567
##	1840	1	0.0017	1.5353	0.0013	1.1580
##	1850	8	0.0139	1.5492	0.0105	1.1684
##	1860	1	0.0017	1.5509	0.0013	1.1698
##	1870	1	0.0017	1.5527	0.0013	1.1711
##	1880	2	0.0035	1.5561	0.0026	1.1737
##	1890	1	0.0017	1.5579	0.0013	1.1750
##	1900	110	0.1910	1.7489	0.1441	1.3191
##	1910	2	0.0035	1.7524	0.0026	1.3217
##	1920	2	0.0035	1.7559	0.0026	1.3243
##	1930	1	0.0017	1.7576	0.0013	1.3256
##	1940	4	0.0069	1.7646	0.0052	1.3309
##	1950	8	0.0139	1.7785	0.0105	1.3413
##	1970	2	0.0035	1.7819	0.0026	1.3440
##	1980	1	0.0017	1.7837	0.0013	1.3453
##	1985	1	0.0017	1.7854	0.0013	1.3466
##	1990	1	0.0017	1.7871	0.0013	1.3479
##	2000	2089	3.6281	5.4153	2.7364	4.0843
##	2005	1	0.0017	5.4170	0.0013	4.0856
##	2008	1	0.0017	5.4187	0.0013	4.0869
##	2010	2	0.0035	5.4222	0.0026	4.0895
##	2020	1	0.0017	5.4239	0.0013	4.0909
##	2025	1	0.0017	5.4257	0.0013	4.0922
##	2030	2	0.0035	5.4292	0.0026	4.0948
##	2040	1	0.0017	5.4309	0.0013	4.0961
##	2048	1	0.0017	5.4326	0.0013	4.0974
##	2050	20	0.0347	5.4674	0.0262	4.1236
##	2052	1	0.0017	5.4691	0.0013	4.1249
##	2055	1	0.0017	5.4708	0.0013	4.1262
##	2065	2	0.0035	5.4743	0.0026	4.1288
##	2070	3	0.0052	5.4795	0.0039	4.1328
##	2075	1	0.0017	5.4813	0.0013	4.1341

##	2080	4	0.0069	5.4882	0.0052	4.1393
##	2083	1	0.0017	5.4899	0.0013	4.1406
##	2085	2	0.0035	5.4934	0.0026	4.1433
##	2090	3	0.0052	5.4986	0.0039	4.1472
##	2094	1	0.0017	5.5004	0.0013	4.1485
##	2095	1	0.0017	5.5021	0.0013	4.1498
##	2100	421	0.7312	6.2333	0.5515	4.7013
##	2110	1	0.0017	6.2350	0.0013	4.7026
##	2115	1	0.0017	6.2368	0.0013	4.7039
##	2120	1	0.0017	6.2385	0.0013	4.7052
##	2125	2	0.0035	6.2420	0.0026	4.7078
##	2130	2	0.0035	6.2454	0.0026	4.7104
##	2145	1	0.0017	6.2472	0.0013	4.7118
##	2150	23	0.0399	6.2871	0.0301	4.7419
##	2152	1	0.0017	6.2889	0.0013	4.7432
##	2155	2	0.0035	6.2923	0.0026	4.7458
##	2160	1	0.0017	6.2941	0.0013	4.7471
##	2170	1	0.0017	6.2958	0.0013	4.7484
##	2175	1	0.0017	6.2975	0.0013	4.7497
##	2180	5	0.0087	6.3062	0.0065	4.7563
##	2200	547	0.9500	7.2562	0.7165	5.4728
##	2210	3	0.0052	7.2615	0.0039	5.4767
##	2220	1	0.0017	7.2632	0.0013	5.4781
##	2225	4	0.0069	7.2701	0.0052	5.4833
##	2230	3	0.0052	7.2753	0.0039	5.4872
##	2235	1	0.0017	7.2771	0.0013	5.4885
##	2240	5	0.0087	7.2858	0.0065	5.4951
##	2250	108	0.1876	7.4733	0.1415	5.6366
##	2252	1	0.0017	7.4751	0.0013	5.6379
##	2255	1	0.0017	7.4768	0.0013	5.6392
##	2256	1	0.0017	7.4786	0.0013	5.6405
##	2260	4	0.0069	7.4855	0.0052	5.6457
##	2270	7	0.0122	7.4977	0.0092	5.6549
##	2275	2	0.0035	7.5011	0.0026	5.6575
##	2280	3	0.0052	7.5063	0.0039	5.6614
##	2285	1	0.0017	7.5081	0.0013	5.6628
##	2290	3	0.0052	7.5133	0.0039	5.6667
##	2300	858	1.4902	9.0034	1.1239	6.7906
##	2310	1	0.0017	9.0052	0.0013	6.7919
##	2320	4	0.0069	9.0121	0.0052	6.7971
##	2325	1	0.0017	9.0139	0.0013	6.7984
##	2330	4	0.0069	9.0208	0.0052	6.8037
##	2340	3	0.0052	9.0260	0.0039	6.8076
##	2345	1	0.0017	9.0278	0.0013	6.8089
##	2346	1	0.0017	9.0295	0.0013	6.8102
##	2347	1	0.0017	9.0312	0.0013	6.8115
##	2350	50	0.0868	9.1181	0.0655	6.8770
##	2355	1	0.0017	9.1198	0.0013	6.8783
##	2360	7	0.0122	9.1320	0.0092	6.8875
##	2365	2	0.0035	9.1354	0.0026	6.8901
##	2370	5	0.0087	9.1441	0.0065	6.8967
##	2380	4	0.0069	9.1511	0.0052	6.9019
##	2390	2	0.0035	9.1545	0.0026	6.9045
##	2395	1	0.0017	9.1563	0.0013	6.9059

##	2400	782	1.3582	10.5144	1.0244	7.9302
##	2410	2	0.0035	10.5179	0.0026	7.9328
##	2415	2	0.0035	10.5214	0.0026	7.9354
##	2420	10	0.0174	10.5387	0.0131	7.9485
##	2430	10	0.0174	10.5561	0.0131	7.9616
##	2440	3	0.0052	10.5613	0.0039	7.9656
##	2450	66	0.1146	10.6760	0.0865	8.0520
##	2460	5	0.0087	10.6846	0.0065	8.0586
##	2465	1	0.0017	10.6864	0.0013	8.0599
##	2470	8	0.0139	10.7003	0.0105	8.0704
##	2475	2	0.0035	10.7037	0.0026	8.0730
##	2480	9	0.0156	10.7194	0.0118	8.0848
##	2485	1	0.0017	10.7211	0.0013	8.0861
##	2490	1	0.0017	10.7228	0.0013	8.0874
##	2500	3732	6.4816	17.2045	4.8886	12.9760
##	2505	2	0.0035	17.2080	0.0026	12.9786
##	2510	7	0.0122	17.2201	0.0092	12.9878
##	2515	2	0.0035	17.2236	0.0026	12.9904
##	2520	15	0.0261	17.2496	0.0196	13.0100
##	2525	2	0.0035	17.2531	0.0026	13.0127
##	2530	11	0.0191	17.2722	0.0144	13.0271
##	2535	1	0.0017	17.2740	0.0013	13.0284
##	2540	10	0.0174	17.2913	0.0131	13.0415
##	2545	1	0.0017	17.2931	0.0013	13.0428
##	2550	87	0.1511	17.4442	0.1140	13.1568
##	2560	12	0.0208	17.4650	0.0157	13.1725
##	2565	1	0.0017	17.4667	0.0013	13.1738
##	2570	9	0.0156	17.4824	0.0118	13.1856
##	2575	1	0.0017	17.4841	0.0013	13.1869
##	2580	8	0.0139	17.4980	0.0105	13.1974
##	2585	5	0.0087	17.5067	0.0065	13.2039
##	2590	3	0.0052	17.5119	0.0039	13.2078
##	2600	1637	2.8431	20.3550	2.1443	15.3522
##	2605	2	0.0035	20.3585	0.0026	15.3548
##	2610	9	0.0156	20.3741	0.0118	15.3666
##	2620	10	0.0174	20.3915	0.0131	15.3797
##	2625	3	0.0052	20.3967	0.0039	15.3836
##	2630	13	0.0226	20.4193	0.0170	15.4006
##	2635	2	0.0035	20.4227	0.0026	15.4033
##	2640	17	0.0295	20.4523	0.0223	15.4255
##	2645	1	0.0017	20.4540	0.0013	15.4268
##	2650	115	0.1997	20.6537	0.1506	15.5775
##	2653	1	0.0017	20.6555	0.0013	15.5788
##	2654	1	0.0017	20.6572	0.0013	15.5801
##	2655	1	0.0017	20.6589	0.0013	15.5814
##	2660	14	0.0243	20.6832	0.0183	15.5997
##	2665	2	0.0035	20.6867	0.0026	15.6024
##	2670	14	0.0243	20.7110	0.0183	15.6207
##	2675	4	0.0069	20.7180	0.0052	15.6259
##	2680	19	0.0330	20.7510	0.0249	15.6508
##	2690	5	0.0087	20.7597	0.0065	15.6574
##	2700	1784	3.0984	23.8581	2.3369	17.9943
##	2705	2	0.0035	23.8615	0.0026	17.9969
##	2706	1	0.0017	23.8633	0.0013	17.9982

##	2710	11	0.0191	23.8824	0.0144	18.0126
##	2715	3	0.0052	23.8876	0.0039	18.0165
##	2720	15	0.0261	23.9136	0.0196	18.0362
##	2725	2	0.0035	23.9171	0.0026	18.0388
##	2730	10	0.0174	23.9345	0.0131	18.0519
##	2735	1	0.0017	23.9362	0.0013	18.0532
##	2740	12	0.0208	23.9571	0.0157	18.0689
##	2750	258	0.4481	24.4052	0.3380	18.4069
##	2760	9	0.0156	24.4208	0.0118	18.4187
##	2765	2	0.0035	24.4243	0.0026	18.4213
##	2770	9	0.0156	24.4399	0.0118	18.4331
##	2775	3	0.0052	24.4451	0.0039	18.4370
##	2779	1	0.0017	24.4468	0.0013	18.4383
##	2780	18	0.0313	24.4781	0.0236	18.4619
##	2785	1	0.0017	24.4798	0.0013	18.4632
##	2790	6	0.0104	24.4903	0.0079	18.4711
##	2800	2925	5.0801	29.5703	3.8315	22.3026
##	2805	2	0.0035	29.5738	0.0026	22.3052
##	2810	7	0.0122	29.5860	0.0092	22.3144
##	2815	3	0.0052	29.5912	0.0039	22.3183
##	2820	18	0.0313	29.6224	0.0236	22.3419
##	2825	5	0.0087	29.6311	0.0065	22.3484
##	2830	13	0.0226	29.6537	0.0170	22.3654
##	2833	1	0.0017	29.6554	0.0013	22.3667
##	2835	3	0.0052	29.6606	0.0039	22.3707
##	2840	12	0.0208	29.6815	0.0157	22.3864
##	2845	1	0.0017	29.6832	0.0013	22.3877
##	2850	161	0.2796	29.9628	0.2109	22.5986
##	2855	2	0.0035	29.9663	0.0026	22.6012
##	2858	1	0.0017	29.9680	0.0013	22.6025
##	2860	13	0.0226	29.9906	0.0170	22.6196
##	2865	1	0.0017	29.9924	0.0013	22.6209
##	2870	15	0.0261	30.0184	0.0196	22.6405
##	2875	6	0.0104	30.0288	0.0079	22.6484
##	2880	12	0.0208	30.0497	0.0157	22.6641
##	2885	2	0.0035	30.0531	0.0026	22.6667
##	2890	6	0.0104	30.0636	0.0079	22.6746
##	2895	2	0.0035	30.0670	0.0026	22.6772
##	2900	2152	3.7375	33.8046	2.8189	25.4961
##	2905	1	0.0017	33.8063	0.0013	25.4974
##	2910	6	0.0104	33.8167	0.0079	25.5053
##	2915	3	0.0052	33.8219	0.0039	25.5092
##	2920	10	0.0174	33.8393	0.0131	25.5223
##	2925	1	0.0017	33.8411	0.0013	25.5236
##	2930	11	0.0191	33.8602	0.0144	25.5380
##	2932	1	0.0017	33.8619	0.0013	25.5394
##	2935	1	0.0017	33.8636	0.0013	25.5407
##	2940	14	0.0243	33.8879	0.0183	25.5590
##	2945	1	0.0017	33.8897	0.0013	25.5603
##	2950	153	0.2657	34.1554	0.2004	25.7607
##	2955	3	0.0052	34.1606	0.0039	25.7647
##	2960	11	0.0191	34.1797	0.0144	25.7791
##	2965	2	0.0035	34.1832	0.0026	25.7817
##	2970	10	0.0174	34.2006	0.0131	25.7948

##	2975	3	0.0052	34.2058	0.0039	25.7987
##	2980	8	0.0139	34.2197	0.0105	25.8092
##	2985	3	0.0052	34.2249	0.0039	25.8131
##	2990	7	0.0122	34.2370	0.0092	25.8223
##	2995	2	0.0035	34.2405	0.0026	25.8249
##	2998	1	0.0017	34.2422	0.0013	25.8262
##	2999	1	0.0017	34.2440	0.0013	25.8275
##	3000	11021	19.1410	53.3850	14.4365	40.2641
##	3004	2	0.0035	53.3884	0.0026	40.2667
##	3005	2	0.0035	53.3919	0.0026	40.2693
##	3006	2	0.0035	53.3954	0.0026	40.2719
##	3008	1	0.0017	53.3971	0.0013	40.2732
##	3009	2	0.0035	53.4006	0.0026	40.2759
##	3010	20	0.0347	53.4353	0.0262	40.3021
##	3015	2	0.0035	53.4388	0.0026	40.3047
##	3016	1	0.0017	53.4406	0.0013	40.3060
##	3019	1	0.0017	53.4423	0.0013	40.3073
##	3020	14	0.0243	53.4666	0.0183	40.3256
##	3025	4	0.0069	53.4735	0.0052	40.3309
##	3030	8	0.0139	53.4874	0.0105	40.3414
##	3035	3	0.0052	53.4927	0.0039	40.3453
##	3040	10	0.0174	53.5100	0.0131	40.3584
##	3042	1	0.0017	53.5118	0.0013	40.3597
##	3045	3	0.0052	53.5170	0.0039	40.3636
##	3048	1	0.0017	53.5187	0.0013	40.3649
##	3050	114	0.1980	53.7167	0.1493	40.5143
##	3055	3	0.0052	53.7219	0.0039	40.5182
##	3060	11	0.0191	53.7410	0.0144	40.5326
##	3063	1	0.0017	53.7427	0.0013	40.5339
##	3070	14	0.0243	53.7671	0.0183	40.5523
##	3075	7	0.0122	53.7792	0.0092	40.5614
##	3080	6	0.0104	53.7896	0.0079	40.5693
##	3083	1	0.0017	53.7914	0.0013	40.5706
##	3085	2	0.0035	53.7949	0.0026	40.5732
##	3090	9	0.0156	53.8105	0.0118	40.5850
##	3095	1	0.0017	53.8122	0.0013	40.5863
##	3099	1	0.0017	53.8140	0.0013	40.5876
##	3100	2520	4.3767	58.1906	3.3010	43.8886
##	3102	2	0.0035	58.1941	0.0026	43.8912
##	3105	2	0.0035	58.1976	0.0026	43.8938
##	3110	22	0.0382	58.2358	0.0288	43.9227
##	3120	30	0.0521	58.2879	0.0393	43.9620
##	3125	9	0.0156	58.3035	0.0118	43.9737
##	3130	6	0.0104	58.3139	0.0079	43.9816
##	3135	2	0.0035	58.3174	0.0026	43.9842
##	3140	12	0.0208	58.3383	0.0157	43.9999
##	3145	2	0.0035	58.3417	0.0026	44.0026
##	3150	170	0.2953	58.6370	0.2227	44.2253
##	3160	13	0.0226	58.6596	0.0170	44.2423
##	3164	1	0.0017	58.6613	0.0013	44.2436
##	3165	1	0.0017	58.6630	0.0013	44.2449
##	3170	7	0.0122	58.6752	0.0092	44.2541
##	3175	3	0.0052	58.6804	0.0039	44.2580
##	3180	15	0.0261	58.7065	0.0196	44.2776

##	3185	2	0.0035	58.7099	0.0026	44.2803
##	3190	6	0.0104	58.7203	0.0079	44.2881
##	3200	3781	6.5667	65.2871	4.9528	49.2409
##	3205	4	0.0069	65.2940	0.0052	49.2461
##	3210	8	0.0139	65.3079	0.0105	49.2566
##	3215	3	0.0052	65.3131	0.0039	49.2606
##	3219	1	0.0017	65.3149	0.0013	49.2619
##	3220	21	0.0365	65.3513	0.0275	49.2894
##	3225	3	0.0052	65.3566	0.0039	49.2933
##	3230	10	0.0174	65.3739	0.0131	49.3064
##	3235	2	0.0035	65.3774	0.0026	49.3090
##	3240	16	0.0278	65.4052	0.0210	49.3300
##	3245	2	0.0035	65.4087	0.0026	49.3326
##	3250	267	0.4637	65.8724	0.3497	49.6823
##	3255	4	0.0069	65.8793	0.0052	49.6876
##	3260	10	0.0174	65.8967	0.0131	49.7007
##	3265	1	0.0017	65.8984	0.0013	49.7020
##	3270	11	0.0191	65.9175	0.0144	49.7164
##	3275	4	0.0069	65.9245	0.0052	49.7216
##	3280	8	0.0139	65.9384	0.0105	49.7321
##	3285	2	0.0035	65.9419	0.0026	49.7347
##	3290	5	0.0087	65.9505	0.0065	49.7413
##	3300	1627	2.8257	68.7763	2.1312	51.8725
##	3306	1	0.0017	68.7780	0.0013	51.8738
##	3310	7	0.0122	68.7902	0.0092	51.8830
##	3315	3	0.0052	68.7954	0.0039	51.8869
##	3318	1	0.0017	68.7971	0.0013	51.8882
##	3320	18	0.0313	68.8284	0.0236	51.9118
##	3325	5	0.0087	68.8371	0.0065	51.9184
##	3330	9	0.0156	68.8527	0.0118	51.9302
##	3333	1	0.0017	68.8544	0.0013	51.9315
##	3335	1	0.0017	68.8562	0.0013	51.9328
##	3340	13	0.0226	68.8787	0.0170	51.9498
##	3345	4	0.0069	68.8857	0.0052	51.9550
##	3350	97	0.1685	69.0542	0.1271	52.0821
##	3354	1	0.0017	69.0559	0.0013	52.0834
##	3355	1	0.0017	69.0576	0.0013	52.0847
##	3360	7	0.0122	69.0698	0.0092	52.0939
##	3365	1	0.0017	69.0715	0.0013	52.0952
##	3370	8	0.0139	69.0854	0.0105	52.1057
##	3375	6	0.0104	69.0958	0.0079	52.1135
##	3380	19	0.0330	69.1288	0.0249	52.1384
##	3385	1	0.0017	69.1306	0.0013	52.1397
##	3390	5	0.0087	69.1393	0.0065	52.1463
##	3399	1	0.0017	69.1410	0.0013	52.1476
##	3400	1872	3.2512	72.3922	2.4522	54.5998
##	3410	7	0.0122	72.4044	0.0092	54.6089
##	3415	1	0.0017	72.4061	0.0013	54.6102
##	3420	10	0.0174	72.4235	0.0131	54.6233
##	3425	2	0.0035	72.4270	0.0026	54.6260
##	3430	13	0.0226	72.4495	0.0170	54.6430
##	3440	4	0.0069	72.4565	0.0052	54.6482
##	3450	108	0.1876	72.6441	0.1415	54.7897
##	3460	9	0.0156	72.6597	0.0118	54.8015

##	3465	2	0.0035	72.6632	0.0026	54.8041
##	3466	1	0.0017	72.6649	0.0013	54.8054
##	3470	5	0.0087	72.6736	0.0065	54.8120
##	3480	11	0.0191	72.6927	0.0144	54.8264
##	3485	1	0.0017	72.6944	0.0013	54.8277
##	3490	3	0.0052	72.6996	0.0039	54.8316
##	3495	1	0.0017	72.7014	0.0013	54.8329
##	3496	1	0.0017	72.7031	0.0013	54.8342
##	3500	4706	8.1733	80.8764	6.1644	60.9987
##	3510	9	0.0156	80.8920	0.0118	61.0105
##	3515	2	0.0035	80.8955	0.0026	61.0131
##	3520	9	0.0156	80.9111	0.0118	61.0249
##	3525	1	0.0017	80.9128	0.0013	61.0262
##	3530	7	0.0122	80.9250	0.0092	61.0354
##	3535	1	0.0017	80.9267	0.0013	61.0367
##	3540	2	0.0035	80.9302	0.0026	61.0393
##	3550	73	0.1268	81.0570	0.0956	61.1349
##	3560	7	0.0122	81.0692	0.0092	61.1441
##	3570	10	0.0174	81.0865	0.0131	61.1572
##	3580	6	0.0104	81.0969	0.0079	61.1650
##	3585	1	0.0017	81.0987	0.0013	61.1663
##	3590	5	0.0087	81.1074	0.0065	61.1729
##	3595	1	0.0017	81.1091	0.0013	61.1742
##	3600	1257	2.1831	83.2922	1.6466	62.8208
##	3608	1	0.0017	83.2940	0.0013	62.8221
##	3610	5	0.0087	83.3027	0.0065	62.8286
##	3620	6	0.0104	83.3131	0.0079	62.8365
##	3625	2	0.0035	83.3165	0.0026	62.8391
##	3630	3	0.0052	83.3218	0.0039	62.8430
##	3640	5	0.0087	83.3304	0.0065	62.8496
##	3650	53	0.0920	83.4225	0.0694	62.9190
##	3660	3	0.0052	83.4277	0.0039	62.9229
##	3665	1	0.0017	83.4294	0.0013	62.9242
##	3670	3	0.0052	83.4346	0.0039	62.9282
##	3675	1	0.0017	83.4364	0.0013	62.9295
##	3680	3	0.0052	83.4416	0.0039	62.9334
##	3685	2	0.0035	83.4451	0.0026	62.9360
##	3690	2	0.0035	83.4485	0.0026	62.9387
##	3700	906	1.5735	85.0221	1.1868	64.1254
##	3705	1	0.0017	85.0238	0.0013	64.1267
##	3708	1	0.0017	85.0255	0.0013	64.1281
##	3710	4	0.0069	85.0325	0.0052	64.1333
##	3715	2	0.0035	85.0360	0.0026	64.1359
##	3720	3	0.0052	85.0412	0.0039	64.1398
##	3725	2	0.0035	85.0446	0.0026	64.1425
##	3727	1	0.0017	85.0464	0.0013	64.1438
##	3730	4	0.0069	85.0533	0.0052	64.1490
##	3740	4	0.0069	85.0603	0.0052	64.1543
##	3745	1	0.0017	85.0620	0.0013	64.1556
##	3750	88	0.1528	85.2148	0.1153	64.2708
##	3760	4	0.0069	85.2218	0.0052	64.2761
##	3765	1	0.0017	85.2235	0.0013	64.2774
##	3770	4	0.0069	85.2305	0.0052	64.2826
##	3775	2	0.0035	85.2339	0.0026	64.2852

##	3780	3	0.0052	85.2392	0.0039	64.2892
##	3790	3	0.0052	85.2444	0.0039	64.2931
##	3795	2	0.0035	85.2478	0.0026	64.2957
##	3800	1243	2.1588	87.4066	1.6282	65.9239
##	3810	2	0.0035	87.4101	0.0026	65.9266
##	3815	1	0.0017	87.4119	0.0013	65.9279
##	3820	3	0.0052	87.4171	0.0039	65.9318
##	3830	2	0.0035	87.4205	0.0026	65.9344
##	3840	2	0.0035	87.4240	0.0026	65.9370
##	3850	50	0.0868	87.5109	0.0655	66.0025
##	3860	2	0.0035	87.5143	0.0026	66.0052
##	3870	2	0.0035	87.5178	0.0026	66.0078
##	3875	1	0.0017	87.5195	0.0013	66.0091
##	3880	2	0.0035	87.5230	0.0026	66.0117
##	3886	1	0.0017	87.5247	0.0013	66.0130
##	3890	4	0.0069	87.5317	0.0052	66.0183
##	3900	651	1.1306	88.6623	0.8528	66.8710
##	3905	1	0.0017	88.6641	0.0013	66.8723
##	3910	3	0.0052	88.6693	0.0039	66.8763
##	3915	1	0.0017	88.6710	0.0013	66.8776
##	3920	1	0.0017	88.6728	0.0013	66.8789
##	3930	1	0.0017	88.6745	0.0013	66.8802
##	3940	3	0.0052	88.6797	0.0039	66.8841
##	3950	25	0.0434	88.7231	0.0327	66.9169
##	3960	3	0.0052	88.7283	0.0039	66.9208
##	3970	1	0.0017	88.7301	0.0013	66.9221
##	3975	1	0.0017	88.7318	0.0013	66.9234
##	3980	1	0.0017	88.7335	0.0013	66.9247
##	3990	4	0.0069	88.7405	0.0052	66.9300
##	3998	1	0.0017	88.7422	0.0013	66.9313
##	4000	2920	5.0714	93.8136	3.8249	70.7562
##	4005	1	0.0017	93.8153	0.0013	70.7575
##	4009	1	0.0017	93.8171	0.0013	70.7588
##	4015	1	0.0017	93.8188	0.0013	70.7601
##	4017	1	0.0017	93.8206	0.0013	70.7615
##	4020	2	0.0035	93.8240	0.0026	70.7641
##	4030	2	0.0035	93.8275	0.0026	70.7667
##	4045	1	0.0017	93.8292	0.0013	70.7680
##	4050	7	0.0122	93.8414	0.0092	70.7772
##	4060	2	0.0035	93.8449	0.0026	70.7798
##	4065	1	0.0017	93.8466	0.0013	70.7811
##	4070	2	0.0035	93.8501	0.0026	70.7837
##	4080	2	0.0035	93.8536	0.0026	70.7863
##	4090	1	0.0017	93.8553	0.0013	70.7877
##	4095	1	0.0017	93.8570	0.0013	70.7890
##	4100	313	0.5436	94.4006	0.4100	71.1990
##	4120	1	0.0017	94.4024	0.0013	71.2003
##	4150	8	0.0139	94.4163	0.0105	71.2108
##	4160	2	0.0035	94.4197	0.0026	71.2134
##	4170	3	0.0052	94.4250	0.0039	71.2173
##	4180	1	0.0017	94.4267	0.0013	71.2186
##	4200	432	0.7503	95.1770	0.5659	71.7845
##	4220	1	0.0017	95.1787	0.0013	71.7858
##	4250	15	0.0261	95.2048	0.0196	71.8055

##	4260	1	0.0017	95.2065	0.0013	71.8068
##	4280	1	0.0017	95.2082	0.0013	71.8081
##	4300	202	0.3508	95.5591	0.2646	72.0727
##	4315	1	0.0017	95.5608	0.0013	72.0740
##	4340	1	0.0017	95.5625	0.0013	72.0753
##	4350	3	0.0052	95.5678	0.0039	72.0792
##	4400	107	0.1858	95.7536	0.1402	72.2194
##	4406	1	0.0017	95.7553	0.0013	72.2207
##	4450	5	0.0087	95.7640	0.0065	72.2272
##	4500	635	1.1029	96.8669	0.8318	73.0590
##	4530	1	0.0017	96.8686	0.0013	73.0603
##	4550	2	0.0035	96.8721	0.0026	73.0630
##	4600	93	0.1615	97.0336	0.1218	73.1848
##	4650	2	0.0035	97.0371	0.0026	73.1874
##	4670	1	0.0017	97.0388	0.0013	73.1887
##	4700	76	0.1320	97.1708	0.0996	73.2883
##	4750	3	0.0052	97.1760	0.0039	73.2922
##	4760	1	0.0017	97.1777	0.0013	73.2935
##	4780	1	0.0017	97.1795	0.0013	73.2948
##	4790	1	0.0017	97.1812	0.0013	73.2961
##	4800	142	0.2466	97.4278	0.1860	73.4821
##	4850	4	0.0069	97.4348	0.0052	73.4874
##	4900	68	0.1181	97.5529	0.0891	73.5765
##	4915	1	0.0017	97.5546	0.0013	73.5778
##	4950	3	0.0052	97.5598	0.0039	73.5817
##	5000	811	1.4085	98.9684	1.0623	74.6440
##	5002	1	0.0017	98.9701	0.0013	74.6453
##	5050	1	0.0017	98.9718	0.0013	74.6467
##	5100	29	0.0504	99.0222	0.0380	74.6846
##	5120	1	0.0017	99.0239	0.0013	74.6859
##	5180	1	0.0017	99.0257	0.0013	74.6873
##	5200	63	0.1094	99.1351	0.0825	74.7698
##	5260	1	0.0017	99.1368	0.0013	74.7711
##	5300	37	0.0643	99.2011	0.0485	74.8196
##	5400	26	0.0452	99.2462	0.0341	74.8536
##	5410	1	0.0017	99.2480	0.0013	74.8549
##	5500	76	0.1320	99.3800	0.0996	74.9545
##	5520	1	0.0017	99.3817	0.0013	74.9558
##	5550	1	0.0017	99.3834	0.0013	74.9571
##	5555	1	0.0017	99.3852	0.0013	74.9584
##	5600	30	0.0521	99.4373	0.0393	74.9977
##	5650	1	0.0017	99.4390	0.0013	74.9990
##	5700	15	0.0261	99.4651	0.0196	75.0187
##	5800	22	0.0382	99.5033	0.0288	75.0475
##	5891	1	0.0017	99.5050	0.0013	75.0488
##	5900	15	0.0261	99.5311	0.0196	75.0684
##	6000	266	0.4620	99.9931	0.3484	75.4169
##	6100	1	0.0017	99.9948	0.0013	75.4182
##	6200	1	0.0017	99.9965	0.0013	75.4195
##	7000	1	0.0017	99.9983	0.0013	75.4208
##	7200	1	0.0017	100.0000	0.0013	75.4221
##	<NA>	18763			24.5779	100.0000
##	Total	76341	100.0000	100.0000	100.0000	100.0000

Important de comprendre les NA

```
data$m19[data$m19 == 9996] <- NA_real_
data$m19[data$m19 == 9998] <- NA_real_
freq(data$m19)
```

```
## Frequencies
## data$m19
## Label: birth weight in kilograms (3 decimals)
## Type: Numeric
##
```

	Freq	% Valid	% Valid Cum.	% Total	% Total Cum.
500	57	0.0990	0.0990	0.0747	0.0747
600	6	0.0104	0.1094	0.0079	0.0825
620	1	0.0017	0.1112	0.0013	0.0838
625	1	0.0017	0.1129	0.0013	0.0851
700	7	0.0122	0.1250	0.0092	0.0943
750	3	0.0052	0.1303	0.0039	0.0982
800	7	0.0122	0.1424	0.0092	0.1074
820	1	0.0017	0.1442	0.0013	0.1087
900	7	0.0122	0.1563	0.0092	0.1179
950	1	0.0017	0.1580	0.0013	0.1192
998	1	0.0017	0.1598	0.0013	0.1205
1000	189	0.3283	0.4880	0.2476	0.3681
1040	1	0.0017	0.4898	0.0013	0.3694
1100	11	0.0191	0.5089	0.0144	0.3838
1150	2	0.0035	0.5123	0.0026	0.3864
1160	1	0.0017	0.5141	0.0013	0.3877
1176	1	0.0017	0.5158	0.0013	0.3890
1200	49	0.0851	0.6009	0.0642	0.4532
1250	6	0.0104	0.6113	0.0079	0.4611
1300	34	0.0591	0.6704	0.0445	0.5056
1310	1	0.0017	0.6721	0.0013	0.5069
1400	44	0.0764	0.7485	0.0576	0.5646
1420	2	0.0035	0.7520	0.0026	0.5672
1440	1	0.0017	0.7538	0.0013	0.5685
1450	5	0.0087	0.7624	0.0065	0.5751
1470	1	0.0017	0.7642	0.0013	0.5764
1500	192	0.3335	1.0976	0.2515	0.8279
1520	3	0.0052	1.1029	0.0039	0.8318
1540	1	0.0017	1.1046	0.0013	0.8331
1550	1	0.0017	1.1063	0.0013	0.8344
1580	1	0.0017	1.1081	0.0013	0.8357
1600	47	0.0816	1.1897	0.0616	0.8973
1610	2	0.0035	1.1932	0.0026	0.8999
1630	1	0.0017	1.1949	0.0013	0.9012
1640	2	0.0035	1.1984	0.0026	0.9038
1650	7	0.0122	1.2105	0.0092	0.9130
1660	2	0.0035	1.2140	0.0026	0.9156
1670	1	0.0017	1.2157	0.0013	0.9169

##	1680	2	0.0035	1.2192	0.0026	0.9196
##	1700	46	0.0799	1.2991	0.0603	0.9798
##	1705	1	0.0017	1.3008	0.0013	0.9811
##	1720	1	0.0017	1.3026	0.0013	0.9824
##	1725	2	0.0035	1.3061	0.0026	0.9851
##	1730	1	0.0017	1.3078	0.0013	0.9864
##	1740	4	0.0069	1.3147	0.0052	0.9916
##	1750	13	0.0226	1.3373	0.0170	1.0086
##	1770	1	0.0017	1.3391	0.0013	1.0099
##	1785	1	0.0017	1.3408	0.0013	1.0113
##	1790	3	0.0052	1.3460	0.0039	1.0152
##	1800	106	0.1841	1.5301	0.1389	1.1540
##	1825	1	0.0017	1.5318	0.0013	1.1553
##	1830	1	0.0017	1.5336	0.0013	1.1567
##	1840	1	0.0017	1.5353	0.0013	1.1580
##	1850	8	0.0139	1.5492	0.0105	1.1684
##	1860	1	0.0017	1.5509	0.0013	1.1698
##	1870	1	0.0017	1.5527	0.0013	1.1711
##	1880	2	0.0035	1.5561	0.0026	1.1737
##	1890	1	0.0017	1.5579	0.0013	1.1750
##	1900	110	0.1910	1.7489	0.1441	1.3191
##	1910	2	0.0035	1.7524	0.0026	1.3217
##	1920	2	0.0035	1.7559	0.0026	1.3243
##	1930	1	0.0017	1.7576	0.0013	1.3256
##	1940	4	0.0069	1.7646	0.0052	1.3309
##	1950	8	0.0139	1.7785	0.0105	1.3413
##	1970	2	0.0035	1.7819	0.0026	1.3440
##	1980	1	0.0017	1.7837	0.0013	1.3453
##	1985	1	0.0017	1.7854	0.0013	1.3466
##	1990	1	0.0017	1.7871	0.0013	1.3479
##	2000	2089	3.6281	5.4153	2.7364	4.0843
##	2005	1	0.0017	5.4170	0.0013	4.0856
##	2008	1	0.0017	5.4187	0.0013	4.0869
##	2010	2	0.0035	5.4222	0.0026	4.0895
##	2020	1	0.0017	5.4239	0.0013	4.0909
##	2025	1	0.0017	5.4257	0.0013	4.0922
##	2030	2	0.0035	5.4292	0.0026	4.0948
##	2040	1	0.0017	5.4309	0.0013	4.0961
##	2048	1	0.0017	5.4326	0.0013	4.0974
##	2050	20	0.0347	5.4674	0.0262	4.1236
##	2052	1	0.0017	5.4691	0.0013	4.1249
##	2055	1	0.0017	5.4708	0.0013	4.1262
##	2065	2	0.0035	5.4743	0.0026	4.1288
##	2070	3	0.0052	5.4795	0.0039	4.1328
##	2075	1	0.0017	5.4813	0.0013	4.1341
##	2080	4	0.0069	5.4882	0.0052	4.1393
##	2083	1	0.0017	5.4899	0.0013	4.1406
##	2085	2	0.0035	5.4934	0.0026	4.1433
##	2090	3	0.0052	5.4986	0.0039	4.1472
##	2094	1	0.0017	5.5004	0.0013	4.1485
##	2095	1	0.0017	5.5021	0.0013	4.1498
##	2100	421	0.7312	6.2333	0.5515	4.7013
##	2110	1	0.0017	6.2350	0.0013	4.7026
##	2115	1	0.0017	6.2368	0.0013	4.7039

##	2120	1	0.0017	6.2385	0.0013	4.7052
##	2125	2	0.0035	6.2420	0.0026	4.7078
##	2130	2	0.0035	6.2454	0.0026	4.7104
##	2145	1	0.0017	6.2472	0.0013	4.7118
##	2150	23	0.0399	6.2871	0.0301	4.7419
##	2152	1	0.0017	6.2889	0.0013	4.7432
##	2155	2	0.0035	6.2923	0.0026	4.7458
##	2160	1	0.0017	6.2941	0.0013	4.7471
##	2170	1	0.0017	6.2958	0.0013	4.7484
##	2175	1	0.0017	6.2975	0.0013	4.7497
##	2180	5	0.0087	6.3062	0.0065	4.7563
##	2200	547	0.9500	7.2562	0.7165	5.4728
##	2210	3	0.0052	7.2615	0.0039	5.4767
##	2220	1	0.0017	7.2632	0.0013	5.4781
##	2225	4	0.0069	7.2701	0.0052	5.4833
##	2230	3	0.0052	7.2753	0.0039	5.4872
##	2235	1	0.0017	7.2771	0.0013	5.4885
##	2240	5	0.0087	7.2858	0.0065	5.4951
##	2250	108	0.1876	7.4733	0.1415	5.6366
##	2252	1	0.0017	7.4751	0.0013	5.6379
##	2255	1	0.0017	7.4768	0.0013	5.6392
##	2256	1	0.0017	7.4786	0.0013	5.6405
##	2260	4	0.0069	7.4855	0.0052	5.6457
##	2270	7	0.0122	7.4977	0.0092	5.6549
##	2275	2	0.0035	7.5011	0.0026	5.6575
##	2280	3	0.0052	7.5063	0.0039	5.6614
##	2285	1	0.0017	7.5081	0.0013	5.6628
##	2290	3	0.0052	7.5133	0.0039	5.6667
##	2300	858	1.4902	9.0034	1.1239	6.7906
##	2310	1	0.0017	9.0052	0.0013	6.7919
##	2320	4	0.0069	9.0121	0.0052	6.7971
##	2325	1	0.0017	9.0139	0.0013	6.7984
##	2330	4	0.0069	9.0208	0.0052	6.8037
##	2340	3	0.0052	9.0260	0.0039	6.8076
##	2345	1	0.0017	9.0278	0.0013	6.8089
##	2346	1	0.0017	9.0295	0.0013	6.8102
##	2347	1	0.0017	9.0312	0.0013	6.8115
##	2350	50	0.0868	9.1181	0.0655	6.8770
##	2355	1	0.0017	9.1198	0.0013	6.8783
##	2360	7	0.0122	9.1320	0.0092	6.8875
##	2365	2	0.0035	9.1354	0.0026	6.8901
##	2370	5	0.0087	9.1441	0.0065	6.8967
##	2380	4	0.0069	9.1511	0.0052	6.9019
##	2390	2	0.0035	9.1545	0.0026	6.9045
##	2395	1	0.0017	9.1563	0.0013	6.9059
##	2400	782	1.3582	10.5144	1.0244	7.9302
##	2410	2	0.0035	10.5179	0.0026	7.9328
##	2415	2	0.0035	10.5214	0.0026	7.9354
##	2420	10	0.0174	10.5387	0.0131	7.9485
##	2430	10	0.0174	10.5561	0.0131	7.9616
##	2440	3	0.0052	10.5613	0.0039	7.9656
##	2450	66	0.1146	10.6760	0.0865	8.0520
##	2460	5	0.0087	10.6846	0.0065	8.0586
##	2465	1	0.0017	10.6864	0.0013	8.0599

##	2470	8	0.0139	10.7003	0.0105	8.0704
##	2475	2	0.0035	10.7037	0.0026	8.0730
##	2480	9	0.0156	10.7194	0.0118	8.0848
##	2485	1	0.0017	10.7211	0.0013	8.0861
##	2490	1	0.0017	10.7228	0.0013	8.0874
##	2500	3732	6.4816	17.2045	4.8886	12.9760
##	2505	2	0.0035	17.2080	0.0026	12.9786
##	2510	7	0.0122	17.2201	0.0092	12.9878
##	2515	2	0.0035	17.2236	0.0026	12.9904
##	2520	15	0.0261	17.2496	0.0196	13.0100
##	2525	2	0.0035	17.2531	0.0026	13.0127
##	2530	11	0.0191	17.2722	0.0144	13.0271
##	2535	1	0.0017	17.2740	0.0013	13.0284
##	2540	10	0.0174	17.2913	0.0131	13.0415
##	2545	1	0.0017	17.2931	0.0013	13.0428
##	2550	87	0.1511	17.4442	0.1140	13.1568
##	2560	12	0.0208	17.4650	0.0157	13.1725
##	2565	1	0.0017	17.4667	0.0013	13.1738
##	2570	9	0.0156	17.4824	0.0118	13.1856
##	2575	1	0.0017	17.4841	0.0013	13.1869
##	2580	8	0.0139	17.4980	0.0105	13.1974
##	2585	5	0.0087	17.5067	0.0065	13.2039
##	2590	3	0.0052	17.5119	0.0039	13.2078
##	2600	1637	2.8431	20.3550	2.1443	15.3522
##	2605	2	0.0035	20.3585	0.0026	15.3548
##	2610	9	0.0156	20.3741	0.0118	15.3666
##	2620	10	0.0174	20.3915	0.0131	15.3797
##	2625	3	0.0052	20.3967	0.0039	15.3836
##	2630	13	0.0226	20.4193	0.0170	15.4006
##	2635	2	0.0035	20.4227	0.0026	15.4033
##	2640	17	0.0295	20.4523	0.0223	15.4255
##	2645	1	0.0017	20.4540	0.0013	15.4268
##	2650	115	0.1997	20.6537	0.1506	15.5775
##	2653	1	0.0017	20.6555	0.0013	15.5788
##	2654	1	0.0017	20.6572	0.0013	15.5801
##	2655	1	0.0017	20.6589	0.0013	15.5814
##	2660	14	0.0243	20.6832	0.0183	15.5997
##	2665	2	0.0035	20.6867	0.0026	15.6024
##	2670	14	0.0243	20.7110	0.0183	15.6207
##	2675	4	0.0069	20.7180	0.0052	15.6259
##	2680	19	0.0330	20.7510	0.0249	15.6508
##	2690	5	0.0087	20.7597	0.0065	15.6574
##	2700	1784	3.0984	23.8581	2.3369	17.9943
##	2705	2	0.0035	23.8615	0.0026	17.9969
##	2706	1	0.0017	23.8633	0.0013	17.9982
##	2710	11	0.0191	23.8824	0.0144	18.0126
##	2715	3	0.0052	23.8876	0.0039	18.0165
##	2720	15	0.0261	23.9136	0.0196	18.0362
##	2725	2	0.0035	23.9171	0.0026	18.0388
##	2730	10	0.0174	23.9345	0.0131	18.0519
##	2735	1	0.0017	23.9362	0.0013	18.0532
##	2740	12	0.0208	23.9571	0.0157	18.0689
##	2750	258	0.4481	24.4052	0.3380	18.4069
##	2760	9	0.0156	24.4208	0.0118	18.4187

##	2765	2	0.0035	24.4243	0.0026	18.4213
##	2770	9	0.0156	24.4399	0.0118	18.4331
##	2775	3	0.0052	24.4451	0.0039	18.4370
##	2779	1	0.0017	24.4468	0.0013	18.4383
##	2780	18	0.0313	24.4781	0.0236	18.4619
##	2785	1	0.0017	24.4798	0.0013	18.4632
##	2790	6	0.0104	24.4903	0.0079	18.4711
##	2800	2925	5.0801	29.5703	3.8315	22.3026
##	2805	2	0.0035	29.5738	0.0026	22.3052
##	2810	7	0.0122	29.5860	0.0092	22.3144
##	2815	3	0.0052	29.5912	0.0039	22.3183
##	2820	18	0.0313	29.6224	0.0236	22.3419
##	2825	5	0.0087	29.6311	0.0065	22.3484
##	2830	13	0.0226	29.6537	0.0170	22.3654
##	2833	1	0.0017	29.6554	0.0013	22.3667
##	2835	3	0.0052	29.6606	0.0039	22.3707
##	2840	12	0.0208	29.6815	0.0157	22.3864
##	2845	1	0.0017	29.6832	0.0013	22.3877
##	2850	161	0.2796	29.9628	0.2109	22.5986
##	2855	2	0.0035	29.9663	0.0026	22.6012
##	2858	1	0.0017	29.9680	0.0013	22.6025
##	2860	13	0.0226	29.9906	0.0170	22.6196
##	2865	1	0.0017	29.9924	0.0013	22.6209
##	2870	15	0.0261	30.0184	0.0196	22.6405
##	2875	6	0.0104	30.0288	0.0079	22.6484
##	2880	12	0.0208	30.0497	0.0157	22.6641
##	2885	2	0.0035	30.0531	0.0026	22.6667
##	2890	6	0.0104	30.0636	0.0079	22.6746
##	2895	2	0.0035	30.0670	0.0026	22.6772
##	2900	2152	3.7375	33.8046	2.8189	25.4961
##	2905	1	0.0017	33.8063	0.0013	25.4974
##	2910	6	0.0104	33.8167	0.0079	25.5053
##	2915	3	0.0052	33.8219	0.0039	25.5092
##	2920	10	0.0174	33.8393	0.0131	25.5223
##	2925	1	0.0017	33.8411	0.0013	25.5236
##	2930	11	0.0191	33.8602	0.0144	25.5380
##	2932	1	0.0017	33.8619	0.0013	25.5394
##	2935	1	0.0017	33.8636	0.0013	25.5407
##	2940	14	0.0243	33.8879	0.0183	25.5590
##	2945	1	0.0017	33.8897	0.0013	25.5603
##	2950	153	0.2657	34.1554	0.2004	25.7607
##	2955	3	0.0052	34.1606	0.0039	25.7647
##	2960	11	0.0191	34.1797	0.0144	25.7791
##	2965	2	0.0035	34.1832	0.0026	25.7817
##	2970	10	0.0174	34.2006	0.0131	25.7948
##	2975	3	0.0052	34.2058	0.0039	25.7987
##	2980	8	0.0139	34.2197	0.0105	25.8092
##	2985	3	0.0052	34.2249	0.0039	25.8131
##	2990	7	0.0122	34.2370	0.0092	25.8223
##	2995	2	0.0035	34.2405	0.0026	25.8249
##	2998	1	0.0017	34.2422	0.0013	25.8262
##	2999	1	0.0017	34.2440	0.0013	25.8275
##	3000	11021	19.1410	53.3850	14.4365	40.2641
##	3004	2	0.0035	53.3884	0.0026	40.2667

##	3005	2	0.0035	53.3919	0.0026	40.2693
##	3006	2	0.0035	53.3954	0.0026	40.2719
##	3008	1	0.0017	53.3971	0.0013	40.2732
##	3009	2	0.0035	53.4006	0.0026	40.2759
##	3010	20	0.0347	53.4353	0.0262	40.3021
##	3015	2	0.0035	53.4388	0.0026	40.3047
##	3016	1	0.0017	53.4406	0.0013	40.3060
##	3019	1	0.0017	53.4423	0.0013	40.3073
##	3020	14	0.0243	53.4666	0.0183	40.3256
##	3025	4	0.0069	53.4735	0.0052	40.3309
##	3030	8	0.0139	53.4874	0.0105	40.3414
##	3035	3	0.0052	53.4927	0.0039	40.3453
##	3040	10	0.0174	53.5100	0.0131	40.3584
##	3042	1	0.0017	53.5118	0.0013	40.3597
##	3045	3	0.0052	53.5170	0.0039	40.3636
##	3048	1	0.0017	53.5187	0.0013	40.3649
##	3050	114	0.1980	53.7167	0.1493	40.5143
##	3055	3	0.0052	53.7219	0.0039	40.5182
##	3060	11	0.0191	53.7410	0.0144	40.5326
##	3063	1	0.0017	53.7427	0.0013	40.5339
##	3070	14	0.0243	53.7671	0.0183	40.5523
##	3075	7	0.0122	53.7792	0.0092	40.5614
##	3080	6	0.0104	53.7896	0.0079	40.5693
##	3083	1	0.0017	53.7914	0.0013	40.5706
##	3085	2	0.0035	53.7949	0.0026	40.5732
##	3090	9	0.0156	53.8105	0.0118	40.5850
##	3095	1	0.0017	53.8122	0.0013	40.5863
##	3099	1	0.0017	53.8140	0.0013	40.5876
##	3100	2520	4.3767	58.1906	3.3010	43.8886
##	3102	2	0.0035	58.1941	0.0026	43.8912
##	3105	2	0.0035	58.1976	0.0026	43.8938
##	3110	22	0.0382	58.2358	0.0288	43.9227
##	3120	30	0.0521	58.2879	0.0393	43.9620
##	3125	9	0.0156	58.3035	0.0118	43.9737
##	3130	6	0.0104	58.3139	0.0079	43.9816
##	3135	2	0.0035	58.3174	0.0026	43.9842
##	3140	12	0.0208	58.3383	0.0157	43.9999
##	3145	2	0.0035	58.3417	0.0026	44.0026
##	3150	170	0.2953	58.6370	0.2227	44.2253
##	3160	13	0.0226	58.6596	0.0170	44.2423
##	3164	1	0.0017	58.6613	0.0013	44.2436
##	3165	1	0.0017	58.6630	0.0013	44.2449
##	3170	7	0.0122	58.6752	0.0092	44.2541
##	3175	3	0.0052	58.6804	0.0039	44.2580
##	3180	15	0.0261	58.7065	0.0196	44.2776
##	3185	2	0.0035	58.7099	0.0026	44.2803
##	3190	6	0.0104	58.7203	0.0079	44.2881
##	3200	3781	6.5667	65.2871	4.9528	49.2409
##	3205	4	0.0069	65.2940	0.0052	49.2461
##	3210	8	0.0139	65.3079	0.0105	49.2566
##	3215	3	0.0052	65.3131	0.0039	49.2606
##	3219	1	0.0017	65.3149	0.0013	49.2619
##	3220	21	0.0365	65.3513	0.0275	49.2894
##	3225	3	0.0052	65.3566	0.0039	49.2933

##	3230	10	0.0174	65.3739	0.0131	49.3064
##	3235	2	0.0035	65.3774	0.0026	49.3090
##	3240	16	0.0278	65.4052	0.0210	49.3300
##	3245	2	0.0035	65.4087	0.0026	49.3326
##	3250	267	0.4637	65.8724	0.3497	49.6823
##	3255	4	0.0069	65.8793	0.0052	49.6876
##	3260	10	0.0174	65.8967	0.0131	49.7007
##	3265	1	0.0017	65.8984	0.0013	49.7020
##	3270	11	0.0191	65.9175	0.0144	49.7164
##	3275	4	0.0069	65.9245	0.0052	49.7216
##	3280	8	0.0139	65.9384	0.0105	49.7321
##	3285	2	0.0035	65.9419	0.0026	49.7347
##	3290	5	0.0087	65.9505	0.0065	49.7413
##	3300	1627	2.8257	68.7763	2.1312	51.8725
##	3306	1	0.0017	68.7780	0.0013	51.8738
##	3310	7	0.0122	68.7902	0.0092	51.8830
##	3315	3	0.0052	68.7954	0.0039	51.8869
##	3318	1	0.0017	68.7971	0.0013	51.8882
##	3320	18	0.0313	68.8284	0.0236	51.9118
##	3325	5	0.0087	68.8371	0.0065	51.9184
##	3330	9	0.0156	68.8527	0.0118	51.9302
##	3333	1	0.0017	68.8544	0.0013	51.9315
##	3335	1	0.0017	68.8562	0.0013	51.9328
##	3340	13	0.0226	68.8787	0.0170	51.9498
##	3345	4	0.0069	68.8857	0.0052	51.9550
##	3350	97	0.1685	69.0542	0.1271	52.0821
##	3354	1	0.0017	69.0559	0.0013	52.0834
##	3355	1	0.0017	69.0576	0.0013	52.0847
##	3360	7	0.0122	69.0698	0.0092	52.0939
##	3365	1	0.0017	69.0715	0.0013	52.0952
##	3370	8	0.0139	69.0854	0.0105	52.1057
##	3375	6	0.0104	69.0958	0.0079	52.1135
##	3380	19	0.0330	69.1288	0.0249	52.1384
##	3385	1	0.0017	69.1306	0.0013	52.1397
##	3390	5	0.0087	69.1393	0.0065	52.1463
##	3399	1	0.0017	69.1410	0.0013	52.1476
##	3400	1872	3.2512	72.3922	2.4522	54.5998
##	3410	7	0.0122	72.4044	0.0092	54.6089
##	3415	1	0.0017	72.4061	0.0013	54.6102
##	3420	10	0.0174	72.4235	0.0131	54.6233
##	3425	2	0.0035	72.4270	0.0026	54.6260
##	3430	13	0.0226	72.4495	0.0170	54.6430
##	3440	4	0.0069	72.4565	0.0052	54.6482
##	3450	108	0.1876	72.6441	0.1415	54.7897
##	3460	9	0.0156	72.6597	0.0118	54.8015
##	3465	2	0.0035	72.6632	0.0026	54.8041
##	3466	1	0.0017	72.6649	0.0013	54.8054
##	3470	5	0.0087	72.6736	0.0065	54.8120
##	3480	11	0.0191	72.6927	0.0144	54.8264
##	3485	1	0.0017	72.6944	0.0013	54.8277
##	3490	3	0.0052	72.6996	0.0039	54.8316
##	3495	1	0.0017	72.7014	0.0013	54.8329
##	3496	1	0.0017	72.7031	0.0013	54.8342
##	3500	4706	8.1733	80.8764	6.1644	60.9987

##	3510	9	0.0156	80.8920	0.0118	61.0105
##	3515	2	0.0035	80.8955	0.0026	61.0131
##	3520	9	0.0156	80.9111	0.0118	61.0249
##	3525	1	0.0017	80.9128	0.0013	61.0262
##	3530	7	0.0122	80.9250	0.0092	61.0354
##	3535	1	0.0017	80.9267	0.0013	61.0367
##	3540	2	0.0035	80.9302	0.0026	61.0393
##	3550	73	0.1268	81.0570	0.0956	61.1349
##	3560	7	0.0122	81.0692	0.0092	61.1441
##	3570	10	0.0174	81.0865	0.0131	61.1572
##	3580	6	0.0104	81.0969	0.0079	61.1650
##	3585	1	0.0017	81.0987	0.0013	61.1663
##	3590	5	0.0087	81.1074	0.0065	61.1729
##	3595	1	0.0017	81.1091	0.0013	61.1742
##	3600	1257	2.1831	83.2922	1.6466	62.8208
##	3608	1	0.0017	83.2940	0.0013	62.8221
##	3610	5	0.0087	83.3027	0.0065	62.8286
##	3620	6	0.0104	83.3131	0.0079	62.8365
##	3625	2	0.0035	83.3165	0.0026	62.8391
##	3630	3	0.0052	83.3218	0.0039	62.8430
##	3640	5	0.0087	83.3304	0.0065	62.8496
##	3650	53	0.0920	83.4225	0.0694	62.9190
##	3660	3	0.0052	83.4277	0.0039	62.9229
##	3665	1	0.0017	83.4294	0.0013	62.9242
##	3670	3	0.0052	83.4346	0.0039	62.9282
##	3675	1	0.0017	83.4364	0.0013	62.9295
##	3680	3	0.0052	83.4416	0.0039	62.9334
##	3685	2	0.0035	83.4451	0.0026	62.9360
##	3690	2	0.0035	83.4485	0.0026	62.9387
##	3700	906	1.5735	85.0221	1.1868	64.1254
##	3705	1	0.0017	85.0238	0.0013	64.1267
##	3708	1	0.0017	85.0255	0.0013	64.1281
##	3710	4	0.0069	85.0325	0.0052	64.1333
##	3715	2	0.0035	85.0360	0.0026	64.1359
##	3720	3	0.0052	85.0412	0.0039	64.1398
##	3725	2	0.0035	85.0446	0.0026	64.1425
##	3727	1	0.0017	85.0464	0.0013	64.1438
##	3730	4	0.0069	85.0533	0.0052	64.1490
##	3740	4	0.0069	85.0603	0.0052	64.1543
##	3745	1	0.0017	85.0620	0.0013	64.1556
##	3750	88	0.1528	85.2148	0.1153	64.2708
##	3760	4	0.0069	85.2218	0.0052	64.2761
##	3765	1	0.0017	85.2235	0.0013	64.2774
##	3770	4	0.0069	85.2305	0.0052	64.2826
##	3775	2	0.0035	85.2339	0.0026	64.2852
##	3780	3	0.0052	85.2392	0.0039	64.2892
##	3790	3	0.0052	85.2444	0.0039	64.2931
##	3795	2	0.0035	85.2478	0.0026	64.2957
##	3800	1243	2.1588	87.4066	1.6282	65.9239
##	3810	2	0.0035	87.4101	0.0026	65.9266
##	3815	1	0.0017	87.4119	0.0013	65.9279
##	3820	3	0.0052	87.4171	0.0039	65.9318
##	3830	2	0.0035	87.4205	0.0026	65.9344
##	3840	2	0.0035	87.4240	0.0026	65.9370

##	3850	50	0.0868	87.5109	0.0655	66.0025
##	3860	2	0.0035	87.5143	0.0026	66.0052
##	3870	2	0.0035	87.5178	0.0026	66.0078
##	3875	1	0.0017	87.5195	0.0013	66.0091
##	3880	2	0.0035	87.5230	0.0026	66.0117
##	3886	1	0.0017	87.5247	0.0013	66.0130
##	3890	4	0.0069	87.5317	0.0052	66.0183
##	3900	651	1.1306	88.6623	0.8528	66.8710
##	3905	1	0.0017	88.6641	0.0013	66.8723
##	3910	3	0.0052	88.6693	0.0039	66.8763
##	3915	1	0.0017	88.6710	0.0013	66.8776
##	3920	1	0.0017	88.6728	0.0013	66.8789
##	3930	1	0.0017	88.6745	0.0013	66.8802
##	3940	3	0.0052	88.6797	0.0039	66.8841
##	3950	25	0.0434	88.7231	0.0327	66.9169
##	3960	3	0.0052	88.7283	0.0039	66.9208
##	3970	1	0.0017	88.7301	0.0013	66.9221
##	3975	1	0.0017	88.7318	0.0013	66.9234
##	3980	1	0.0017	88.7335	0.0013	66.9247
##	3990	4	0.0069	88.7405	0.0052	66.9300
##	3998	1	0.0017	88.7422	0.0013	66.9313
##	4000	2920	5.0714	93.8136	3.8249	70.7562
##	4005	1	0.0017	93.8153	0.0013	70.7575
##	4009	1	0.0017	93.8171	0.0013	70.7588
##	4015	1	0.0017	93.8188	0.0013	70.7601
##	4017	1	0.0017	93.8206	0.0013	70.7615
##	4020	2	0.0035	93.8240	0.0026	70.7641
##	4030	2	0.0035	93.8275	0.0026	70.7667
##	4045	1	0.0017	93.8292	0.0013	70.7680
##	4050	7	0.0122	93.8414	0.0092	70.7772
##	4060	2	0.0035	93.8449	0.0026	70.7798
##	4065	1	0.0017	93.8466	0.0013	70.7811
##	4070	2	0.0035	93.8501	0.0026	70.7837
##	4080	2	0.0035	93.8536	0.0026	70.7863
##	4090	1	0.0017	93.8553	0.0013	70.7877
##	4095	1	0.0017	93.8570	0.0013	70.7890
##	4100	313	0.5436	94.4006	0.4100	71.1990
##	4120	1	0.0017	94.4024	0.0013	71.2003
##	4150	8	0.0139	94.4163	0.0105	71.2108
##	4160	2	0.0035	94.4197	0.0026	71.2134
##	4170	3	0.0052	94.4250	0.0039	71.2173
##	4180	1	0.0017	94.4267	0.0013	71.2186
##	4200	432	0.7503	95.1770	0.5659	71.7845
##	4220	1	0.0017	95.1787	0.0013	71.7858
##	4250	15	0.0261	95.2048	0.0196	71.8055
##	4260	1	0.0017	95.2065	0.0013	71.8068
##	4280	1	0.0017	95.2082	0.0013	71.8081
##	4300	202	0.3508	95.5591	0.2646	72.0727
##	4315	1	0.0017	95.5608	0.0013	72.0740
##	4340	1	0.0017	95.5625	0.0013	72.0753
##	4350	3	0.0052	95.5678	0.0039	72.0792
##	4400	107	0.1858	95.7536	0.1402	72.2194
##	4406	1	0.0017	95.7553	0.0013	72.2207
##	4450	5	0.0087	95.7640	0.0065	72.2272

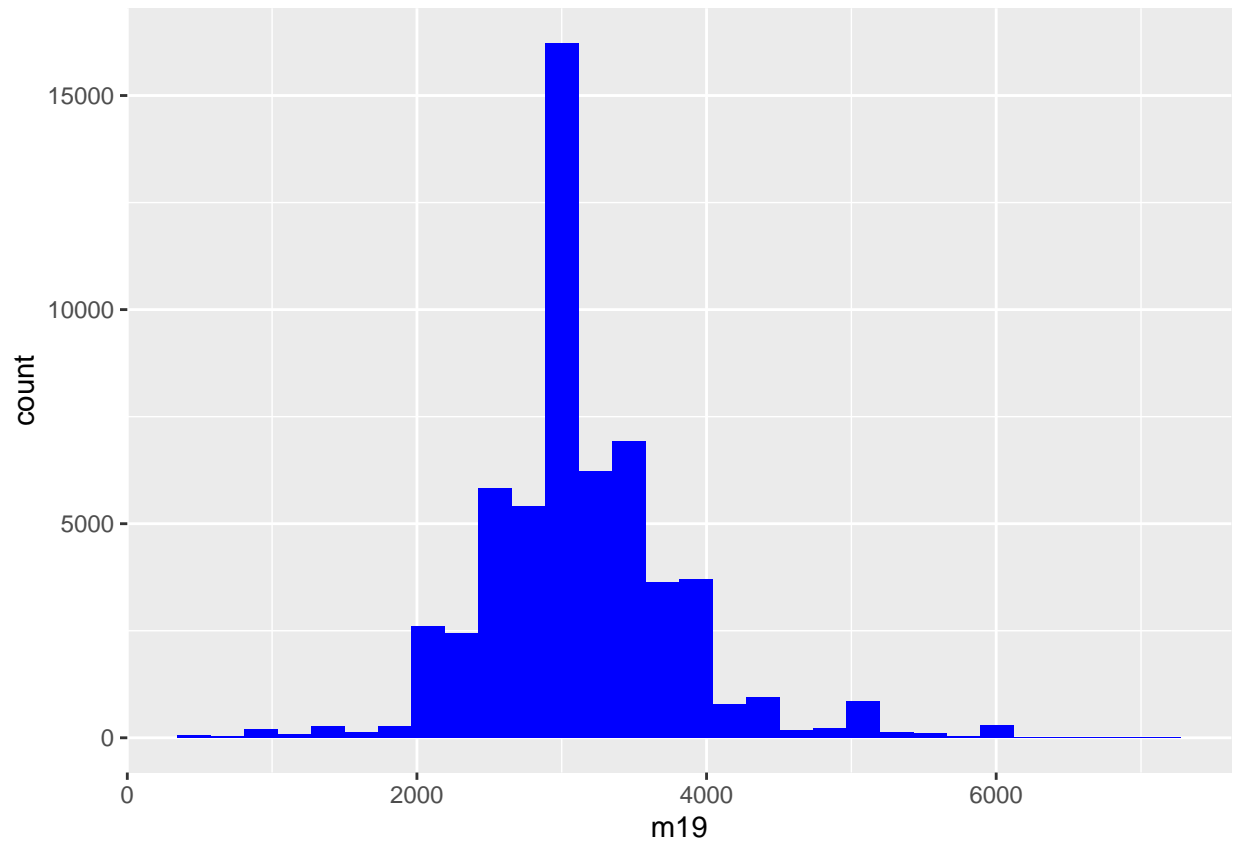
##	4500	635	1.1029	96.8669	0.8318	73.0590
##	4530	1	0.0017	96.8686	0.0013	73.0603
##	4550	2	0.0035	96.8721	0.0026	73.0630
##	4600	93	0.1615	97.0336	0.1218	73.1848
##	4650	2	0.0035	97.0371	0.0026	73.1874
##	4670	1	0.0017	97.0388	0.0013	73.1887
##	4700	76	0.1320	97.1708	0.0996	73.2883
##	4750	3	0.0052	97.1760	0.0039	73.2922
##	4760	1	0.0017	97.1777	0.0013	73.2935
##	4780	1	0.0017	97.1795	0.0013	73.2948
##	4790	1	0.0017	97.1812	0.0013	73.2961
##	4800	142	0.2466	97.4278	0.1860	73.4821
##	4850	4	0.0069	97.4348	0.0052	73.4874
##	4900	68	0.1181	97.5529	0.0891	73.5765
##	4915	1	0.0017	97.5546	0.0013	73.5778
##	4950	3	0.0052	97.5598	0.0039	73.5817
##	5000	811	1.4085	98.9684	1.0623	74.6440
##	5002	1	0.0017	98.9701	0.0013	74.6453
##	5050	1	0.0017	98.9718	0.0013	74.6467
##	5100	29	0.0504	99.0222	0.0380	74.6846
##	5120	1	0.0017	99.0239	0.0013	74.6859
##	5180	1	0.0017	99.0257	0.0013	74.6873
##	5200	63	0.1094	99.1351	0.0825	74.7698
##	5260	1	0.0017	99.1368	0.0013	74.7711
##	5300	37	0.0643	99.2011	0.0485	74.8196
##	5400	26	0.0452	99.2462	0.0341	74.8536
##	5410	1	0.0017	99.2480	0.0013	74.8549
##	5500	76	0.1320	99.3800	0.0996	74.9545
##	5520	1	0.0017	99.3817	0.0013	74.9558
##	5550	1	0.0017	99.3834	0.0013	74.9571
##	5555	1	0.0017	99.3852	0.0013	74.9584
##	5600	30	0.0521	99.4373	0.0393	74.9977
##	5650	1	0.0017	99.4390	0.0013	74.9990
##	5700	15	0.0261	99.4651	0.0196	75.0187
##	5800	22	0.0382	99.5033	0.0288	75.0475
##	5891	1	0.0017	99.5050	0.0013	75.0488
##	5900	15	0.0261	99.5311	0.0196	75.0684
##	6000	266	0.4620	99.9931	0.3484	75.4169
##	6100	1	0.0017	99.9948	0.0013	75.4182
##	6200	1	0.0017	99.9965	0.0013	75.4195
##	7000	1	0.0017	99.9983	0.0013	75.4208
##	7200	1	0.0017	100.0000	0.0013	75.4221
##	<NA>	18763			24.5779	100.0000
##	Total	76341	100.0000	100.0000	100.0000	100.0000

Visualisation

```
ggplot(data) +
  geom_histogram(aes(x = m19), fill="blue")
```

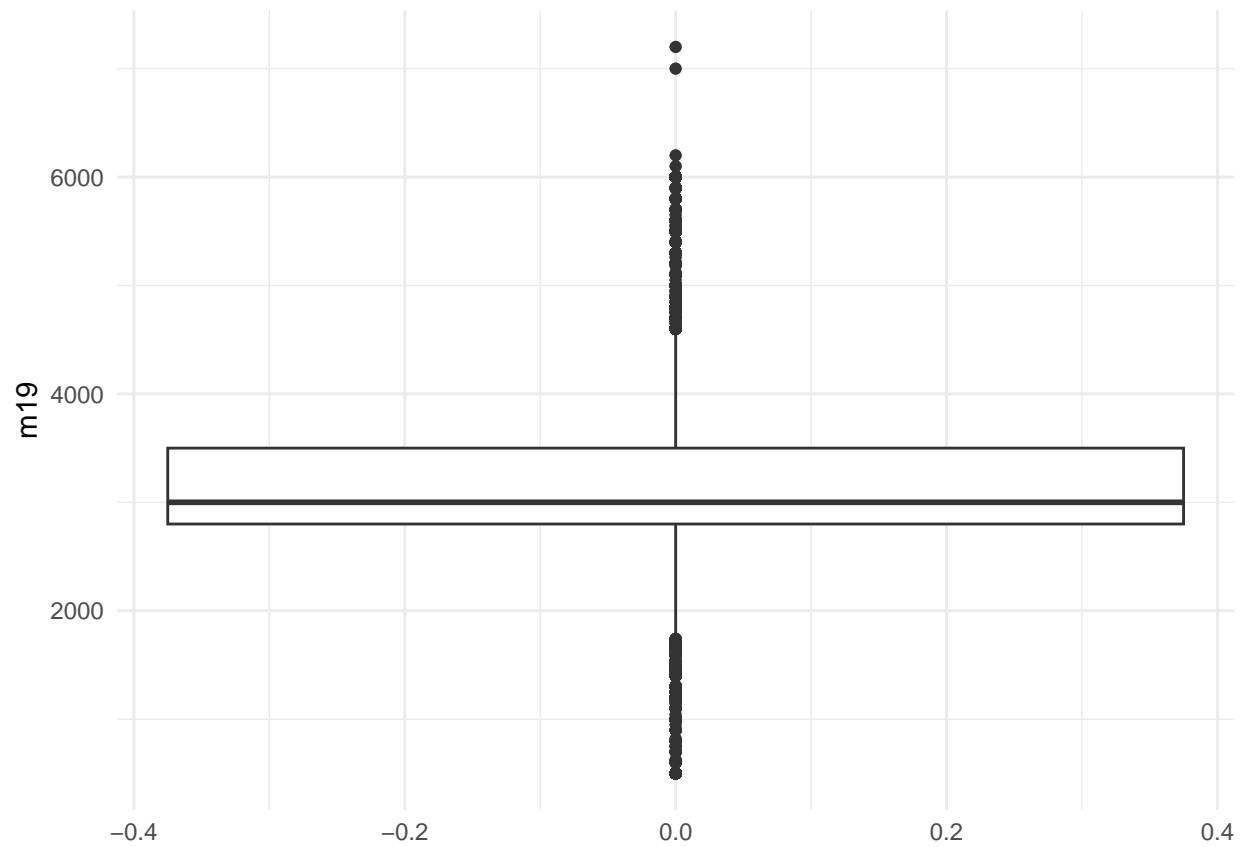
```
## 'stat_bin()' using 'bins = 30'. Pick better value with 'binwidth'.
```

```
## Warning: Removed 18763 rows containing non-finite values ('stat_bin()').
```



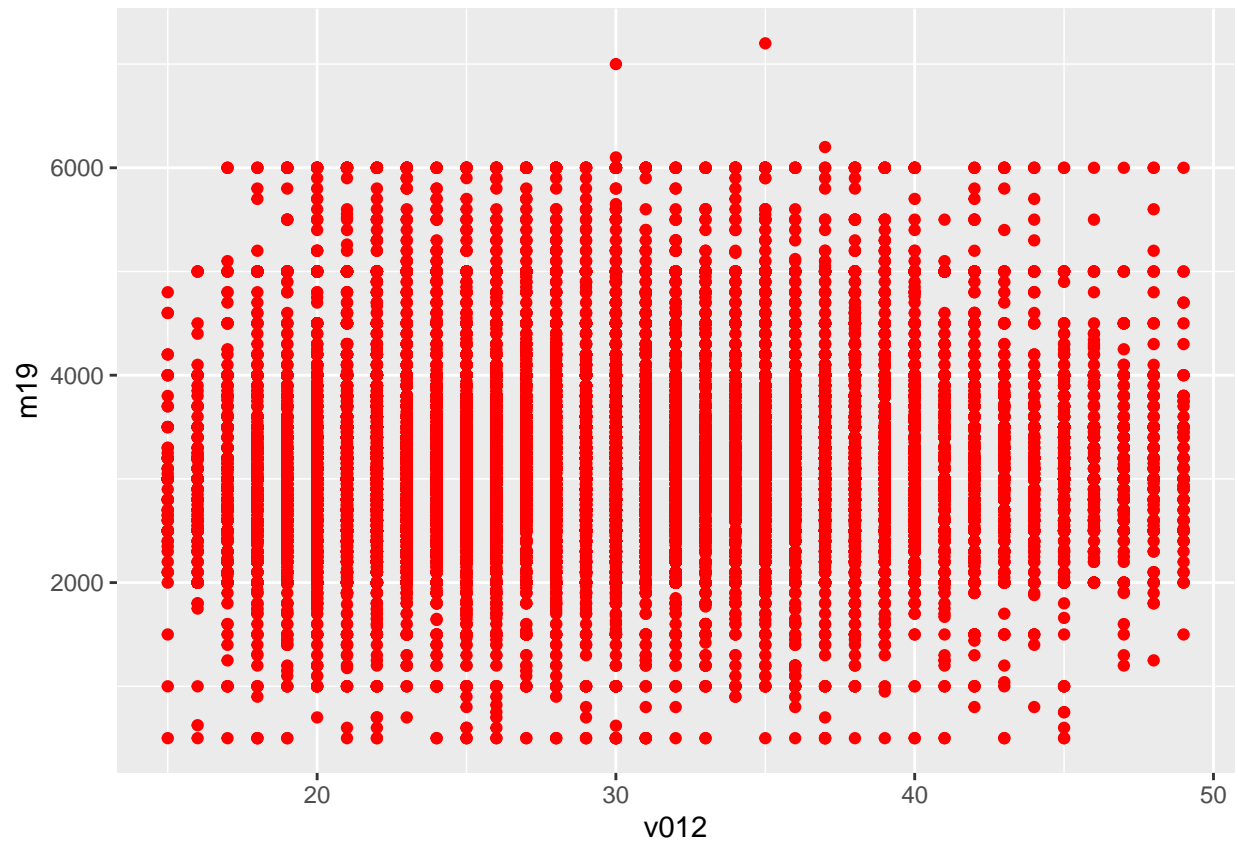
```
ggplot(data) +  
  geom_boxplot(aes(y = m19)) +  
  theme_minimal()
```

```
## Warning: Removed 18763 rows containing non-finite values ('stat_boxplot()').
```



```
ggplot(data) +  
  geom_point(aes(x = v012, y = m19), color="red")
```

```
## Warning: Removed 18763 rows containing missing values ('geom_point()').
```

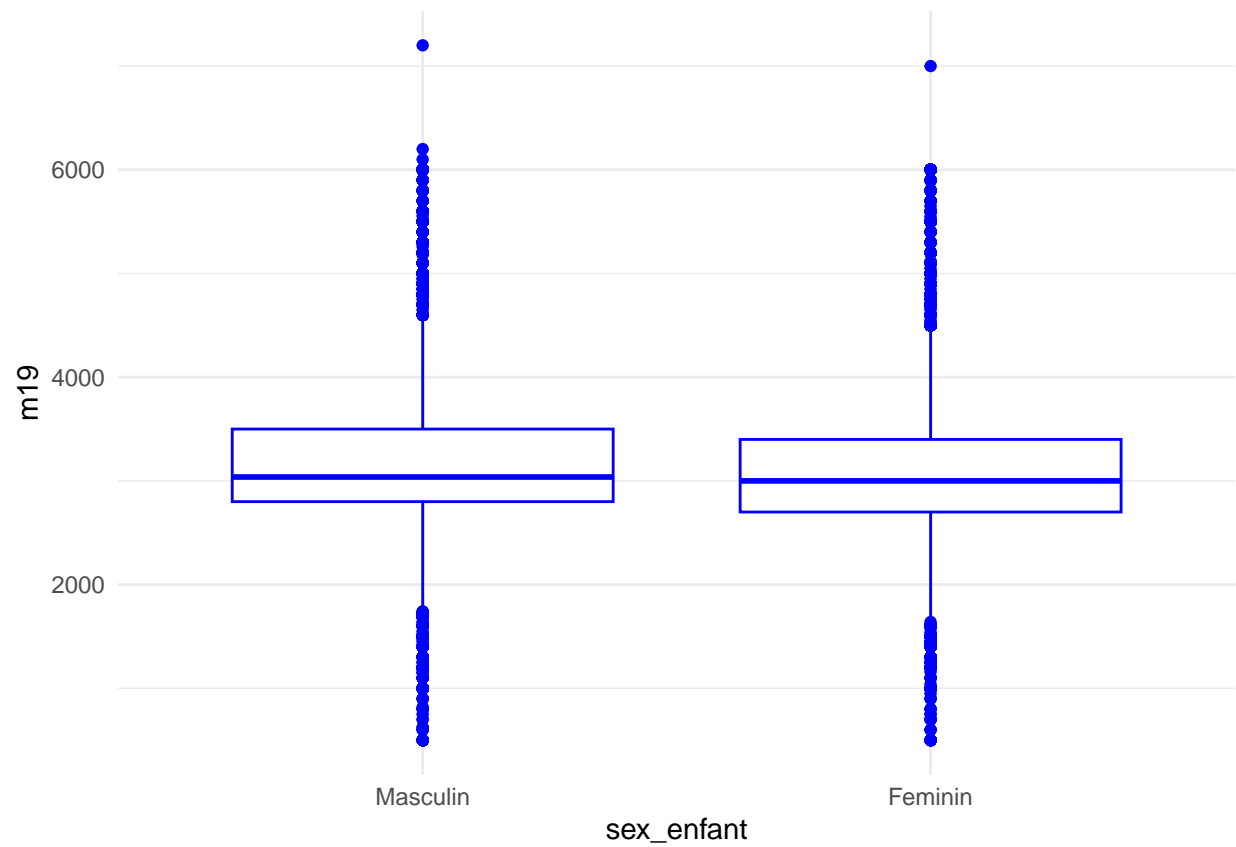


Association avec les prédicteurs et quelque visualisation

- Box plot du poids à la naissance selon certaine caractéristiques

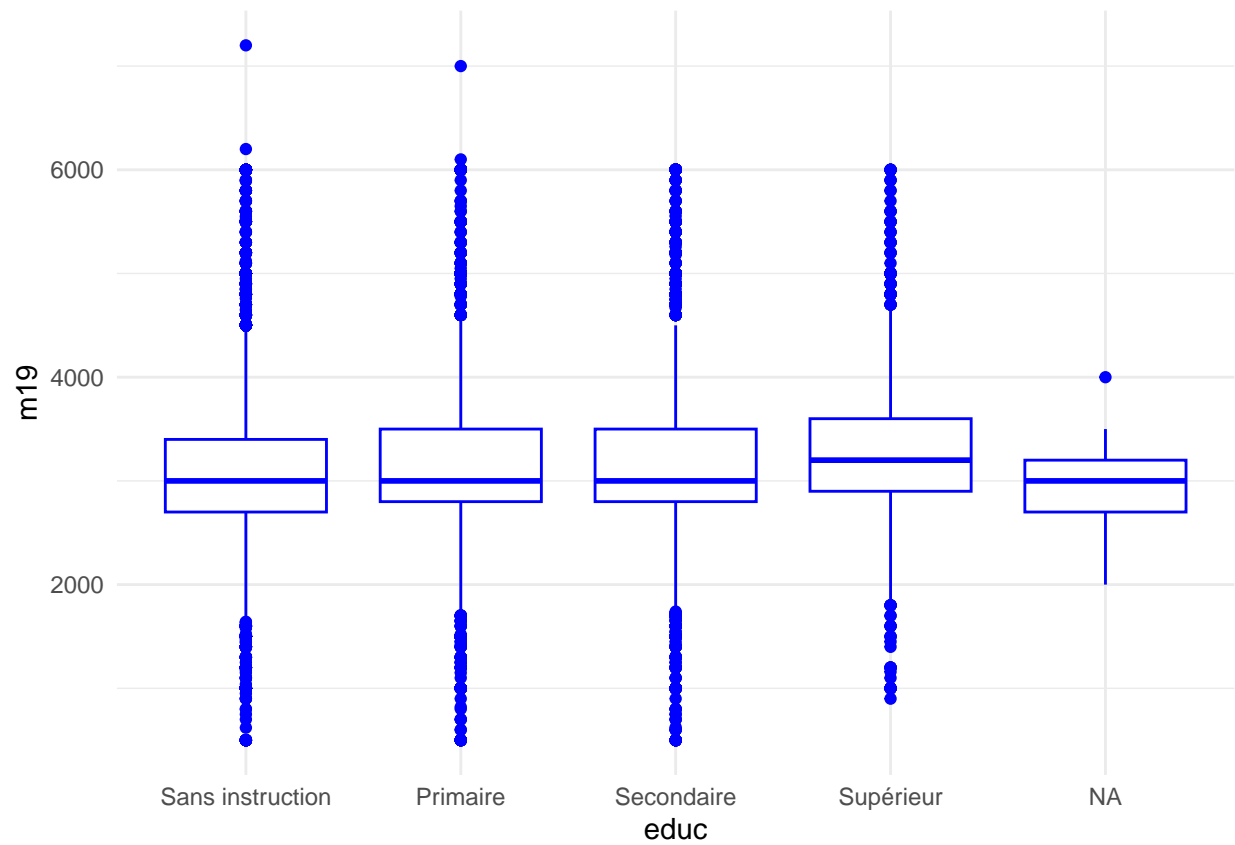
```
ggplot(data) +
  geom_boxplot(aes(x = sex_enfant, y = m19), color="blue")+
  theme_minimal()
```

```
## Warning: Removed 18763 rows containing non-finite values ('stat_boxplot()').
```



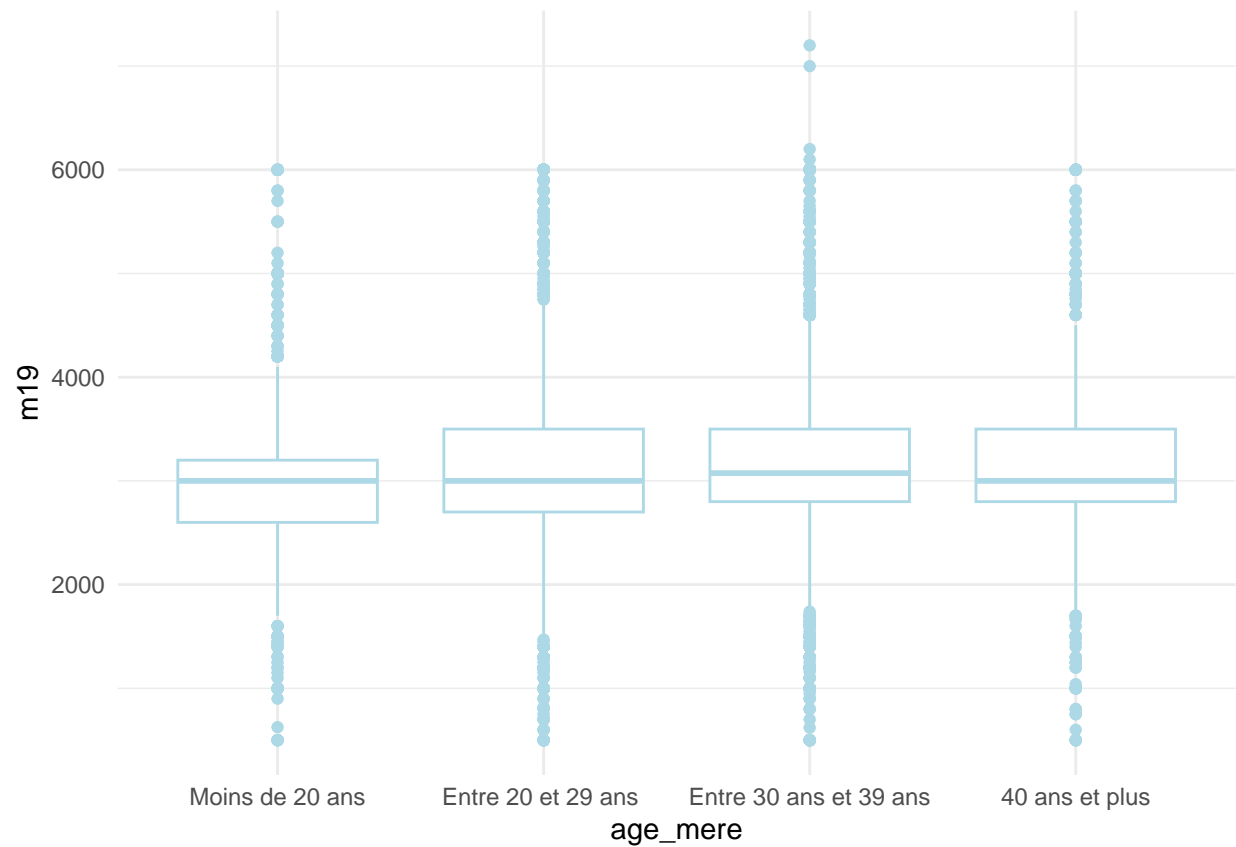
```
ggplot(data) +  
  geom_boxplot(aes(x = educ, y = m19), color="blue")+  
  theme_minimal()
```

Warning: Removed 18763 rows containing non-finite values (‘stat_boxplot()’).



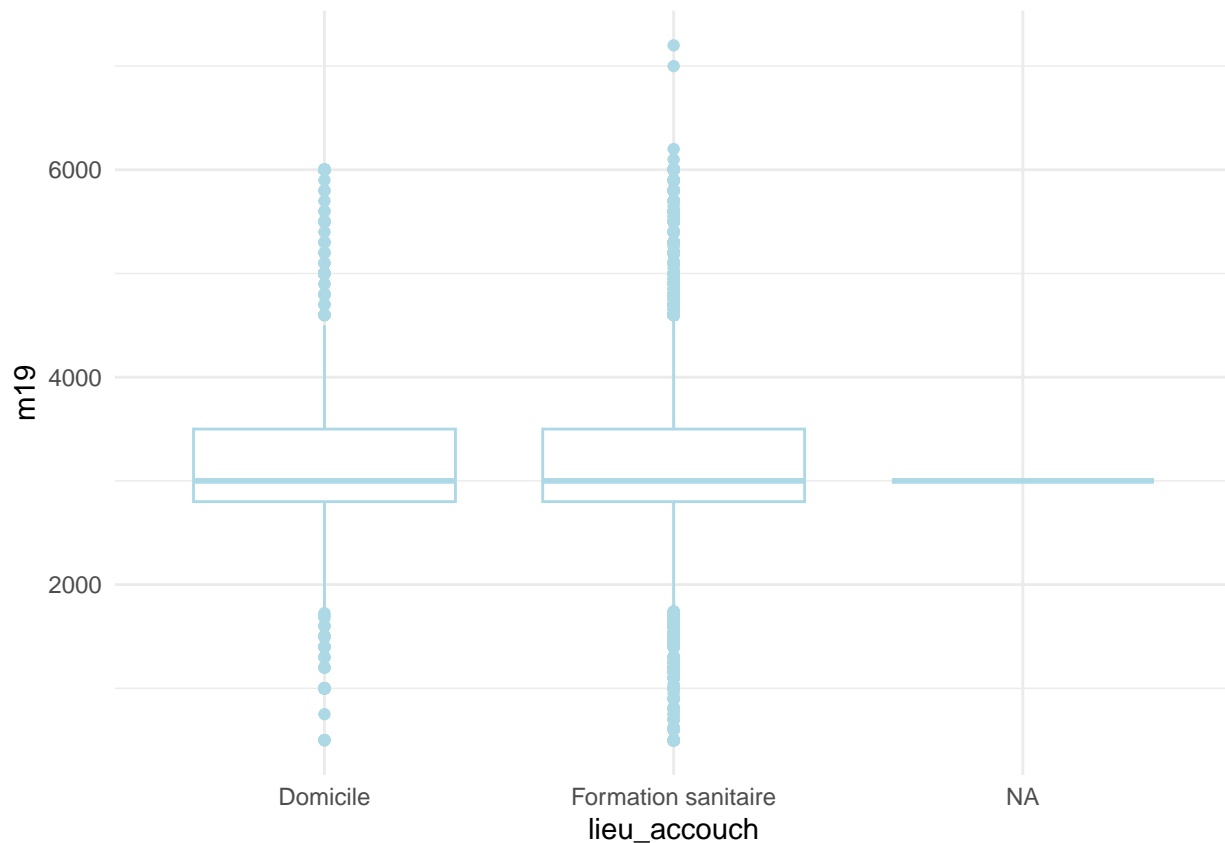
```
ggplot(data) +
  geom_boxplot(aes(x = age_mere, y = m19), color="lightblue")+
  theme_minimal()
```

Warning: Removed 18763 rows containing non-finite values (‘stat_boxplot()’).



```
ggplot(data) +  
  geom_boxplot(aes(x = lieu_accouch, y = m19), color="lightblue")+  
  theme_minimal()
```

```
## Warning: Removed 18763 rows containing non-finite values ('stat_boxplot()').
```

On observe qu'il y a les valeurs manquantes, normalement il faut les traiter et prendre des décisions en fonction de leur nature.

Pour l'heure, nous allons utiliser une imputation multiple avec le package mice

```
data <- data %>%
  select(m19, dead, educ, activite, attitude_violence, pouvoir_decision, v012, age_mere, degmedia, ins_
```

- test de comparaison

ici évaluer la normalité la variable m19.

- Si normale, faire un t.test pour les variables à deux niveaux et Anova pour ceux ayant plus de deux niveaux
- Sinon, test de rank Kruskal wallis

Note. il y'a plusieurs variétés substantielles que je n'ai pas évoqué qu'il convient d'évoquer dans les cadres des tests d'hypothèses

=====

Estimation du modèle de regression linéaire

- Division de la base en données d'entraînement et test
- CARET (short for Classification And REgression Training)

```
rm(list = ls())
```

```
load("base_bf_complete.rda")
```

```
library(caret)
```

```
## Loading required package: lattice
```

```
##
```

```
## Attaching package: 'caret'
```

```
## The following object is masked from 'package:purrr':
```

```
##
```

```
## lift
```

```
data <- base %>%
```

```
  select(m19, educ, activite, attitude_violence, pouvoir_decision, age_mere,  
         degmedia, ins_conj, sex_enfant, rang_naiss, interval_precedent,  
         lieu_accouch, naissance_voulu, allaiter_heure, source_eau, type_toilet,  
         contraception, taille_menage, sex_chef, niveau_vie, milieu_residence)
```

```
set.seed(123)
```

```
d <- sort(sample(nrow(data), nrow(data) * 0.7))
```

```
data_train <- data[d, ]
```

```
data_test <- data[-d,]
```

- Construction du modèle

```
model_reg <- lm(m19 ~ ., data = data_train)
```

```
model_reg %>% summary()
```

```
##
```

```
## Call:
```

```
## lm(formula = m19 ~ ., data = data_train)
```

```
##
```

```
## Residuals:
```

```
##      Min       1Q   Median       3Q      Max  
## -2410.0  -281.5     5.4   237.5  3367.1
```

```
##
```

```
## Coefficients:
```

```
##
```

	Estimate	Std. Error	t value
## (Intercept)	3039.4048	126.6599	23.997
## educPrimaire	39.5327	17.3639	2.277
## educSecondaire	28.5878	19.4474	1.470
## educSupérieur	42.6282	63.0191	0.676
## activiteTravailleuses qualifiées ou non qualifiées	55.6161	15.5772	3.570
## activiteSans emploi	-0.1856	13.9828	-0.013

## attitude_violenceFavorable	9.7047	11.4646	0.846
## pouvoir_decisionMoyen	88.2202	36.1149	2.443
## pouvoir_decisionFaible	43.0434	34.2242	1.258
## age_mereEntre 20 et 29 ans	36.5105	27.9312	1.307
## age_mereEntre 30 ans et 39 ans	31.6967	31.5642	1.004
## age_mere40 ans et plus	17.9187	35.9393	0.499
## degmediaFaible	-18.3686	13.3677	-1.374
## degmediamoyenne	-26.4434	17.0231	-1.553
## degmediaElevé	17.4889	45.4099	0.385
## ins_conjPrimaire	14.9759	17.8184	0.840
## ins_conjSecondaire	-8.3950	21.0929	-0.398
## ins_conjSupérieur	115.2547	42.6072	2.705
## sex_enfantFeminin	-32.4418	11.1982	-2.897
## rang_naissRang 2 ou 3	-217.7299	109.1757	-1.994
## rang_naissRang 4 ou plus	-212.3867	110.6521	-1.919
## interval_precedentPlus de 24 mois	68.0592	20.7263	3.284
## interval_precedentNon concerné	-281.0513	110.5031	-2.543
## lieu_accouchFormation sanitaire	18.2147	27.0762	0.673
## naissance_vouluvoulu pour plutard	-8.1602	19.1720	-0.426
## naissance_vouluidésirée	35.8966	45.9208	0.782
## allaiter_heureNon	-31.9437	11.9581	-2.671
## source_eauNon ameliorée	2.0223	19.4073	0.104
## type_toiletNon ameliorée	-22.0355	13.5964	-1.621
## contraceptionOui	-1.2080	11.7301	-0.103
## taille_menage4-6	8.6177	25.2112	0.342
## taille_menage7 et plus	28.8326	24.8403	1.161
## sex_chefFeminin	24.3713	20.6567	1.180
## niveau_vieMoyen	21.2400	15.7823	1.346
## niveau_vieRiche	50.9713	18.0946	2.817
## milieu_residenceRural	-19.3749	16.9427	-1.144
##	Pr(> t)		
## (Intercept)	< 2e-16	***	
## educPrimaire	0.022828	*	
## educSecondaire	0.141597		
## educSupérieur	0.498784		
## activiteTravailleuses qualifiées ou non qualifiées	0.000358	***	
## activiteSans emploi	0.989407		
## attitude_violenceFavorable	0.397301		
## pouvoir_decisionMoyen	0.014595	*	
## pouvoir_decisionFaible	0.208539		
## age_mereEntre 20 et 29 ans	0.191194		
## age_mereEntre 30 ans et 39 ans	0.315312		
## age_mere40 ans et plus	0.618087		
## degmediaFaible	0.169445		
## degmediamoyenne	0.120368		
## degmediaElevé	0.700148		
## ins_conjPrimaire	0.400664		
## ins_conjSecondaire	0.690638		
## ins_conjSupérieur	0.006843	**	
## sex_enfantFeminin	0.003776	**	
## rang_naissRang 2 ou 3	0.046150	*	
## rang_naissRang 4 ou plus	0.054966	.	
## interval_precedentPlus de 24 mois	0.001029	**	
## interval_precedentNon concerné	0.010996	*	

```
## lieu_accouchFormation sanitaire          0.501145
## naissance_vouluvoulu pour plutard       0.670388
## naissance_vouluindésirée                0.434409
## allaiter_heureNon                        0.007570 **
## source_eauNon ameliorée                 0.917010
## type_toiletNon ameliorée                0.105122
## contraceptionOui                       0.917978
## taille_menage4-6                       0.732496
## taille_menage7 et plus                  0.245788
## sex_chefFeminin                         0.238101
## niveau_vieMoyen                         0.178398
## niveau_vieRiche                         0.004859 **
## milieu_residenceRural                   0.252841
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 519.7 on 8604 degrees of freedom
## Multiple R-squared:  0.02771,    Adjusted R-squared:  0.02375
## F-statistic: 7.006 on 35 and 8604 DF,  p-value: < 2.2e-16
```

- Prédiction du poids à la naissance

```
# Poids prédit sur les données d'entraînement

poid_predit <- predict(model_reg, newdata = data_train[,-1])

# Poids prédit sur les données test

poid_predit2 <- predict(model_reg, newdata = data_test[,-1])
```

- Validation du modèle : Outils de validation le MSE (Mean square error)

La formule du MSE (Mean Squared Error, ou Erreur Quadratique Moyenne en français) est la suivante :

$$MSE = \frac{1}{n} \sum_{i=1}^n (y_i - \hat{y}_i)^2$$

Le MSE est une mesure de la qualité d'un modèle de prédiction. Voici ce que le MSE indique :

- 1. Erreur Moyenne** : Le MSE calcule la moyenne des carrés des erreurs de prédiction. Chaque erreur est la différence entre la valeur réelle et la valeur prédite ($y_i - \hat{y}_i$)
- 2. Sensibilité aux Grandes Erreurs** : En élevant les erreurs au carré, le MSE attribue plus de poids aux grandes erreurs par rapport aux petites erreurs. Cela signifie que le MSE est particulièrement sensible aux grandes erreurs de prédiction, ce qui peut être utile pour identifier des modèles qui parfois font de grosses erreurs.
- 3. Échelle** : Le MSE est exprimé dans les mêmes unités que la variable à prédire, mais élevé au carré. Par exemple, si vous prédisiez des distances en mètres, le MSE sera en mètres carrés. Cela peut parfois rendre l'interprétation directe du MSE difficile.

Lors de la validation d'un modèle de prédiction, le MSE est couramment utilisé pour les raisons suivantes :

- 1. Comparaison de Modèles** : En comparant le MSE de différents modèles, vous pouvez identifier lequel a, en moyenne, les prédictions les plus proches des valeurs réelles. Un modèle avec un MSE plus faible est généralement considéré comme ayant de meilleures performances de prédiction.

2. Évaluation de la Performance : Le MSE fournit une seule valeur résumée qui peut être utilisée pour évaluer la performance globale du modèle sur l'ensemble des données de test.

3. Optimisation : Lors de l'ajustement des hyperparamètres de modèles (comme en utilisant des techniques de validation croisée), le MSE peut être utilisé comme critère d'optimisation pour trouver les meilleurs paramètres qui minimisent l'erreur de prédiction.

```
MSE_train <- (1/nrow(data_train))*sum(sqrt((data_train$m19 - poid_predit)^2))

MSE_test <- (1/nrow(data_test))*sum(sqrt((data_test$m19-poid_predit2)^2))

MSE_train
```

```
## [1] 362.0695
```

```
MSE_test
```

```
## [1] 357.4971
```

On voit que l'erreur quadratique moyen ne s'éloigne pas trop entre les données d'entraînement et les données test. Ce qui montre que le modèle se généralise assez bien avec une MSE =

Regularisation

```
library(glmnet)
```

```
## Loading required package: Matrix
```

```
##
```

```
## Attaching package: 'Matrix'
```

```
## The following objects are masked from 'package:tidyr':
```

```
##
```

```
##      expand, pack, unpack
```

```
## Loaded glmnet 4.1-8
```

Rappel : x : matrice des variables prédictes (chaque variable dichotomisée) y : la variable de réponse ou de résultat alpha : le paramètre de mélange elasticnet. Les valeurs autorisées comprennent : "1" : pour la régression lasso "0" : pour la régression ridge une valeur comprise entre 0 et 1 (disons 0,5) pour la régression elasticnet. lambda : une valeur numérique définissant la quantité de rétrécissement (pénalité) à spécifier).

Dans la régression pénalisée, on doit spécifier un lambda constant pour ajuster la quantité de rétrécissement du coefficient. Le meilleur lambda pour les données, peut être défini comme le lambda qui minimise le taux d'erreur de prédiction par cross validation. Ceci peut être déterminé automatiquement à l'aide de la fonction cv.glmnet().

```
dummyVars
```

```
## function (formula, ...)
## {
##     UseMethod("dummyVars")
## }
## <bytecode: 0x121389c30>
## <environment: namespace:caret>

#Convertir les facteurs en variables indicatrices

dummy <- dummyVars(" ~ .", data = data_train, fullRank = TRUE)
data_transformed <- data.frame(predict(dummy, newdata = data_train))

# Matrice des prédicteurs

x_train <- as.matrix(data_transformed[, -1])
y_train <- data_train$m19
```

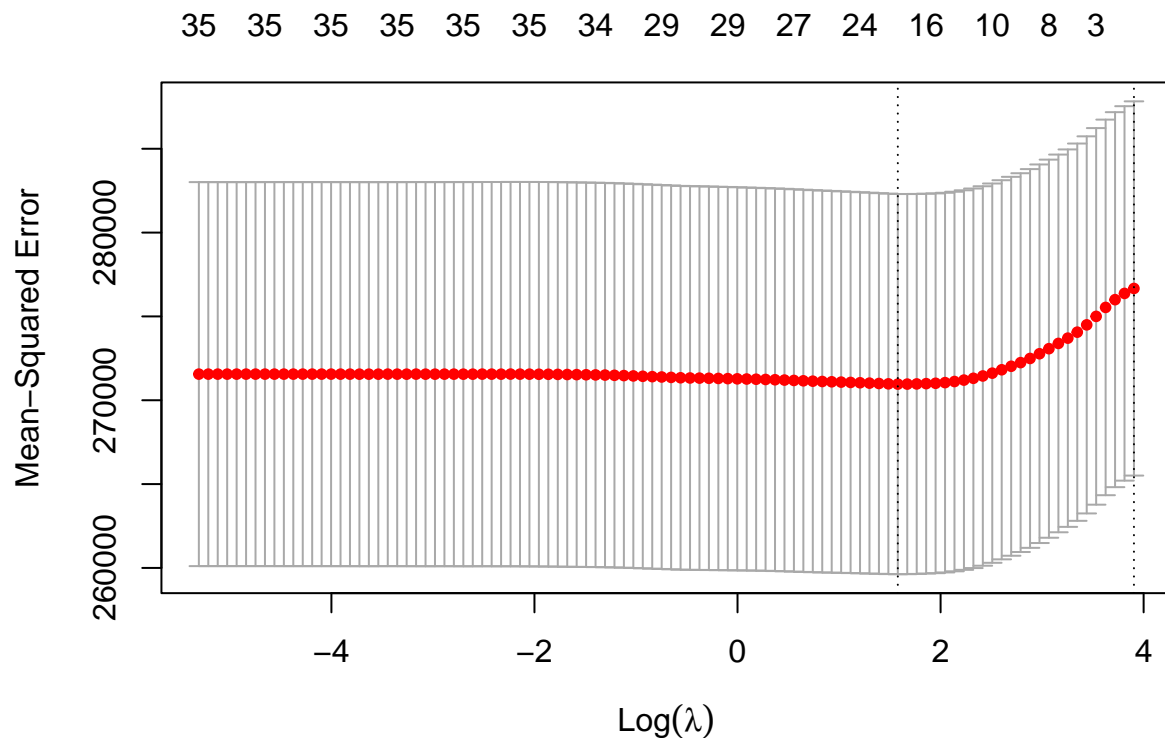
Régularisation de type LASSO

cherchons le meilleur lambda par cross-validation à 10 plis

```
cv_lasso <- cv.glmnet(x_train, y_train, alpha = 1, nfolds = 10 , intercept= TRUE, standardize = TRUE)
```

Visualisation des résultats de la validation croisée avec régularisation Lasso (la valeur optimale de lambda qui minimise l'erreur de validation croisée est en pointillé)

```
plot(cv_lasso)
```



Le graphique affiche l'erreur de validation croisée en fonction du logarithme de lambda. La ligne verticale pointillée de gauche indique que le logarithme de la valeur optimale de lambda est d'environ $\exp(2.2)$, ce qui est celui qui minimise l'erreur de prédiction. Cette valeur de lambda donnera le modèle le plus précis. La valeur exacte de lambda peut être visualisée comme suit :

```
cv_lasso$lambda.min
```

```
## [1] 4.84929
```

```
cv_lasso$lambda.1se
```

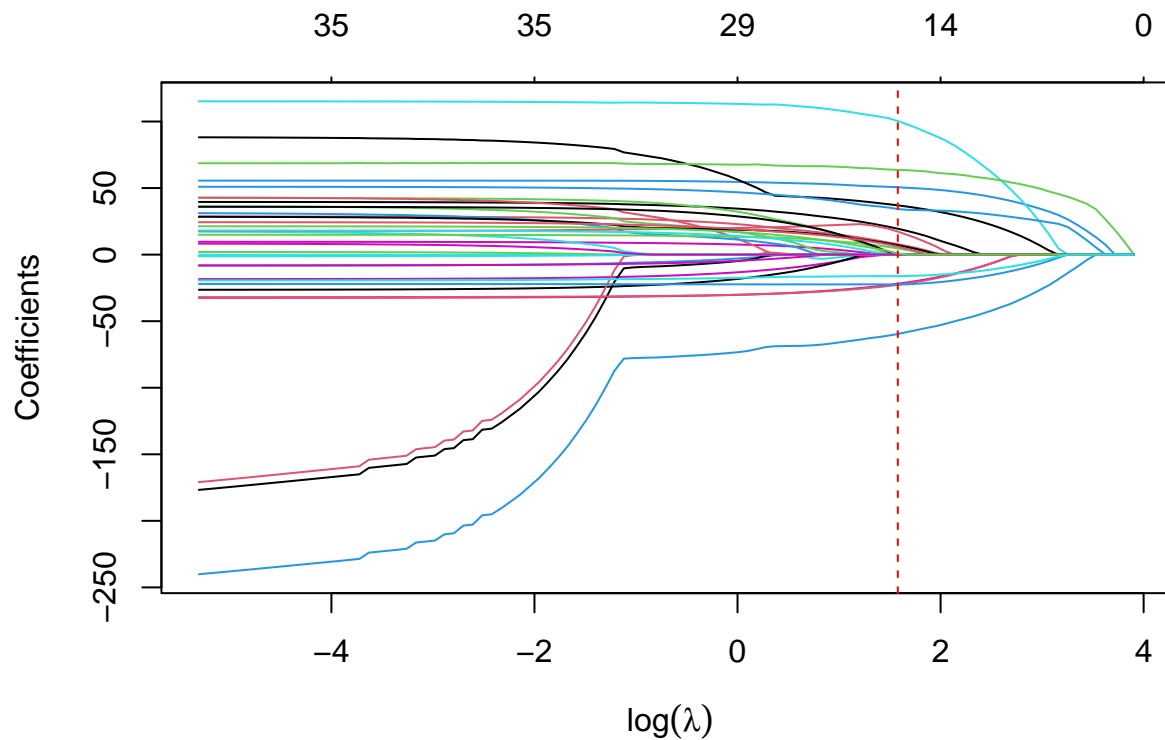
```
## [1] 49.63399
```

Entraînement du modèle LASSO, puis recherche du LASSO optimal

```
model_lasso <- glmnet(x_train, y_train, alpha = 1)
```

#Visualisation de l'évolution des coefficients selon la valeur de lambda avec régularisation LASSO + li

```
plot(model_lasso, xvar = "lambda", label = FALSE, xlab = ~ log(lambda))
abline( v = log(cv_lasso$lambda.min), col = "red", lty = 2)
```



- Modèle Lasso optimal

```
model_lasso <- glmnet(x_train, y_train, alpha = 1, lambda = cv_lasso$lambda.min)
```

- Prédiction

```
# Sur les données d'entraînement
pred_lasso_train <- predict(model_lasso, newx = x_train)

# Sur les données test

dummy <- dummyVars(" ~ .", data = data_test, fullRank = TRUE)
data_transformed <- data.frame(predict(dummy, newdata = data_test))

x_test <- as.matrix(data_transformed[,-1])
pred_lasso_test <- predict(model_lasso, newx = x_test)
```

- Validation du modèle

```
MSE_train <- (1/nrow(data_train))*sum(sqrt((data_train$m19-pred_lasso_train)^2))
MSE_test <- (1/nrow(data_test))*sum(sqrt((data_test$m19-pred_lasso_test)^2))

MSE_train
```



```
## [1] 361.9384
```

```
MSE_test
```

```
## [1] 356.5862
```

```
Entrainement.      Test
```

```
Regression 362.06 357.4 Lasso 361.9384 356.5862
```

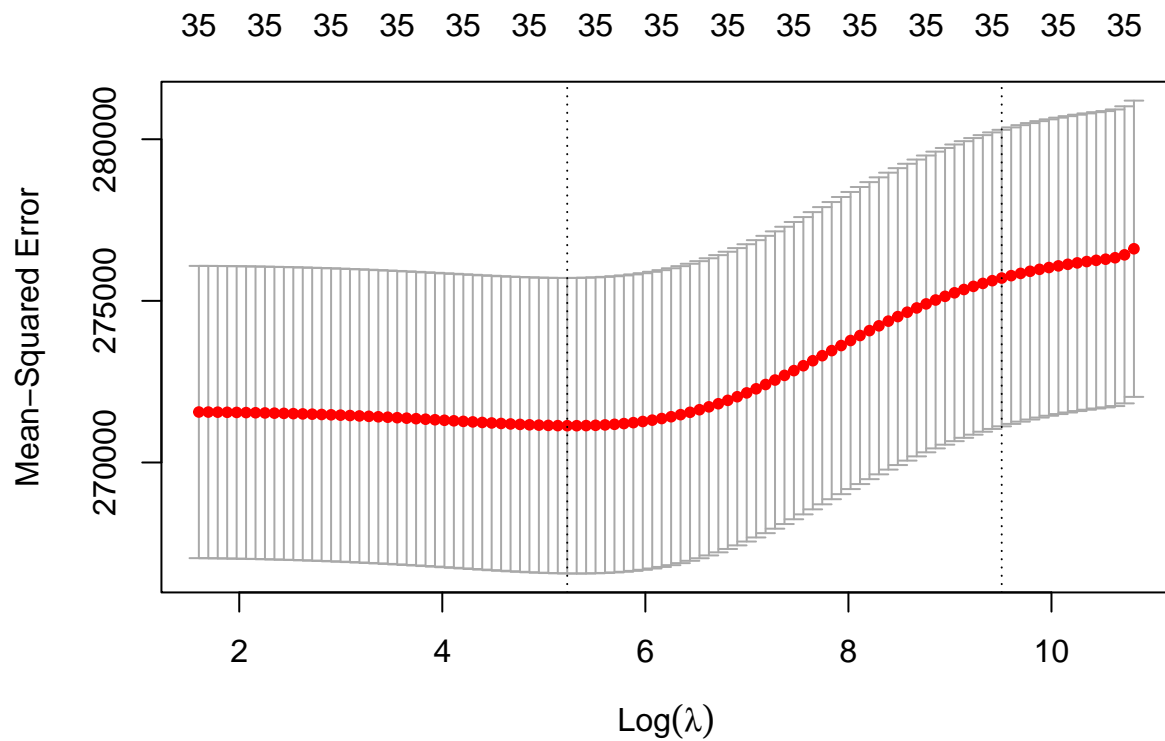
Régularisation de type Ridge

cherchons le meilleur lambda par cross-validation à 10 plis

```
cv_ridge <- cv.glmnet(x_train, y_train, alpha=0, nfolds=10, intercept=TRUE, standardize=TRUE)
```

Visualisation des résultats de la validation croisée avec régularisation Lasso (la valeur optimale de lambda qui minimise l'erreur de validation croisée est en pointillé)

```
plot(cv_ridge)
```



```
cv_lasso$lambda.min
```

```
## [1] 4.84929
```

```
cv_ridge$lambda.min
```

```
## [1] 186.8688
```

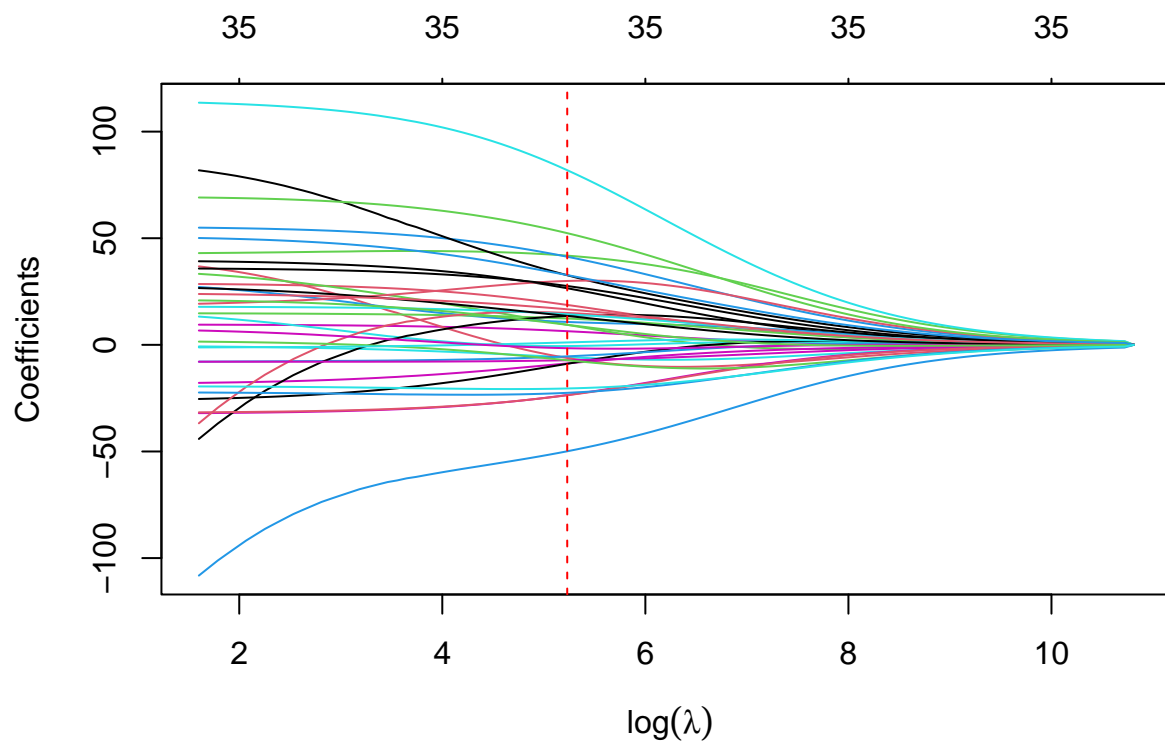
```
cv_lasso$lambda.1se
```

```
## [1] 49.63399
```

Entrainement du modèle ridge, puis recherche du ridge optimal

```
model_ridge <- glmnet(x_train, y_train, alpha = 0)
```

```
plot(model_ridge, xvar = "lambda", label = FALSE, xlab = ~ log(lambda))  
abline(v = log(cv_ridge$lambda.min), col = "red", lty = 2)
```



- Modèle Ridge optimal

```
model_ridge <- glmnet(x_train, y_train, alpha = 0, lambda = cv_ridge$lambda.min)
```

- Prédiction

```
# Sur les données d'entraînement
pred_ridge_train <- predict(model_ridge,newx = x_train)

# sur les données test
pred_ridge_test <- predict(model_ridge,newx = x_test)
```

- Validation du modèle

```
MSE_train <- (1/nrow(data_train))*sum(sqrt((data_train$m19-pred_ridge_train)^2))
MSE_test <- (1/nrow(data_test))*sum(sqrt((data_test$m19-pred_ridge_test)^2))

MSE_train
```

```
## [1] 361.8285
```

```
MSE_test
```

```
## [1] 356.3734
```

Regularisation de type elastic net

```
cv_elastic <- cv.glmnet(x_train, y_train, alpha = 0.3, nfolds = 10 , intercept= TRUE, standardize = TRUE)
```

- Modèle elasticnet optimal

```
model_elastic <- glmnet(x_train, y_train, alpha = 0.5, lambda = cv_elastic$lambda.min)
```

- Prédiction

```
# Sur les données d'entraînement
pred_elastic_train <- predict(model_elastic,newx = x_train)

# sur les données test
pred_elastic_test <- predict(model_elastic,newx = x_test)
```

- Validation du modèle

```
MSE_train <- (1/nrow(data_train))*sum(sqrt((data_train$m19-pred_elastic_train)^2))
MSE_test <- (1/nrow(data_test))*sum(sqrt((data_test$m19-pred_elastic_test)^2))

MSE_train
```

```
## [1] 361.9258
```

```
MSE_test
```

```
## [1] 356.4135
```

Première conclusion : On constate que les modèles de régression linéaire pénalisés tendent à diminuer légèrement la MSE par rapport à la régression linéaire classique.

Autres modèles d'apprentissage automatique pour les problèmes de regression

Machine à vecteur de support (SVM)

Notons que le type de SVM utilisé pour la régression est appelé "Support Vector Regression" (SVR).

```
library(e1071)

svr_model <- svm(m19 ~ ., data = data_train, type = "eps-regression", kernel = "linear") #le kernel pe
?svm
```

- Prédiction

```
# Sur les données d'entrainement

pred_svm_train <- predict(svr_model,newdata = data_train[, -1])

# sur les données test
pred_svm_test <- predict(svr_model,newdata =data_test[, -1])
```

- Validation du modèle

```
MSE_train <- (1/nrow(data_train))*sum(sqrt((data_train$m19-pred_svm_train)^2))
MSE_test <- (1/nrow(data_test))*sum(sqrt((data_test$m19-pred_svm_test)^2))

MSE_train
```

```
## [1] 360.3439
```

```
MSE_test
```

```
## [1] 354.2792
```

On peut optimiser en jouant sur le noyau.

Ce modèle propose une MSE de 354 plus petit que ceux des modèles précédents

Modèle ensembliste : Random Forest

```

library(randomForest)

## randomForest 4.7-1.1

## Type rfNews() to see new features/changes/bug fixes.

##
## Attaching package: 'randomForest'

## The following object is masked from 'package:dplyr':
##
##      combine

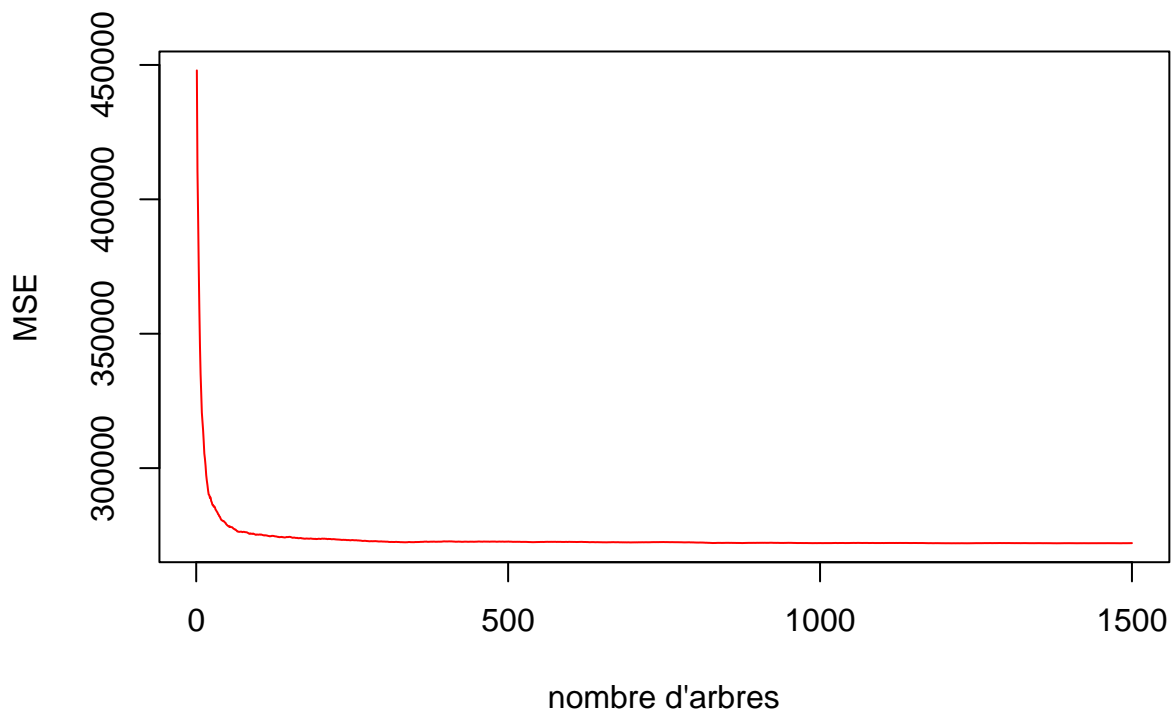
## The following object is masked from 'package:ggplot2':
##
##      margin

model_rf <- randomForest(m19 ~ ., data = data_train, ntree = 1500, mtry = 4, importance = TRUE)

?randomForest

plot(model_rf$mse, type = "l", xlab = "nombre d'arbres", ylab = "MSE", col="red")

```



- Prédiction

```
# Sur les données d'entraînement
pred_rf_train <- predict(model_rf,newdata = data_train[, -1])

# sur les données test
pred_rf_test <- predict(model_rf,newdata = data_test[, -1])
```

- Validation du modèle

```
MSE_train=(1/nrow(data_train))*sum(sqrt((data_train$m19-pred_rf_train)^2))
MSE_test=(1/nrow(data_test))*sum(sqrt((data_test$m19-pred_rf_test)^2))

MSE_train
```

```
## [1] 258.977
```

```
MSE_test
```

```
## [1] 363.6683
```

	Entrainement.	Test
--	---------------	------

Regression	362.06	357.4	Lasso	361.9384	356.5862	Ridge	361.8285	356.3734	Elastic	361.9258	356.4135	SVM
	360.3439	354.2792	Forêts alé.	259.2464	363.3698							

Deep learning

```
#install.packages("neuralnet")
library(neuralnet)
```

```
##
## Attaching package: 'neuralnet'

## The following object is masked from 'package:dplyr':
##
## compute
```

```
nn_model <- neuralnet(
  y_train ~ ., # Spécifier la formule
  data = x_train,
  hidden = 4, # Nombre de neurones dans chaque couche cachée
  linear.output = TRUE, # Pour la régression
)
```

- Prédiction

```
# Sur les données d'entraînement
pred_nn_train=predict(nn_model,newdata = x_train)

# sur les données test
pred_nn_test=predict(nn_model,newdata =x_test)
```

- Validation du modèle

```
MSE_train=(1/nrow(data_train))*sum(sqrt((data_train$m19-pred_nn_train)^2))
MSE_test=(1/nrow(data_test))*sum(sqrt((data_test$m19-pred_nn_test)^2))
```

```
MSE_train
```

```
## [1] 365.5373
```

```
MSE_test
```

```
## [1] 359.2413
```

On a une MSE=359.24

Bien que ceci ne soit qu'une démonstration, nous pouvons optimiser ce modèle en jouant sur le nombre de neurones et sur nombre de couche caché.