Untitled

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ANALISI ALBERI DECISIONALI perdita di peso

1. ESPLORATION:

```
library(sas7bdat)
```

```
## Warning: package 'sas7bdat' was built under R version 4.3.3
```

```
df <- read.sas7bdat("/Users/matteosimeoni/Desktop/Fuobauxo/FUOBAUXO.sas7bdat", encoding = "latin1")
head(df)
```

```
##   id step  data birth_date          birth_place gender eta  sdo_code
## 1 10    1 19877       2465              Taranto      m  48 201402666
## 2 11    1 19890       3606               Varese      m  45 201402881
## 3 12    1 20214       6652     Vaslui (ROMANIA)      f  37  20152207
## 4 13    1 20213       -682   Venaria Reale (TO)      f  57  20152180
## 5 14    1 20215       4372         Cremona (CR)      m  43  20152231
## 6 15    1 20214      -6344 Minervino Murge (BA)      m  73  20152209
##   qualification job_category                      patient_key dm
## 1             4           15 785642faf0999f56552930695a55b3ae  n
## 2             3           15 09da6b39bbc840c94d5d3745bd0dda92  n
## 3             4           14 18b81d90c4101c150376cc3b98b491cb  n
## 4             3           10 9bbb75c47da57148216cb05e93137c33  n
## 5             3           14 aaef444a560a288675510c4831d22f32  n
## 6             3           12 d9c1b648e11cae4c00cefbe9ec411bbc  n
##   ret_diab_nprolif ret_diab_prolif nefr_inc insuf_ren_cr neurop_diab BPCO
## 1                n               n        n            n           n    n
## 2                n               n        n            n           n    n
## 3                n               n        n            n           n    n
## 4                n               n        n            n           n    n
## 5                n               n        n            n           n    n
## 6                n               n        n            y           n    n
##   insuf_resp_cr OSAS steat_ep cirr_ep cardiop_isc cardiop_dil cardiop_iper_ostr
## 1             n    y        n       n           n           n                 n
## 2             n    y        y       n           n           n                 n
## 3             n    n        n       n           n           n                 n
## 4             n    n        n       n           n           n                 n
## 5             n    y        n       n           n           n                 n
## 6             n    y        y       n           n           n                 n
##   valv_patia pat_osteo_dis dep psic DCA iper_art ipogon PCO prev_chirurg_bar
## 1          n             n   n    n   y        n      n   n                n
## 2          n             n   n    n   y        y      n   n                n
## 3          n             n   n    n   y        y      n   n                n
```

```
## 4          n             n   y    n   n        y      n   n               n
## 5          n             n   n    n   n        n      n   n               n
## 6          n             y   n    n   n        y      n   n               n
##   tip_chirurg_bar mese_chirurg_bar anno_chirurg_bar ansia neoplas esofago
## 1             NaN              NaN              NaN
## 2             NaN              NaN              NaN     n       n
## 3             NaN              NaN              NaN
## 4             NaN              NaN              NaN
## 5             NaN              NaN              NaN
## 6             NaN              NaN              NaN
##   mammella utero colon_retto rene pancreas polmone stomaco porostata tiroide
## 1
## 2
## 3
## 4
## 5
## 6
##   fegato ovaio testicolo altro tip_altro  peso altezza      BMI circ_vita
## 1                                      169.3     172 57.22688       153
## 2                                      166.9     172 56.41563       154
## 3                                      148.0     164 55.02677       145
## 4                                      138.5     163 52.12842       132
## 5                                      120.6     174 39.83353       124
## 6                                      116.8     164 43.42653       134
##   circ_fian rapporto_vita_fian PAS PAD freq_card rapporto_vita_alt bioimped
## 1       151             1.013 140  90        88             0.889
## 2       153             1.006 155  80        81             0.895
## 3       155             0.935 150  90        90               NaN       na
## 4       156             0.846 135  80        88               NaN        y
## 5       128             0.968 120  80        78               NaN        y
## 6       120             1.116 145  80        68               NaN        y
##   fm_kg fm_kg_na fm_perc fm_perc_na ffm_kg ffm_kg_na ffm_perc ffm_perc_na
## 1   NaN      NaN     NaN        NaN    NaN       NaN      NaN
## 2   NaN      NaN     NaN        NaN    NaN       NaN      NaN
## 3   NaN      NaN     NaN        NaN    NaN       NaN      NaN
## 4  69.8     50.4    68.7       49.6
## 5  58.7     48.7    61.9       51.3
## 6  47.6     41.4    67.3       58.6
##   massa_musc_kg massa_musc_kg_na massa_musc_perc massa_musc_perc_na acqua_extra
## 1           NaN                            NaN                            NaN
## 2           NaN                            NaN                            NaN
## 3           NaN                            NaN                            NaN
## 4          36.3                           26.2                           29.1
## 5          36.0                           29.8                           24.0
## 6          29.2                           25.5                           36.1
##   acqua_extra_na acqua_intra acqua_intra_na calorim_ind REE_kcal_die
## 1                      NaN                                     NaN
## 2                      NaN                                     NaN
## 3                      NaN                          n          NaN
## 4                     21.2                          n          NaN
## 5                     21.3                          n          NaN
## 6                     17.7                          n          NaN
##   REE_kcal_die_na REE_perc REE_perc_na quoz_resp quoz_resp_na harris_benedict
## 1                     NaN                  NaN                           NaN
```

```
## 2                     NaN                  NaN                       2923.18
## 3                     NaN                  NaN                           NaN
## 4                     NaN                  NaN                           NaN
## 5                     NaN                  NaN                           NaN
## 6                     NaN                  NaN                           NaN
##   eritroc eritroc_na ematocr ematocr_na  emo emo_na vol_glob vol_glob_na leuco
## 1     NaN        NaN     NaN        NaN  NaN    NaN      NaN         NaN   NaN
## 2     NaN        NaN     NaN        NaN  NaN    NaN      NaN         NaN   NaN
## 3    5.19        NaN    43.7        NaN 13.9    NaN     84.2         NaN   8.2
## 4    4.64        NaN    40.5        NaN 12.7    NaN     87.2         NaN   6.8
## 5    5.02        NaN    45.8        NaN 14.5    NaN     91.3         NaN   7.1
## 6    4.27        NaN    40.8        NaN 13.0    NaN     95.4         NaN   8.0
##   leuco_na piastr piastr_na VES ves_na AST ast_na ALT alt_na fosf_alc
## 1      NaN    NaN       NaN NaN    NaN NaN    NaN NaN    NaN      NaN
## 2      NaN    NaN       NaN NaN    NaN NaN    NaN NaN    NaN      NaN
## 3      NaN    286       NaN  18    NaN  20    NaN  28    NaN      NaN
## 4      NaN    180       NaN   9    NaN  20    NaN  34    NaN      NaN
## 5      NaN    135       NaN  35    NaN  17    NaN  22    NaN      NaN
## 6      NaN    226       NaN  37    NaN  15    NaN  17    NaN      NaN
##   fosf_alc_na gammaGT gammaGT_na  CK ck_na album album_na uric uric_na creatin
## 1         NaN    NaN        NaN NaN    NaN   NaN      NaN  NaN    NaN      NaN
## 2         NaN    NaN        NaN NaN    NaN   NaN      NaN  NaN    NaN      NaN
## 3         NaN     24        NaN NaN    NaN   8.3      NaN  0.7    NaN      0.7
## 4         NaN     36        NaN NaN    NaN   6.0      NaN  0.8    NaN      0.8
## 5         NaN     22        NaN NaN    NaN   5.3      NaN  0.9    NaN      0.9
## 6         NaN     23        NaN NaN    NaN  11.0      NaN  1.8    NaN      1.8
##   creatin_na vel_filtr vel_filtr_na micr_album micr_album_na col_tot col_tot_na
## 1        NaN      NaN         NaN       NaN         NaN      NaN         NaN
## 2        NaN      NaN         NaN       NaN         NaN      NaN         NaN
## 3        NaN      NaN         NaN        68         NaN      192         NaN
## 4        NaN      NaN         NaN         2         NaN      188         NaN
## 5        NaN      NaN         NaN         3         NaN      267         NaN
## 6        NaN       54         NaN        10         NaN      187         NaN
##   HDL hdl_na LDL ldl_na trigl trigl_na glic_bas glic_bas_na glic_OGTT
## 1 NaN    NaN NaN    NaN   NaN      NaN      NaN         NaN       NaN
## 2 NaN    NaN NaN    NaN   NaN      NaN      NaN         NaN       NaN
## 3  44    NaN 127    NaN   182      NaN       87         NaN       145
## 4  57    NaN 121    NaN    92      NaN       96         NaN       NaN
## 5  35    NaN 199    NaN   256      NaN       84         NaN       NaN
## 6  28    NaN 135    NaN   135      NaN      129         NaN       NaN
##   glic_OGTT_na insulinem_bas insulinem_bas_na insulinem_OGTT insulinem_OGTT_na
## 1          NaN          NaN             NaN           NaN              NaN
## 2          NaN          NaN             NaN           NaN              NaN
## 3          NaN         27.8             NaN         224.9              NaN
## 4          NaN          9.3             NaN           NaN              NaN
## 5          NaN          9.1             NaN           NaN              NaN
## 6          NaN         22.2             NaN           NaN              NaN
##   HOMA_IR homa_ir_na emo_gli emo_gli_na calcemia calcemia_na fosfor fosfor_na
## 1     NaN        NaN     NaN        NaN      NaN         NaN    NaN       NaN
## 2     NaN        NaN     NaN        NaN      NaN         NaN    NaN       NaN
## 3     NaN        NaN      45        NaN      9.8         NaN    NaN       NaN
## 4     NaN        NaN      41        NaN      9.1         NaN    NaN       NaN
## 5     NaN        NaN      40        NaN      9.4         NaN    NaN       NaN
## 6     NaN        NaN      55        NaN      8.7         NaN    NaN       NaN
```

```
##   sodio sodio_na pot pot_na homo homo_na prot_C_reat prot_C_reat_na testost_tot
## 1   NaN      NaN   NaN    NaN  NaN     NaN         NaN            NaN        NaN
## 2   NaN      NaN   NaN    NaN  NaN     NaN         NaN            NaN        NaN
## 3   141      4.5   NaN    NaN  0.8     NaN         NaN            NaN        NaN
## 4   143      4.0   NaN    NaN  0.5     NaN         NaN            NaN        NaN
## 5   140      4.2   NaN    NaN  1.6     NaN         NaN            NaN        NaN
## 6   143      3.7   NaN    NaN  0.9     NaN         NaN            NaN        5.7
##   testost_tot_na SHBG shbg_na testost_lib testost_lib_na estradiolo
## 1            NaN  NaN      NaN         NaN            NaN
## 2            NaN  NaN      NaN         NaN            NaN
## 3            NaN  NaN      NaN         NaN            NaN
## 4            NaN  NaN      NaN         NaN            NaN
## 5            NaN  NaN      NaN         NaN            NaN
## 6            NaN  NaN      NaN         NaN            NaN
##   estradiolo_na FSH FSH_na  LH LH_na cortisolemia cortisolemia_na cortisoluria
## 1           NaN  NaN    NaN  NaN    NaN         NaN            NaN         NaN
## 2           NaN  NaN    NaN  NaN    NaN         NaN            NaN         NaN
## 3           NaN  NaN    NaN  NaN    NaN         NaN            NaN         NaN
## 4           NaN  NaN    NaN  NaN    NaN         NaN            NaN         NaN
## 5           NaN  NaN    NaN  NaN    NaN         NaN            NaN         NaN
## 6           NaN  NaN    NaN  NaN    NaN         NaN            NaN         NaN
##   cortisoluria_na ACTH ACTH_na fT3_pgml fT3_pgml_na fT3_pmoll fT3_pmoll_na
## 1             NaN  NaN     NaN      NaN         NaN       NaN          NaN
## 2             NaN  NaN     NaN      NaN         NaN       NaN          NaN
## 3             NaN  NaN     NaN      NaN         NaN       NaN          NaN
## 4             NaN  NaN     NaN      NaN         NaN       NaN          NaN
## 5             NaN  NaN     NaN      NaN         NaN       NaN          NaN
## 6             NaN  NaN     NaN      NaN         NaN       NaN          NaN
##   fT4_pgml fT4_pgml_na fT4_pmoll fT4_pmoll_na  TSH TSH_na prolat prolat_na
## 1      NaN         NaN       NaN          NaN  NaN    NaN     NaN        NaN
## 2      NaN         NaN       NaN          NaN  NaN    NaN     NaN        NaN
## 3     11.6         NaN       NaN          NaN 3.96    NaN     NaN        NaN
## 4      NaN         NaN       NaN          NaN 1.97    NaN     NaN        NaN
## 5      NaN         NaN       NaN          NaN 1.91    NaN     NaN        NaN
## 6      NaN         NaN       8.5          NaN 8.39    NaN     NaN        NaN
##   paratormone paratormone_na calcifed calcifed_na leptina leptina_na prel_serot
## 1         NaN           NaN      NaN         NaN      NaN        NaN          NA
## 2         NaN           NaN      NaN         NaN      NaN        NaN          NA
## 3         NaN           NaN        9         NaN      NaN        NaN          NA
## 4         NaN           NaN        9         NaN      NaN        NaN          NA
## 5         NaN           NaN        9         NaN      NaN        NaN          NA
## 6         NaN           NaN        9         NaN      NaN        NaN          NA
##   prel_genet prel_epi
## 1         NA       NA
## 2         NA       NA
## 3         NA       NA
## 4         NA       NA
## 5         NA       NA
## 6         NA       NA
##   altro_lab
## 1        NA
## 2        NA
## 3        NA
## 4        NA
```

```
## 5 al 8/5/2015 Fibrinogeno 448; \nal 11/5/2015 tempo protrombina 1.65; aPTT 1.26.
## 6
##   neutrofili neutrofili_val neutrofili_na linfociti linfociti_val linfociti_na
## 1        NaN            NaN                    NaN           NaN
## 2        NaN            NaN                    NaN           NaN
## 3         60            4.9                     31           2.5
## 4         54            3.6                     32           2.2
## 5         57            4.1                     31           2.2
## 6         55            4.4                     30           2.4
##   monociti monociti_val monociti_na eosinofili eosinofili_val eosinofili_na
## 1      NaN          NaN                   NaN            NaN
## 2      NaN          NaN                   NaN            NaN
## 3        6          0.5                     2            0.2
## 4        9          0.6                     5            0.3
## 5        8          0.6                     2            0.1
## 6        9          0.8                     4            0.3
##   basofili basofili_val basofili_na ACR ACR_na other_tfa
## 1      NaN          NaN            NaN                n
## 2      NaN          NaN            NaN                n
## 3        1          0.1            NaN                y
## 4        0          0.0            NaN                y
## 5        2          0.1            NaN                y
## 6        1          0.1            NaN                y
##                                  other_tfa_nomefarm
## 1
## 2
## 3 Pantoprazolo 40mg 1cpr/die; Tachidol 1 cpr al bisogno
## 4 Lyrica 75mg 1 cpr x2/die; Levocetirizina 5mg 1cpr/die
## 5       Metadone 25mg/die; BiPAP; analgesici al bisogno
## 6      Normix 200mg 2+2 x6gg/mese; Psorcutan al bisogno
##   other_endocrine_agent_nomefarm insuline_nomefarm oral_antidiab_nomefarm
## 1
## 2
## 3
## 4
## 5
## 6
##   corticost_per_musculo_nomefarm NSAIDs_nomefarm antipsychotic_nomefarm
## 1
## 2
## 3
## 4
## 5
## 6
##         antianx_antiinson_nomefarm antidepres_nomefarm
## 1 Lexotan, 30 gtt se crisi d'ansia
## 2
## 3
## 4           Rivotril 10-12 gtt/die
## 5
## 6
##   comb_bronchodilators_nomefarm corticost_per_bronco_nomefarm
## 1
## 2
```

```
## 3
## 4
## 5
## 6
##   methylxanthines_nomefarm anticholinergic_nomefarm beta_adrenergic_nomefarm
## 1
## 2
## 3
## 4
## 5
## 6
##   other_anticoag_nomefarm
## 1
## 2
## 3
## 4
## 5
## 6
##                                   oral_anticoag_nomefarm
## 1
## 2
## 3
## 4
## 5 Coumadin sec INR ora 1+1/2cpr x 5gg poi 1+3/4cpr x 2gg
## 6
##   other_anti_platelets_nomefarm dipirydamole_nomefarm clopidogrel_nomefarm
## 1
## 2
## 3
## 4
## 5
## 6
##   ticlopidine_nomefarm acetyl_acid_nomefarm statin_ezetimibe_nomefarm
## 1
## 2
## 3
## 4
## 5
## 6
##   other_lipid_low_nomefarm ezetimibe_nomefarm fibrate_nomefarm statine_nomefarm
## 1
## 2
## 3
## 4
## 5
## 6
##   diur_pot_sp_diur_nomefarm BB_diur_nomefarm
## 1
## 2
## 3
## 4
## 5
## 6
##                                     ARB_CCB_nomefarm
```

```
## 1
## 2 SeviKar (Olmesartan/ Amlodipina) 40 /10 mg 1 cp/die
## 3
## 4
## 5
## 6
##                 ARB_diur_nomefarm ACE_CCB_nomefarm
## 1
## 2
## 3
## 4
## 5
## 6 Combisartan 160/12.5mg 1 cpr h8
##                 ACE_diur_nomefarm other_antihyp_nomefarm
## 1
## 2
## 3
## 4 Ramipril HCT 5/25mg 1/2 cpr/die
## 5
## 6                                 Doxazosin 4mg 1cpr h20
##              diur_nomefarm               CCB_nomefarm              BB_nomefarm
## 1
## 2     Lasix 25 mg 2 cp/die     Norvasc 10 mg 1 cp/die Dilatrend 25 mg 1 cp/die
## 3
## 4                          Amlodipina 5mg 1/2 cpr/die
## 5
## 6 Furosemide 25mg 1 cpr h8  Amlodipina 5mg 1cpr h8-20
##           ARB_nomefarm            ACE_nomefarm other_endocrine_agent insuline
## 1                                                                  n        n
## 2                                                                  n        n
## 3 Pritor 40mg 1cpr/die                                             n        n
## 4                                                                  n        n
## 5                                                                  n        n
## 6                      Captopril se elevata PA                     n        n
##   oral_antidiab corticost_per_musculo NSAIDs antipsychotic
## 1             n                     n      n             n
## 2             n                     n      n             n
## 3             n                     n      n             n
## 4             n                     n      n             n
## 5             n                     n      n             n
## 6             n                     n      n             n
##   antianxiety_antiinsonnia antidepres combined_bronchodilators
## 1                        y          n                        n
## 2                        n          n                        n
## 3                        n          n                        n
## 4                        y          n                        n
## 5                        n          n                        n
## 6                        n          n                        n
##   corticost_per_bronco methylxanthines anticholinergic beta_adrenergic
## 1                    n               n               n              n
## 2                    n               n               n              n
## 3                    n               n               n              n
## 4                    n               n               n              n
## 5                    n               n               n              n
```

```
## 6                   n              n              n              n
##   other_anticoag oral_anticoag other_anti_platelets dipirydamole clopidogrel
## 1              n             n                   n            n           n
## 2              n             n                   n            y           n
## 3              n             n                   n            n           n
## 4              n             n                   n            n           n
## 5              n             y                   n            n           n
## 6              n             n                   n            n           n
##   ticlopidine acetyl_acid statin_ezetimibe other_lipid_low ezetimibe fibrate
## 1           n           n                n               n         n       n
## 2           n           n                n               n         n       n
## 3           n           n                n               n         n       n
## 4           n           n                n               n         n       n
## 5           n           n                n               n         n       n
## 6           n           n                n               n         n       n
##   statine diur_pot_sp_diur BB_diur ARB_CCB ARB_diur ACE_CCB ACE_diur
## 1       n               n       n       n        n       n        n
## 2       n               n       n       y        n       n        n
## 3       n               n       n       n        n       n        n
## 4       n               n       n       n        n       n        y
## 5       n               n       n       n        n       n        n
## 6       n               n       n       n        y       n        n
##   other_antihyp diur CCB BB ARB ACE PAD_1min_rec PAD_picco PAD_bas
## 1             n    n   n  n   n   n
## 2             n    y   y  y   n   n
## 3             n    n   n  n   y   n
## 4             n    n   y  n   n   n
## 5             n    n   n  n   n   n
## 6             y    y   y  n   n   y
##   tip_altro_evento_cv anno_evento_cv_na anno_evento_cv altro_evento_cv
## 1
## 2
## 3
## 4
## 5
## 6
##   stroke_anno_na stroke_anno stroke TIA_anno_na TIA_anno TIA BPAC_anno_na
## 1
## 2
## 3
## 4
## 5
## 6
##   BPAC_anno BPAC PTCA_anno_na PTCA_anno PTCA IMA_anno_na IMA_anno IMA
## 1
## 2
## 3
## 4
## 5
## 6
##   SCA_anno_na SCA_anno SCA EPA_anno_na EPA_anno EPA miocardite_anno_na
## 1
## 2
## 3
```

```
## 4
## 5
## 6
##   miocardite_anno miocardite pericardite_anno_na pericardite_anno pericardite
## 1
## 2
## 3
## 4
## 5
## 6
##   endocardite_anno_na endocardite_anno endocardite ecocardio ECG_D_HOLTER_na
## 1
## 2
## 3                                                        n
## 4                                                        n
## 5                                                        n
## 6                                                        n
##   ST_d_val note conclusioni dispnea angor FA TV BEV ST_na ST_val ST
## 1
## 2
## 3
## 4
## 5
## 6
##   PAS_1min_rec_na PAS_1min_rec PAS_picco_na PAS_picco PAS_bas_na PAS_bas
## 1
## 2
## 3
## 4
## 5
## 6
##   calo_FC_rec_na calo_FC_rec indice_cronotropo_na indice_cronotropo
## 1
## 2
## 3
## 4
## 5
## 6
##   FC_perc_max_teo_na FC_perc_max_teo FC_1min_rec_na FC_1min_rec FC_picco_na
## 1
## 2
## 3
## 4
## 5
## 6
##   FC_picco FC_bas_na FC_bas watt_picco_na watt_picco METs_picco_na METs_picco
## 1
## 2
## 3
## 4
## 5
## 6
##   durata_ergo_na durata_ergo test_ergo perc_PAD_sup70_notte_na
## 1
```

```
## 2
## 3
## 4
## 5
## 6
##   perc_PAD_sup70_notte perc_PAS_sup110_notte_na perc_PAS_sup110_notte VC_73_NA
## 1
## 2
## 3
## 4
## 5
## 6
##   VC_73 VC_72_NA VC_72 VC_71_NA VC_71 VC_70_NA VC_70 VC_69_NA VC_69 VC_68_NA
## 1
## 2
## 3
## 4
## 5
## 6
##   VC_68 VC_67_NA VC_67 VC_66_NA VC_66 VC_65_NA VC_65 VC_64_NA VC_64 VC_63_NA
## 1
## 2
## 3
## 4
## 5
## 6
##   VC_63 VC_62_NA VC_62 PAD1_notte_na PAD1_notte PAD1_diurno_na PAD1_diurno
## 1
## 2
## 3
## 4
## 5
## 6
##   PAD1_tot_na PAD1_tot PAS1_notte_na PAS1_notte PAS1_diurno_na PAS1_diurno
## 1
## 2
## 3
## 4
## 5
## 6
##   PAS1_tot_na PAS1_tot stenosi_tricusp_na stenosi_tricusp_val stenosi_tricusp
## 1
## 2
## 3
## 4
## 5
## 6
##   stenosi_mitr_na stenosi_mitr_val stenosi_mitr stenosi_aort_na
## 1
## 2
## 3
## 4
## 5
## 6
```

```
##   stenosi_aort_val stenosi_aort insuff_tricusp_na insuff_tricusp_val
## 1
## 2
## 3
## 4
## 5
## 6
##   insuff_tricusp insuff_mitr_na insuff_mitr_val insuff_mitr insuff_polm_na
## 1
## 2
## 3
## 4
## 5
## 6
##   insuff_polm_val insuff_polm insuff_aort_na insuff_aort_val insuff_aort
## 1
## 2
## 3
## 4
## 5
## 6
##   TAPSE_na TAPSE rapp_E_E_na rapp_E_E rapp_E_A_na rapp_E_A fraz_eiez_na
## 1
## 2
## 3
## 4
## 5
## 6
##   fraz_eiez IVS_conc IVS_ecc IVS massa_ventr_sx_na massa_ventr_sx PP_na PP
## 1
## 2
## 3
## 4
## 5
## 6
##   SIV_na SIV DTD_na DTD flutter_atr_d_na flutter_atr_d_val flutter_atr_d
## 1
## 2
## 3
## 4
## 5
## 6
##   risp_ventr_d_na risp_ventr_d fib_atr_d durata_d_na durata_d numero_d_na
## 1
## 2
## 3
## 4
## 5
## 6
##   numero_d pause_d episodi_TV_d num_BESV_d_na num_BESV_d num_BEV_d_na num_BEV_d
## 1
## 2
## 3
## 4
```

```
## 5
## 6
##   ABPM ST_d_na ST_d freq_d ritmo_sin_d_na ritmo_sin_d ECG_D_HOLTER
## 1
## 2
## 3    n                                                           n
## 4    n                                                           n
## 5    n                                                           n
## 6    n                                                           n
##   freq_ventr_std_na freq_ventr_std flutter_atr_std risp_ventr_std_na
## 1
## 2
## 3                                              n
## 4                                              n
## 5                                              n
## 6                                              n
##   risp_ventr_std fib_atr_std segni_IVS_std onda_T_std ST_std_na ST_std_val
## 1
## 2
## 3                        n            n          1
## 4                        n            y          1
## 5                        n            n          1
## 6                        n            n          1
##   ST_std QTc_std_na QTc_std QT_std_na QT_std QRS_std_na QRS_std PQ_std_na
## 1
## 2
## 3      1            446.00          402.00             96.00
## 4      1            438.00          392.00             90.00
## 5      1            424.00          398.00             96.00
## 6      1            411.00          418.00             98.00
##   PQ_std freq_std_na freq_std ritmo_sin_std ECG_STD tip_evento_na tip_evento
## 1
## 2
## 3 132.00               74.00            y       y
## 4 150.00               75.00            y       y
## 5 150.00               68.00            y       y
## 6                      58.00            y       y
##   eventi_cv TSD_OC_score TSD_OC_score_na VAS_diff_motorie_score
## 1                   NaN                                    NaN
## 2                   NaN                                    NaN
## 3         n         NaN                                    NaN
## 4         n         NaN                                    NaN
## 5         n         NaN                                    NaN
## 6         n         NaN                                    NaN
##   VAS_diff_motorie_score_na VAS_dolore_score VAS_dolore_score_na FSS_score
## 1                                       NaN
## 2                                       NaN
## 3                                       NaN
## 4                                       NaN
## 5                                       NaN
## 6                                       NaN
##   FSS_score_na CBA_VE_score_na CBA_VE_ansia CBA_VE_ansia_na CBA_VE_benessere
## 1
## 2
```

```
## 3
## 4
## 5
## 6
##   CBA_VE_benessere_na CBA_VE_cambiamento_pos CBA_VE_cambiamento_pos_na
## 1
## 2
## 3
## 4
## 5
## 6
##   CBA_VE_depressione CBA_VE_depressione_na CBA_VE_score
## 1
## 2
## 3
## 4
## 5
## 6
##   CBA_VE_disagio_psicologico CBA_VE_disagio_psicologico_na PGWBI_score_na
## 1
## 2
## 3
## 4
## 5
## 6
##   PGWBI_ansia PGWBI_ansia_na PGWBI_depressione PGWBI_depressione_na
## 1         NaN                              NaN
## 2         NaN                              NaN
## 3         NaN                              NaN
## 4         NaN                              NaN
## 5         NaN                              NaN
## 6         NaN                              NaN
##   PGWBI_pos_benessere PGWBI_pos_benessere_na PGWBI_autocontr PGWBI_autocontr_na
## 1                 NaN                                  NaN
## 2                 NaN                                  NaN
## 3                 NaN                                  NaN
## 4                 NaN                                  NaN
## 5                 NaN                                  NaN
## 6                 NaN                                  NaN
##   PGWBI_salute_gen PGWBI_salute_gen_na PGWBI_vitalita PGWBI_vitalita_na
## 1              NaN                               NaN
## 2              NaN                               NaN
## 3              NaN                               NaN
## 4              NaN                               NaN
## 5              NaN                               NaN
## 6              NaN                               NaN
##   PGWBI_punteggio_tot PGWBI_punteggio_tot_na abit_alim abit_alim_na comp_alim
## 1                 NaN
## 2                 NaN
## 3                 NaN
## 4                 NaN
## 5                 NaN
## 6                 NaN
##   comp_alim_na fumo tip_fumatore periodo_fumo periodo_fumo_na alcool
```

```
## 1
## 2
## 3
## 4
## 5
## 6
##   periodo_alcool periodo_alcool_na abuso_sost tip_abuso_sost tip_abuso_sost_na
## 1
## 2
## 3
## 4
## 5
## 6
##   periodo_abuso_sost periodo_abuso_sost_na YFAS_score YFAS_score_na
## 1
## 2
## 3
## 4
## 5
## 6
##   Moynihan_score Moynihan_score_na problema_eta altezza_step1 problema_BMI
## 1            NaN                        nessuno           172      nessuno
## 2            NaN                        nessuno           172      nessuno
## 3            NaN                        nessuno           164      nessuno
## 4            NaN                        nessuno           163      nessuno
## 5            NaN                        nessuno           174      nessuno
## 6            NaN                        nessuno           164      nessuno
##   peso_1 peso_2 peso_3 peso_4 peso_5 peso_6 peso_7 peso_8 peso_9 peso_10
## 1  169.3  152.6  150.2    NaN    NaN    NaN    NaN    NaN    NaN     NaN
## 2  166.9  150.7  150.0    NaN    NaN    NaN    NaN    NaN    NaN     NaN
## 3  148.0  138.3  122.5    NaN    NaN    NaN    NaN    NaN    NaN     NaN
## 4  138.5  133.4    NaN    NaN    NaN    NaN    NaN    NaN    NaN     NaN
## 5  120.6  113.8    NaN    NaN    NaN    NaN    NaN    NaN    NaN     NaN
## 6  116.8  112.2    NaN    NaN    NaN    NaN    NaN    NaN    NaN     NaN
##   peso_11 peso_12
## 1     NaN     NaN
## 2     NaN     NaN
## 3     NaN     NaN
## 4     NaN     NaN
## 5     NaN     NaN
## 6     NaN     NaN
```

Dimensioni dataset

```
dim(df)
```

```
## [1] 2076  562
```

Ci sono 2076 pazienti, con queste caratteristiche:

```
mean(df$eta,  na.rm = TRUE)
```

```
## [1] 57.74635
```

```
mean(df$peso,  na.rm = TRUE) #peso iniziale
```

```
## [1] 115.0901
```

```r
mean(df$altezza,  na.rm = TRUE)
```

```
## [1] 162.6252
```

```r
mean(df$BMI,  na.rm = TRUE)
```

```
## [1] 43.40166
```

```r
sd(df$eta,  na.rm = TRUE)
```

```
## [1] 13.55458
```

```r
sd(df$peso,  na.rm = TRUE) #peso iniziale
```

```
## [1] 23.43547
```

```r
sd(df$altezza,  na.rm = TRUE)
```

```
## [1] 10.16016
```

```r
sd(df$BMI,  na.rm = TRUE)
```

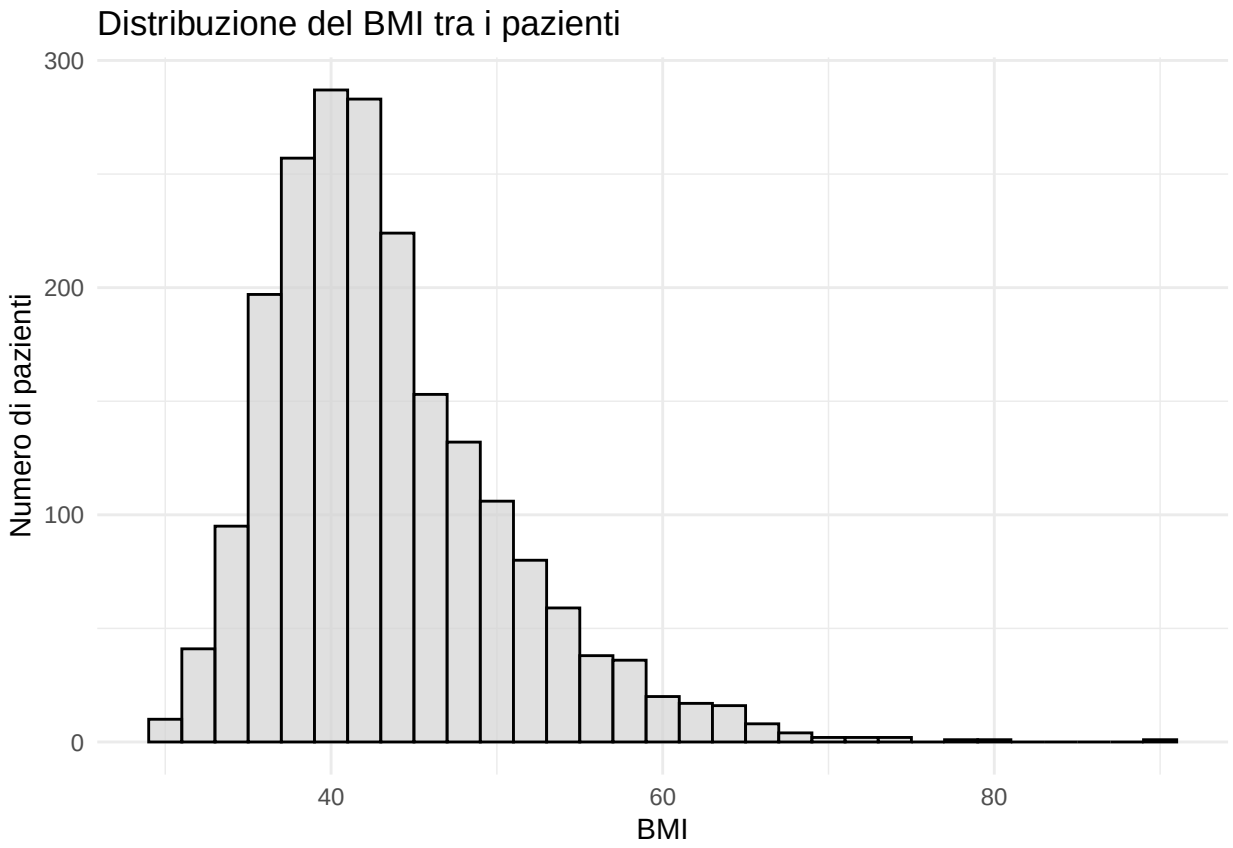
```
## [1] 7.143534
```

Analizzando le medie e le deviazioni standard di queste variabili posso concludere che i pazienti sono affetti da obesità

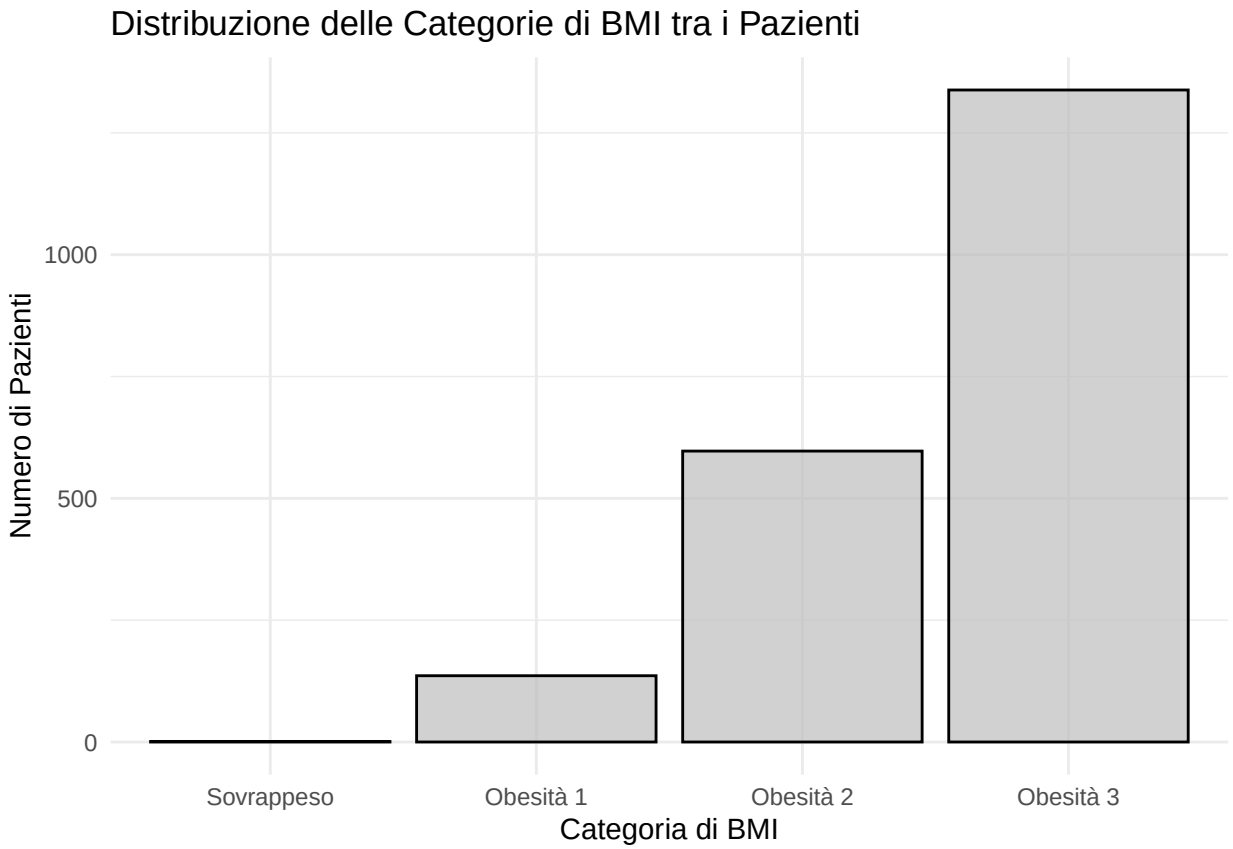
Analisi distribuzione BMI

```r
library(ggplot2)

ggplot(df, aes(x = BMI)) +
  geom_histogram(binwidth = 2, fill = "light grey", color = "black", alpha = 0.7) +
  labs(title = "Distribuzione del BMI tra i pazienti",
       x = "BMI",
       y = "Numero di pazienti") +
  theme_minimal()
```

```
## Warning: Removed 4 rows containing non-finite outside the scale range
## (`stat_bin()`).
```




```r
# Creiamo una nuova colonna per le categorie di BMI
df$bmi_categoria <- cut(df$BMI,
                        breaks = c(-Inf, 18.5, 24.9, 29.9, 34.9, 39.9, Inf),
                        labels = c("Sottopeso", "Normopeso", "Sovrappeso", "Obesità 1", "Obesità 2", "O

df <- df[!is.na(df$bmi_categoria), ]

ggplot(df, aes(x = bmi_categoria)) +
  geom_bar(fill = "gray", color = "black", alpha = 0.7) +
  labs(title = "Distribuzione delle Categorie di BMI tra i Pazienti",
       x = "Categoria di BMI",
       y = "Numero di Pazienti") +
  theme_minimal()
```

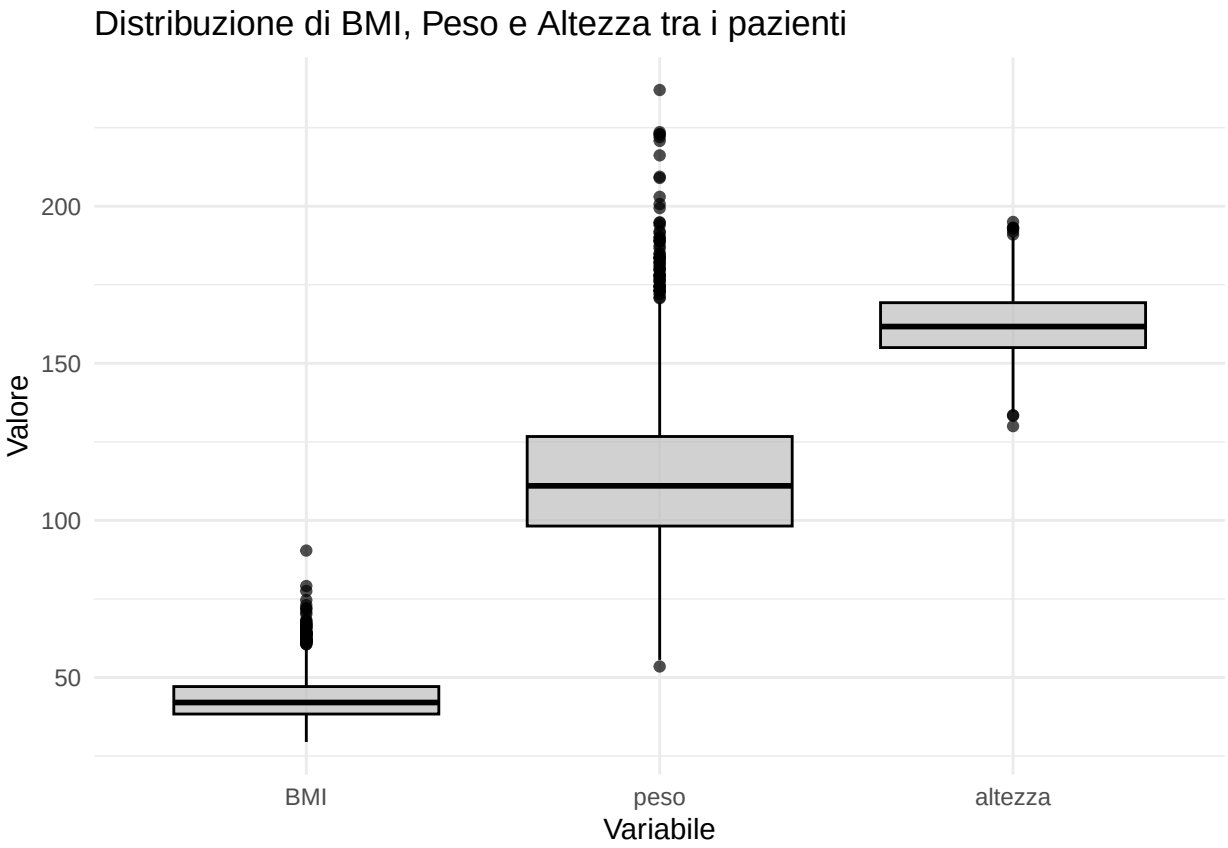



```
df$bmi_categoria <- NULL
```

$$\text{BMI medio} = \frac{115.09}{(1.6263)^2} \approx 43.53$$

Il BMI medio rispecchia ciò che si vede nel grafico a barre

```
library(ggplot2)
library(reshape2)

df_melt <- melt(df, measure.vars = c("BMI", "peso", "altezza"),
                variable.name = "variabile", value.name = "valore")

ggplot(df_melt, aes(x = variabile, y = valore)) +
  geom_boxplot(fill = "gray", color = "black", alpha = 0.7) +
  labs(title = "Distribuzione di BMI, Peso e Altezza tra i pazienti",
       x = "Variabile",
       y = "Valore") +
  theme_minimal() +
  theme(legend.position = "none")
```



La variabilità del peso è significativamente più elevata rispetto al BMI e all'altezza, come indicato dalla lunghezza della "scatola" e dalla presenza di molti outliers. Il BMI è meno disperso, ma gli outliers presenti indicano che ci sono alcuni pazienti con valori estremi. L'altezza ha una distribuzione piuttosto stretta, con meno variabilità rispetto alle altre due variabili, come atteso.

```
# Sostituire le stringhe vuote ("") con NA
df[df == ""] <- NA
# Sostituire "NULL" o altri valori carattere specifici con NA
df[df == "NULL"] <- NA
```

Visualizzo quanti NaN ha il df e quanti ce ne sono mediamente per colonna

```
num_col_with_na <- sum(colSums(is.na(df)) > 0)
total_na <- sum(is.na(df))
mean_columns <- total_na/ 562 #n colonne

cat("Numero di colonne con almeno un valore NaN: ", num_col_with_na, "\n")
```

```
## Numero di colonne con almeno un valore NaN:  543
```

```
cat("Totale NaN nel dataframe: ", total_na, "\n")
```

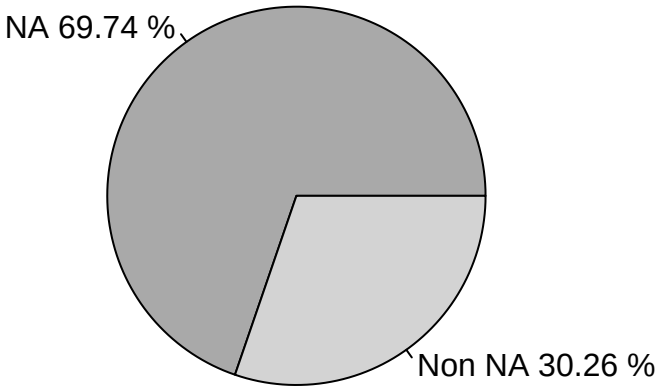
```
## Totale NaN nel dataframe:  812078
```

```
cat("Media NaN per colonna: ", round(mean_columns,0), "\n")
```

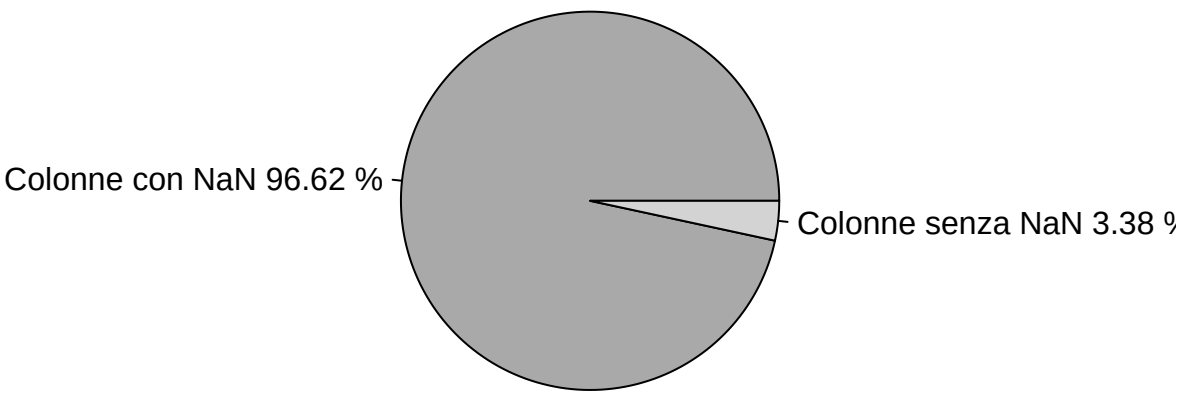
```
## Media NaN per colonna:  1445
```

```
total_cells <- prod(dim(df))
total_na <- 812078
```

```r
total_non_na <- total_cells - total_na

values <- c("NA" = total_na, "Non NA" = total_non_na)

pie(values,
    labels = c(paste("NA", round(total_na / total_cells * 100, 2), "%"),
               paste("Non NA", round(total_non_na / total_cells * 100, 2), "%")),
    col = c("darkgray", "lightgray"),
    main = "Percentuale di celle NA rispetto al Totale")
```




```r
columns_with_nan <- 543
columns_without_nan <- 562 - 543

values <- c("Colonne con NaN" = columns_with_nan, "Colonne senza NaN" = columns_without_nan)

# Crea un grafico a torta
pie(values,
    col = c("darkgray", "lightgray"),  # Colori per NaN e non NaN
    labels = c(paste("Colonne con NaN", round(columns_with_nan / sum(values) * 100, 2), "%"),
               paste("Colonne senza NaN", round(columns_without_nan / sum(values) * 100, 2), "%")),
    main = "Proporzione di colonne con e senza NaN")
```



2. DATA CLEANING

colonna peso e peso_1 sono uguali

```
identical(df$peso, df$peso_1)
```

```
## [1] TRUE
```

la elimino

```
df$peso <- NULL
dim(df)
```

```
## [1] 2072  561
```

Creazione righe progressione peso

Operazione per creare delle nuove righe per ogni id che ha una progressione del peso. Andrò così a creare una colonna **X** (osservaizione precedente) e una colonna **Y** (osservazione successiva). che andranno a creare una riga per ogni osservazione di peso rilevata per ogni **id**.

```
# Identifica tutte le colonne relative al peso (peso_1, peso_2, ..., peso_n)
weight_columns <- grep("peso_", colnames(df), value = TRUE)

transform_dataframe <- function(df) {
  # Lista per memorizzare le righe trasformate
  transformed_rows <- list()

  # Itera su ogni riga del DataFrame
  for (idx in 1:nrow(df)) {
    # Ottieni le informazioni di base (tutte le colonne tranne quelle dei pesi)
    base_info <- df[idx, !colnames(df) %in% weight_columns]

    # Itera su ogni coppia di colonne peso_x e peso_x+1
    for (i in 1:(length(weight_columns) - 1)) {
      peso_x <- df[idx, weight_columns[i]]
      peso_y <- df[idx, weight_columns[i + 1]]

      # Considera solo coppie valide (non-NA)
```

```r
      if (!is.na(peso_x) & !is.na(peso_y)) {
        # Crea una nuova riga con X e Y come i due pesi
        new_row <- base_info
        new_row$X <- peso_x
        new_row$Y <- peso_y

        # Aggiungi la nuova riga alla lista
        transformed_rows[[length(transformed_rows) + 1]] <- new_row
      }
    }
  }

  transformed_df <- do.call(rbind, transformed_rows)

  return(transformed_df)
}

transformed_df <- transform_dataframe(df)

head(transformed_df)
```

```
##     id step  data birth_date      birth_place gender eta  sdo_code
## 1   10    1 19877       2465          Taranto      m  48 201402666
## 2   10    1 19877       2465          Taranto      m  48 201402666
## 210 11    1 19890       3606           Varese      m  45 201402881
## 213 11    1 19890       3606           Varese      m  45 201402881
## 3   12    1 20214       6652 Vaslui (ROMANIA)      f  37  20152207
## 35  12    1 20214       6652 Vaslui (ROMANIA)      f  37  20152207
##     qualification job_category                       patient_key dm
## 1               4           15 785642faf0999f56552930695a55b3ae  n
## 2               4           15 785642faf0999f56552930695a55b3ae  n
## 210             3           15 09da6b39bbc840c94d5d3745bd0dda92  n
## 213             3           15 09da6b39bbc840c94d5d3745bd0dda92  n
## 3               4           14 18b81d90c4101c150376cc3b98b491cb  n
## 35              4           14 18b81d90c4101c150376cc3b98b491cb  n
##     ret_diab_nprolif ret_diab_prolif nefr_inc insuf_ren_cr neurop_diab BPCO
## 1                  n               n        n            n           n    n
## 2                  n               n        n            n           n    n
## 210                n               n        n            n           n    n
## 213                n               n        n            n           n    n
## 3                  n               n        n            n           n    n
## 35                 n               n        n            n           n    n
##     insuf_resp_cr OSAS steat_ep cirr_ep cardiop_isc cardiop_dil
## 1               n    y        n       n           n           n
## 2               n    y        n       n           n           n
## 210             n    y        y       n           n           n
## 213             n    y        y       n           n           n
## 3               n    n        n       n           n           n
## 35              n    n        n       n           n           n
##     cardiop_iper_ostr valv_patia pat_osteo_dis dep psic DCA iper_art ipogon PCO
## 1                   n          n             n   n    n   y        n      n   n
## 2                   n          n             n   n    n   y        n      n   n
## 210                 n          n             n   n    n   y        y      n   n
## 213                 n          n             n   n    n   y        y      n   n
```

```
## 3                  n          n             n   n    n   y        y      n   n
## 35                 n          n             n   n    n   y        y      n   n
##     prev_chirurg_bar tip_chirurg_bar mese_chirurg_bar anno_chirurg_bar ansia
## 1                 n            NaN              NaN             NaN  <NA>
## 2                 n            NaN              NaN             NaN  <NA>
## 210               n            NaN              NaN             NaN     n
## 213               n            NaN              NaN             NaN     n
## 3                 n            NaN              NaN             NaN  <NA>
## 35                n            NaN              NaN             NaN  <NA>
##     neoplas esofago mammella utero colon_retto rene pancreas polmone stomaco
## 1      <NA>    <NA>     <NA>  <NA>        <NA> <NA>     <NA>    <NA>    <NA>
## 2      <NA>    <NA>     <NA>  <NA>        <NA> <NA>     <NA>    <NA>    <NA>
## 210       n    <NA>     <NA>  <NA>        <NA> <NA>     <NA>    <NA>    <NA>
## 213       n    <NA>     <NA>  <NA>        <NA> <NA>     <NA>    <NA>    <NA>
## 3      <NA>    <NA>     <NA>  <NA>        <NA> <NA>     <NA>    <NA>    <NA>
## 35     <NA>    <NA>     <NA>  <NA>        <NA> <NA>     <NA>    <NA>    <NA>
##     porostata tiroide fegato ovaio testicolo altro tip_altro altezza      BMI
## 1        <NA>    <NA>   <NA>  <NA>      <NA>  <NA>      <NA>     172 57.22688
## 2        <NA>    <NA>   <NA>  <NA>      <NA>  <NA>      <NA>     172 57.22688
## 210      <NA>    <NA>   <NA>  <NA>      <NA>  <NA>      <NA>     172 56.41563
## 213      <NA>    <NA>   <NA>  <NA>      <NA>  <NA>      <NA>     172 56.41563
## 3        <NA>    <NA>   <NA>  <NA>      <NA>  <NA>      <NA>     164 55.02677
## 35       <NA>    <NA>   <NA>  <NA>      <NA>  <NA>      <NA>     164 55.02677
##     circ_vita circ_fian rapporto_vita_fian PAS PAD freq_card rapporto_vita_alt
## 1         153       151              1.013 140  90        88             0.889
## 2         153       151              1.013 140  90        88             0.889
## 210       154       153              1.006 155  80        81             0.895
## 213       154       153              1.006 155  80        81             0.895
## 3         145       155              0.935 150  90        90               NaN
## 35        145       155              0.935 150  90        90               NaN
##     bioimped fm_kg fm_kg_na fm_perc fm_perc_na ffm_kg ffm_kg_na ffm_perc
## 1       <NA>   NaN     <NA>     NaN       <NA>    NaN      <NA>      NaN
## 2       <NA>   NaN     <NA>     NaN       <NA>    NaN      <NA>      NaN
## 210     <NA>   NaN     <NA>     NaN       <NA>    NaN      <NA>      NaN
## 213     <NA>   NaN     <NA>     NaN       <NA>    NaN      <NA>      NaN
## 3         na   NaN     <NA>     NaN       <NA>    NaN      <NA>      NaN
## 35        na   NaN     <NA>     NaN       <NA>    NaN      <NA>      NaN
##     ffm_perc_na massa_musc_kg massa_musc_kg_na massa_musc_perc
## 1          <NA>           NaN             <NA>             NaN
## 2          <NA>           NaN             <NA>             NaN
## 210        <NA>           NaN             <NA>             NaN
## 213        <NA>           NaN             <NA>             NaN
## 3          <NA>           NaN             <NA>             NaN
## 35         <NA>           NaN             <NA>             NaN
##     massa_musc_perc_na acqua_extra acqua_extra_na acqua_intra acqua_intra_na
## 1                 <NA>         NaN           <NA>         NaN           <NA>
## 2                 <NA>         NaN           <NA>         NaN           <NA>
## 210               <NA>         NaN           <NA>         NaN           <NA>
## 213               <NA>         NaN           <NA>         NaN           <NA>
## 3                 <NA>         NaN           <NA>         NaN           <NA>
## 35                <NA>         NaN           <NA>         NaN           <NA>
##     calorim_ind REE_kcal_die REE_kcal_die_na REE_perc REE_perc_na quoz_resp
## 1          <NA>          NaN            <NA>      NaN        <NA>       NaN
## 2          <NA>          NaN            <NA>      NaN        <NA>       NaN
```

```
## 210        <NA>          NaN            <NA>      NaN        <NA>       NaN
## 213        <NA>          NaN            <NA>      NaN        <NA>       NaN
## 3             n          NaN            <NA>      NaN        <NA>       NaN
## 35            n          NaN            <NA>      NaN        <NA>       NaN
##     quoz_resp_na harris_benedict eritroc eritroc_na ematocr ematocr_na  emo
## 1          <NA>             NaN     NaN       <NA>     NaN       <NA>  NaN
## 2          <NA>             NaN     NaN       <NA>     NaN       <NA>  NaN
## 210        <NA>         2923.18     NaN       <NA>     NaN       <NA>  NaN
## 213        <NA>         2923.18     NaN       <NA>     NaN       <NA>  NaN
## 3          <NA>             NaN    5.19       <NA>    43.7       <NA> 13.9
## 35         <NA>             NaN    5.19       <NA>    43.7       <NA> 13.9
##     emo_na vol_glob vol_glob_na leuco leuco_na piastr piastr_na VES ves_na AST
## 1     <NA>      NaN        <NA>   NaN     <NA>    NaN      <NA> NaN   <NA> NaN
## 2     <NA>      NaN        <NA>   NaN     <NA>    NaN      <NA> NaN   <NA> NaN
## 210   <NA>      NaN        <NA>   NaN     <NA>    NaN      <NA> NaN   <NA> NaN
## 213   <NA>      NaN        <NA>   NaN     <NA>    NaN      <NA> NaN   <NA> NaN
## 3     <NA>     84.2        <NA>   8.2     <NA>    286      <NA>  18   <NA>  20
## 35    <NA>     84.2        <NA>   8.2     <NA>    286      <NA>  18   <NA>  20
##     ast_na ALT alt_na fosf_alc fosf_alc_na gammaGT gammaGT_na  CK ck_na album
## 1     <NA> NaN   <NA>      NaN        <NA>     NaN       <NA> NaN  <NA>   NaN
## 2     <NA> NaN   <NA>      NaN        <NA>     NaN       <NA> NaN  <NA>   NaN
## 210   <NA> NaN   <NA>      NaN        <NA>     NaN       <NA> NaN  <NA>   NaN
## 213   <NA> NaN   <NA>      NaN        <NA>     NaN       <NA> NaN  <NA>   NaN
## 3     <NA>  28   <NA>      NaN        <NA>      24       <NA> NaN  <NA>   NaN
## 35    <NA>  28   <NA>      NaN        <NA>      24       <NA> NaN  <NA>   NaN
##     album_na uric uric_na creatin creatin_na vel_filtr vel_filtr_na micr_album
## 1       <NA>  NaN    <NA>     NaN       <NA>       NaN         <NA>        NaN
## 2       <NA>  NaN    <NA>     NaN       <NA>       NaN         <NA>        NaN
## 210     <NA>  NaN    <NA>     NaN       <NA>       NaN         <NA>        NaN
## 213     <NA>  NaN    <NA>     NaN       <NA>       NaN         <NA>        NaN
## 3       <NA>  8.3    <NA>     0.7       <NA>       NaN         <NA>         68
## 35      <NA>  8.3    <NA>     0.7       <NA>       NaN         <NA>         68
##     micr_album_na col_tot col_tot_na HDL hdl_na LDL ldl_na trigl trigl_na
## 1            <NA>     NaN       <NA> NaN   <NA> NaN   <NA>   NaN     <NA>
## 2            <NA>     NaN       <NA> NaN   <NA> NaN   <NA>   NaN     <NA>
## 210          <NA>     NaN       <NA> NaN   <NA> NaN   <NA>   NaN     <NA>
## 213          <NA>     NaN       <NA> NaN   <NA> NaN   <NA>   NaN     <NA>
## 3            <NA>     192       <NA>  44   <NA> 127   <NA>   182     <NA>
## 35           <NA>     192       <NA>  44   <NA> 127   <NA>   182     <NA>
##     glic_bas glic_bas_na glic_OGTT glic_OGTT_na insulinem_bas insulinem_bas_na
## 1        NaN        <NA>       NaN         <NA>           NaN             <NA>
## 2        NaN        <NA>       NaN         <NA>           NaN             <NA>
## 210      NaN        <NA>       NaN         <NA>           NaN             <NA>
## 213      NaN        <NA>       NaN         <NA>           NaN             <NA>
## 3         87        <NA>       145         <NA>          27.8             <NA>
## 35        87        <NA>       145         <NA>          27.8             <NA>
##     insulinem_OGTT insulinem_OGTT_na HOMA_IR homa_ir_na emo_gli emo_gli_na
## 1              NaN              <NA>     NaN       <NA>     NaN       <NA>
## 2              NaN              <NA>     NaN       <NA>     NaN       <NA>
## 210            NaN              <NA>     NaN       <NA>     NaN       <NA>
## 213            NaN              <NA>     NaN       <NA>     NaN       <NA>
## 3            224.9              <NA>     NaN       <NA>      45       <NA>
## 35           224.9              <NA>     NaN       <NA>      45       <NA>
##     calcemia calcemia_na fosfor fosfor_na sodio sodio_na pot pot_na homo
```

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## 1        NaN        <NA>    NaN      <NA>   NaN     <NA> NaN   <NA>  NaN
## 2        NaN        <NA>    NaN      <NA>   NaN     <NA> NaN   <NA>  NaN
## 210      NaN        <NA>    NaN      <NA>   NaN     <NA> NaN   <NA>  NaN
## 213      NaN        <NA>    NaN      <NA>   NaN     <NA> NaN   <NA>  NaN
## 3        9.8        <NA>    NaN      <NA>   141     <NA> 4.5   <NA>  NaN
## 35       9.8        <NA>    NaN      <NA>   141     <NA> 4.5   <NA>  NaN
##     homo_na prot_C_reat prot_C_reat_na testost_tot testost_tot_na SHBG shbg_na
## 1      <NA>         NaN           <NA>         NaN           <NA>  NaN    <NA>
## 2      <NA>         NaN           <NA>         NaN           <NA>  NaN    <NA>
## 210    <NA>         NaN           <NA>         NaN           <NA>  NaN    <NA>
## 213    <NA>         NaN           <NA>         NaN           <NA>  NaN    <NA>
## 3      <NA>         0.8           <NA>         NaN           <NA>  NaN    <NA>
## 35     <NA>         0.8           <NA>         NaN           <NA>  NaN    <NA>
##     testost_lib testost_lib_na estradiolo estradiolo_na FSH FSH_na  LH LH_na
## 1           NaN           <NA>        NaN          <NA> NaN   <NA> NaN  <NA>
## 2           NaN           <NA>        NaN          <NA> NaN   <NA> NaN  <NA>
## 210         NaN           <NA>        NaN          <NA> NaN   <NA> NaN  <NA>
## 213         NaN           <NA>        NaN          <NA> NaN   <NA> NaN  <NA>
## 3           NaN           <NA>        NaN          <NA> NaN   <NA> NaN  <NA>
## 35          NaN           <NA>        NaN          <NA> NaN   <NA> NaN  <NA>
##     cortisolemia cortisolemia_na cortisoluria cortisoluria_na ACTH ACTH_na
## 1            NaN            <NA>          NaN            <NA>  NaN    <NA>
## 2            NaN            <NA>          NaN            <NA>  NaN    <NA>
## 210          NaN            <NA>          NaN            <NA>  NaN    <NA>
## 213          NaN            <NA>          NaN            <NA>  NaN    <NA>
## 3            NaN            <NA>          NaN            <NA>  NaN    <NA>
## 35           NaN            <NA>          NaN            <NA>  NaN    <NA>
##     fT3_pgml fT3_pgml_na fT3_pmoll fT3_pmoll_na fT4_pgml fT4_pgml_na fT4_pmoll
## 1        NaN        <NA>       NaN         <NA>      NaN        <NA>       NaN
## 2        NaN        <NA>       NaN         <NA>      NaN        <NA>       NaN
## 210      NaN        <NA>       NaN         <NA>      NaN        <NA>       NaN
## 213      NaN        <NA>       NaN         <NA>      NaN        <NA>       NaN
## 3        NaN        <NA>       NaN         <NA>     11.6        <NA>       NaN
## 35       NaN        <NA>       NaN         <NA>     11.6        <NA>       NaN
##     fT4_pmoll_na  TSH TSH_na prolat prolat_na paratormone paratormone_na
## 1           <NA>  NaN   <NA>    NaN      <NA>         NaN           <NA>
## 2           <NA>  NaN   <NA>    NaN      <NA>         NaN           <NA>
## 210         <NA>  NaN   <NA>    NaN      <NA>         NaN           <NA>
## 213         <NA>  NaN   <NA>    NaN      <NA>         NaN           <NA>
## 3           <NA> 3.96   <NA>    NaN      <NA>         NaN           <NA>
## 35          <NA> 3.96   <NA>    NaN      <NA>         NaN           <NA>
##     calcifed calcifed_na leptina leptina_na prel_serot prel_genet prel_epi
## 1        NaN        <NA>    <NA>       <NA>       <NA>       <NA>     <NA>
## 2        NaN        <NA>    <NA>       <NA>       <NA>       <NA>     <NA>
## 210      NaN        <NA>    <NA>       <NA>       <NA>       <NA>     <NA>
## 213      NaN        <NA>    <NA>       <NA>       <NA>       <NA>     <NA>
## 3          9        <NA>    <NA>       <NA>         na       <NA>     <NA>
## 35         9        <NA>    <NA>       <NA>         na       <NA>     <NA>
##     altro_lab neutrofili neutrofili_val neutrofili_na linfociti linfociti_val
## 1        <NA>        NaN            NaN          <NA>       NaN           NaN
## 2        <NA>        NaN            NaN          <NA>       NaN           NaN
## 210      <NA>        NaN            NaN          <NA>       NaN           NaN
## 213      <NA>        NaN            NaN          <NA>       NaN           NaN
## 3        <NA>         60            4.9          <NA>        31           2.5
```

```
## 35       <NA>         60            4.9          <NA>        31           2.5
##     linfociti_na monociti monociti_val monociti_na eosinofili eosinofili_val
## 1           <NA>      NaN          NaN        <NA>        NaN            NaN
## 2           <NA>      NaN          NaN        <NA>        NaN            NaN
## 210         <NA>      NaN          NaN        <NA>        NaN            NaN
## 213         <NA>      NaN          NaN        <NA>        NaN            NaN
## 3           <NA>        6          0.5        <NA>          2            0.2
## 35          <NA>        6          0.5        <NA>          2            0.2
##     eosinofili_na basofili basofili_val basofili_na ACR ACR_na other_tfa
## 1            <NA>      NaN          NaN        <NA> NaN   <NA>         n
## 2            <NA>      NaN          NaN        <NA> NaN   <NA>         n
## 210          <NA>      NaN          NaN        <NA> NaN   <NA>         n
## 213          <NA>      NaN          NaN        <NA> NaN   <NA>         n
## 3            <NA>        1          0.1        <NA> NaN   <NA>         y
## 35           <NA>        1          0.1        <NA> NaN   <NA>         y
##                                      other_tfa_nomefarm
## 1                                                <NA>
## 2                                                <NA>
## 210                                              <NA>
## 213                                              <NA>
## 3   Pantoprazolo 40mg 1cpr/die; Tachidol 1 cpr al bisogno
## 35  Pantoprazolo 40mg 1cpr/die; Tachidol 1 cpr al bisogno
##     other_endocrine_agent_nomefarm insuline_nomefarm oral_antidiab_nomefarm
## 1                             <NA>              <NA>                  <NA>
## 2                             <NA>              <NA>                  <NA>
## 210                           <NA>              <NA>                  <NA>
## 213                           <NA>              <NA>                  <NA>
## 3                             <NA>              <NA>                  <NA>
## 35                            <NA>              <NA>                  <NA>
##     corticost_per_musculo_nomefarm NSAIDs_nomefarm antipsychotic_nomefarm
## 1                             <NA>           <NA>                  <NA>
## 2                             <NA>           <NA>                  <NA>
## 210                           <NA>           <NA>                  <NA>
## 213                           <NA>           <NA>                  <NA>
## 3                             <NA>           <NA>                  <NA>
## 35                            <NA>           <NA>                  <NA>
##          antianx_antiinson_nomefarm antidepres_nomefarm
## 1   Lexotan, 30 gtt se crisi d'ansia               <NA>
## 2   Lexotan, 30 gtt se crisi d'ansia               <NA>
## 210                           <NA>               <NA>
## 213                           <NA>               <NA>
## 3                             <NA>               <NA>
## 35                            <NA>               <NA>
##     comb_bronchodilators_nomefarm corticost_per_bronco_nomefarm
## 1                            <NA>                         <NA>
## 2                            <NA>                         <NA>
## 210                          <NA>                         <NA>
## 213                          <NA>                         <NA>
## 3                            <NA>                         <NA>
## 35                           <NA>                         <NA>
##     methylxanthines_nomefarm anticholinergic_nomefarm beta_adrenergic_nomefarm
## 1                       <NA>                    <NA>                     <NA>
## 2                       <NA>                    <NA>                     <NA>
## 210                     <NA>                    <NA>                     <NA>
```

```
## 213                    <NA>                    <NA>                    <NA>
## 3                      <NA>                    <NA>                    <NA>
## 35                     <NA>                    <NA>                    <NA>
##     other_anticoag_nomefarm oral_anticoag_nomefarm
## 1                      <NA>                  <NA>
## 2                      <NA>                  <NA>
## 210                    <NA>                  <NA>
## 213                    <NA>                  <NA>
## 3                      <NA>                  <NA>
## 35                     <NA>                  <NA>
##     other_anti_platelets_nomefarm dipirydamole_nomefarm clopidogrel_nomefarm
## 1                            <NA>                 <NA>                 <NA>
## 2                            <NA>                 <NA>                 <NA>
## 210                          <NA>                 <NA>                 <NA>
## 213                          <NA>                 <NA>                 <NA>
## 3                            <NA>                 <NA>                 <NA>
## 35                           <NA>                 <NA>                 <NA>
##     ticlopidine_nomefarm acetyl_acid_nomefarm statin_ezetimibe_nomefarm
## 1                   <NA>                <NA>                      <NA>
## 2                   <NA>                <NA>                      <NA>
## 210                 <NA>                <NA>                      <NA>
## 213                 <NA>                <NA>                      <NA>
## 3                   <NA>                <NA>                      <NA>
## 35                  <NA>                <NA>                      <NA>
##     other_lipid_low_nomefarm ezetimibe_nomefarm fibrate_nomefarm
## 1                       <NA>              <NA>            <NA>
## 2                       <NA>              <NA>            <NA>
## 210                     <NA>              <NA>            <NA>
## 213                     <NA>              <NA>            <NA>
## 3                       <NA>              <NA>            <NA>
## 35                      <NA>              <NA>            <NA>
##     statine_nomefarm diur_pot_sp_diur_nomefarm BB_diur_nomefarm
## 1               <NA>                     <NA>            <NA>
## 2               <NA>                     <NA>            <NA>
## 210             <NA>                     <NA>            <NA>
## 213             <NA>                     <NA>            <NA>
## 3               <NA>                     <NA>            <NA>
## 35              <NA>                     <NA>            <NA>
##                                    ARB_CCB_nomefarm ARB_diur_nomefarm
## 1                                              <NA>              <NA>
## 2                                              <NA>              <NA>
## 210 SeviKar (Olmesartan/ Amlodipina) 40 /10 mg 1 cp/die              <NA>
## 213 SeviKar (Olmesartan/ Amlodipina) 40 /10 mg 1 cp/die              <NA>
## 3                                              <NA>              <NA>
## 35                                             <NA>              <NA>
##     ACE_CCB_nomefarm ACE_diur_nomefarm other_antihyp_nomefarm
## 1               <NA>              <NA>                   <NA>
## 2               <NA>              <NA>                   <NA>
## 210             <NA>              <NA>                   <NA>
## 213             <NA>              <NA>                   <NA>
## 3               <NA>              <NA>                   <NA>
## 35              <NA>              <NA>                   <NA>
##            diur_nomefarm           CCB_nomefarm              BB_nomefarm
## 1                   <NA>                   <NA>                     <NA>
```

```
## 2                   <NA>                   <NA>                    <NA>
## 210 Lasix 25 mg 2 cp/die Norvasc 10 mg 1 cp/die Dilatrend 25 mg 1 cp/die
## 213 Lasix 25 mg 2 cp/die Norvasc 10 mg 1 cp/die Dilatrend 25 mg 1 cp/die
## 3                   <NA>                   <NA>                    <NA>
## 35                  <NA>                   <NA>                    <NA>
##             ARB_nomefarm ACE_nomefarm other_endocrine_agent insuline
## 1                   <NA>         <NA>                     n        n
## 2                   <NA>         <NA>                     n        n
## 210                 <NA>         <NA>                     n        n
## 213                 <NA>         <NA>                     n        n
## 3   Pritor 40mg 1cpr/die         <NA>                     n        n
## 35  Pritor 40mg 1cpr/die         <NA>                     n        n
##     oral_antidiab corticost_per_musculo NSAIDs antipsychotic
## 1               n                     n      n             n
## 2               n                     n      n             n
## 210             n                     n      n             n
## 213             n                     n      n             n
## 3               n                     n      n             n
## 35              n                     n      n             n
##     antianxiety_antiinsonnia antidepres combined_bronchodilators
## 1                          y          n                        n
## 2                          y          n                        n
## 210                        n          n                        n
## 213                        n          n                        n
## 3                          n          n                        n
## 35                         n          n                        n
##     corticost_per_bronco methylxanthines anticholinergic beta_adrenergic
## 1                      n               n               n              n
## 2                      n               n               n              n
## 210                    n               n               n              n
## 213                    n               n               n              n
## 3                      n               n               n              n
## 35                     n               n               n              n
##     other_anticoag oral_anticoag other_anti_platelets dipirydamole clopidogrel
## 1                n             n                    n           n           n
## 2                n             n                    n           n           n
## 210              n             n                    n           y           n
## 213              n             n                    n           y           n
## 3                n             n                    n           n           n
## 35               n             n                    n           n           n
##     ticlopidine acetyl_acid statin_ezetimibe other_lipid_low ezetimibe fibrate
## 1             n           n               n               n        n       n
## 2             n           n               n               n        n       n
## 210           n           n               n               n        n       n
## 213           n           n               n               n        n       n
## 3             n           n               n               n        n       n
## 35            n           n               n               n        n       n
##     statine diur_pot_sp_diur BB_diur ARB_CCB ARB_diur ACE_CCB ACE_diur
## 1         n               n       n       n        n       n        n
## 2         n               n       n       n        n       n        n
## 210       n               n       n       y        n       n        n
## 213       n               n       n       y        n       n        n
## 3         n               n       n       n        n       n        n
## 35        n               n       n       n        n       n        n
```

```
##     other_antihyp diur CCB BB ARB ACE PAD_1min_rec PAD_picco PAD_bas
## 1               n    n   n  n   n   n         <NA>      <NA>    <NA>
## 2               n    n   n  n   n   n         <NA>      <NA>    <NA>
## 210             n    y   y  y   n   n         <NA>      <NA>    <NA>
## 213             n    y   y  y   n   n         <NA>      <NA>    <NA>
## 3               n    n   n  n   y   n         <NA>      <NA>    <NA>
## 35              n    n   n  n   y   n         <NA>      <NA>    <NA>
##     tip_altro_evento_cv anno_evento_cv_na anno_evento_cv altro_evento_cv
## 1                  <NA>              <NA>           <NA>            <NA>
## 2                  <NA>              <NA>           <NA>            <NA>
## 210                <NA>              <NA>           <NA>            <NA>
## 213                <NA>              <NA>           <NA>            <NA>
## 3                  <NA>              <NA>           <NA>            <NA>
## 35                 <NA>              <NA>           <NA>            <NA>
##     stroke_anno_na stroke_anno stroke TIA_anno_na TIA_anno  TIA BPAC_anno_na
## 1             <NA>        <NA>   <NA>        <NA>     <NA> <NA>         <NA>
## 2             <NA>        <NA>   <NA>        <NA>     <NA> <NA>         <NA>
## 210           <NA>        <NA>   <NA>        <NA>     <NA> <NA>         <NA>
## 213           <NA>        <NA>   <NA>        <NA>     <NA> <NA>         <NA>
## 3             <NA>        <NA>   <NA>        <NA>     <NA> <NA>         <NA>
## 35            <NA>        <NA>   <NA>        <NA>     <NA> <NA>         <NA>
##     BPAC_anno BPAC PTCA_anno_na PTCA_anno PTCA IMA_anno_na IMA_anno  IMA
## 1        <NA> <NA>         <NA>      <NA> <NA>        <NA>     <NA> <NA>
## 2        <NA> <NA>         <NA>      <NA> <NA>        <NA>     <NA> <NA>
## 210      <NA> <NA>         <NA>      <NA> <NA>        <NA>     <NA> <NA>
## 213      <NA> <NA>         <NA>      <NA> <NA>        <NA>     <NA> <NA>
## 3        <NA> <NA>         <NA>      <NA> <NA>        <NA>     <NA> <NA>
## 35       <NA> <NA>         <NA>      <NA> <NA>        <NA>     <NA> <NA>
##     SCA_anno_na SCA_anno  SCA EPA_anno_na EPA_anno  EPA miocardite_anno_na
## 1          <NA>     <NA> <NA>        <NA>     <NA> <NA>               <NA>
## 2          <NA>     <NA> <NA>        <NA>     <NA> <NA>               <NA>
## 210        <NA>     <NA> <NA>        <NA>     <NA> <NA>               <NA>
## 213        <NA>     <NA> <NA>        <NA>     <NA> <NA>               <NA>
## 3          <NA>     <NA> <NA>        <NA>     <NA> <NA>               <NA>
## 35         <NA>     <NA> <NA>        <NA>     <NA> <NA>               <NA>
##     miocardite_anno miocardite pericardite_anno_na pericardite_anno pericardite
## 1              <NA>       <NA>                <NA>             <NA>        <NA>
## 2              <NA>       <NA>                <NA>             <NA>        <NA>
## 210            <NA>       <NA>                <NA>             <NA>        <NA>
## 213            <NA>       <NA>                <NA>             <NA>        <NA>
## 3              <NA>       <NA>                <NA>             <NA>        <NA>
## 35             <NA>       <NA>                <NA>             <NA>        <NA>
##     endocardite_anno_na endocardite_anno endocardite ecocardio ECG_D_HOLTER_na
## 1                  <NA>             <NA>        <NA>      <NA>            <NA>
## 2                  <NA>             <NA>        <NA>      <NA>            <NA>
## 210                <NA>             <NA>        <NA>      <NA>            <NA>
## 213                <NA>             <NA>        <NA>      <NA>            <NA>
## 3                  <NA>             <NA>        <NA>         n            <NA>
## 35                 <NA>             <NA>        <NA>         n            <NA>
##     ST_d_val note conclusioni dispnea angor   FA   TV  BEV ST_na ST_val   ST
## 1       <NA> <NA>        <NA>    <NA>  <NA> <NA> <NA> <NA>  <NA>   <NA> <NA>
## 2       <NA> <NA>        <NA>    <NA>  <NA> <NA> <NA> <NA>  <NA>   <NA> <NA>
## 210     <NA> <NA>        <NA>    <NA>  <NA> <NA> <NA> <NA>  <NA>   <NA> <NA>
## 213     <NA> <NA>        <NA>    <NA>  <NA> <NA> <NA> <NA>  <NA>   <NA> <NA>
```

```
## 3       <NA> <NA>        <NA>    <NA>  <NA> <NA> <NA> <NA>  <NA>   <NA> <NA>
## 35      <NA> <NA>        <NA>    <NA>  <NA> <NA> <NA> <NA>  <NA>   <NA> <NA>
##     PAS_1min_rec_na PAS_1min_rec PAS_picco_na PAS_picco PAS_bas_na PAS_bas
## 1              <NA>         <NA>         <NA>      <NA>       <NA>    <NA>
## 2              <NA>         <NA>         <NA>      <NA>       <NA>    <NA>
## 210            <NA>         <NA>         <NA>      <NA>       <NA>    <NA>
## 213            <NA>         <NA>         <NA>      <NA>       <NA>    <NA>
## 3              <NA>         <NA>         <NA>      <NA>       <NA>    <NA>
## 35             <NA>         <NA>         <NA>      <NA>       <NA>    <NA>
##     calo_FC_rec_na calo_FC_rec indice_cronotropo_na indice_cronotropo
## 1             <NA>        <NA>                <NA>              <NA>
## 2             <NA>        <NA>                <NA>              <NA>
## 210           <NA>        <NA>                <NA>              <NA>
## 213           <NA>        <NA>                <NA>              <NA>
## 3             <NA>        <NA>                <NA>              <NA>
## 35            <NA>        <NA>                <NA>              <NA>
##     FC_perc_max_teo_na FC_perc_max_teo FC_1min_rec_na FC_1min_rec FC_picco_na
## 1                 <NA>            <NA>           <NA>        <NA>        <NA>
## 2                 <NA>            <NA>           <NA>        <NA>        <NA>
## 210               <NA>            <NA>           <NA>        <NA>        <NA>
## 213               <NA>            <NA>           <NA>        <NA>        <NA>
## 3                 <NA>            <NA>           <NA>        <NA>        <NA>
## 35                <NA>            <NA>           <NA>        <NA>        <NA>
##     FC_picco FC_bas_na FC_bas watt_picco_na watt_picco METs_picco_na METs_picco
## 1       <NA>      <NA>   <NA>          <NA>       <NA>          <NA>       <NA>
## 2       <NA>      <NA>   <NA>          <NA>       <NA>          <NA>       <NA>
## 210     <NA>      <NA>   <NA>          <NA>       <NA>          <NA>       <NA>
## 213     <NA>      <NA>   <NA>          <NA>       <NA>          <NA>       <NA>
## 3       <NA>      <NA>   <NA>          <NA>       <NA>          <NA>       <NA>
## 35      <NA>      <NA>   <NA>          <NA>       <NA>          <NA>       <NA>
##     durata_ergo_na durata_ergo test_ergo perc_PAD_sup70_notte_na
## 1              <NA>        <NA>      <NA>                    <NA>
## 2              <NA>        <NA>      <NA>                    <NA>
## 210            <NA>        <NA>      <NA>                    <NA>
## 213            <NA>        <NA>      <NA>                    <NA>
## 3              <NA>        <NA>      <NA>                    <NA>
## 35             <NA>        <NA>      <NA>                    <NA>
##     perc_PAD_sup70_notte perc_PAS_sup110_notte_na perc_PAS_sup110_notte
## 1                   <NA>                     <NA>                  <NA>
## 2                   <NA>                     <NA>                  <NA>
## 210                 <NA>                     <NA>                  <NA>
## 213                 <NA>                     <NA>                  <NA>
## 3                   <NA>                     <NA>                  <NA>
## 35                  <NA>                     <NA>                  <NA>
##     VC_73_NA VC_73 VC_72_NA VC_72 VC_71_NA VC_71 VC_70_NA VC_70 VC_69_NA VC_69
## 1       <NA>  <NA>     <NA>  <NA>     <NA>  <NA>     <NA>  <NA>     <NA>  <NA>
## 2       <NA>  <NA>     <NA>  <NA>     <NA>  <NA>     <NA>  <NA>     <NA>  <NA>
## 210     <NA>  <NA>     <NA>  <NA>     <NA>  <NA>     <NA>  <NA>     <NA>  <NA>
## 213     <NA>  <NA>     <NA>  <NA>     <NA>  <NA>     <NA>  <NA>     <NA>  <NA>
## 3       <NA>  <NA>     <NA>  <NA>     <NA>  <NA>     <NA>  <NA>     <NA>  <NA>
## 35      <NA>  <NA>     <NA>  <NA>     <NA>  <NA>     <NA>  <NA>     <NA>  <NA>
##     VC_68_NA VC_68 VC_67_NA VC_67 VC_66_NA VC_66 VC_65_NA VC_65 VC_64_NA VC_64
## 1       <NA>  <NA>     <NA>  <NA>     <NA>  <NA>     <NA>  <NA>     <NA>  <NA>
## 2       <NA>  <NA>     <NA>  <NA>     <NA>  <NA>     <NA>  <NA>     <NA>  <NA>
```

```
## 210     <NA>  <NA>     <NA>  <NA>     <NA>  <NA>     <NA>  <NA>     <NA>  <NA>
## 213     <NA>  <NA>     <NA>  <NA>     <NA>  <NA>     <NA>  <NA>     <NA>  <NA>
## 3       <NA>  <NA>     <NA>  <NA>     <NA>  <NA>     <NA>  <NA>     <NA>  <NA>
## 35      <NA>  <NA>     <NA>  <NA>     <NA>  <NA>     <NA>  <NA>     <NA>  <NA>
##     VC_63_NA VC_63 VC_62_NA VC_62 PAD1_notte_na PAD1_notte PAD1_diurno_na
## 1       <NA>  <NA>     <NA>  <NA>          <NA>       <NA>           <NA>
## 2       <NA>  <NA>     <NA>  <NA>          <NA>       <NA>           <NA>
## 210     <NA>  <NA>     <NA>  <NA>          <NA>       <NA>           <NA>
## 213     <NA>  <NA>     <NA>  <NA>          <NA>       <NA>           <NA>
## 3       <NA>  <NA>     <NA>  <NA>          <NA>       <NA>           <NA>
## 35      <NA>  <NA>     <NA>  <NA>          <NA>       <NA>           <NA>
##     PAD1_diurno PAD1_tot_na PAD1_tot PAS1_notte_na PAS1_notte PAS1_diurno_na
## 1          <NA>        <NA>     <NA>          <NA>       <NA>           <NA>
## 2          <NA>        <NA>     <NA>          <NA>       <NA>           <NA>
## 210        <NA>        <NA>     <NA>          <NA>       <NA>           <NA>
## 213        <NA>        <NA>     <NA>          <NA>       <NA>           <NA>
## 3          <NA>        <NA>     <NA>          <NA>       <NA>           <NA>
## 35         <NA>        <NA>     <NA>          <NA>       <NA>           <NA>
##     PAS1_diurno PAS1_tot_na PAS1_tot stenosi_tricusp_na stenosi_tricusp_val
## 1          <NA>        <NA>     <NA>               <NA>                <NA>
## 2          <NA>        <NA>     <NA>               <NA>                <NA>
## 210        <NA>        <NA>     <NA>               <NA>                <NA>
## 213        <NA>        <NA>     <NA>               <NA>                <NA>
## 3          <NA>        <NA>     <NA>               <NA>                <NA>
## 35         <NA>        <NA>     <NA>               <NA>                <NA>
##     stenosi_tricusp stenosi_mitr_na stenosi_mitr_val stenosi_mitr
## 1              <NA>            <NA>             <NA>         <NA>
## 2              <NA>            <NA>             <NA>         <NA>
## 210            <NA>            <NA>             <NA>         <NA>
## 213            <NA>            <NA>             <NA>         <NA>
## 3              <NA>            <NA>             <NA>         <NA>
## 35             <NA>            <NA>             <NA>         <NA>
##     stenosi_aort_na stenosi_aort_val stenosi_aort insuff_tricusp_na
## 1              <NA>             <NA>         <NA>              <NA>
## 2              <NA>             <NA>         <NA>              <NA>
## 210            <NA>             <NA>         <NA>              <NA>
## 213            <NA>             <NA>         <NA>              <NA>
## 3              <NA>             <NA>         <NA>              <NA>
## 35             <NA>             <NA>         <NA>              <NA>
##     insuff_tricusp_val insuff_tricusp insuff_mitr_na insuff_mitr_val
## 1                 <NA>           <NA>           <NA>            <NA>
## 2                 <NA>           <NA>           <NA>            <NA>
## 210               <NA>           <NA>           <NA>            <NA>
## 213               <NA>           <NA>           <NA>            <NA>
## 3                 <NA>           <NA>           <NA>            <NA>
## 35                <NA>           <NA>           <NA>            <NA>
##     insuff_mitr insuff_polm_na insuff_polm_val insuff_polm insuff_aort_na
## 1          <NA>           <NA>            <NA>        <NA>           <NA>
## 2          <NA>           <NA>            <NA>        <NA>           <NA>
## 210        <NA>           <NA>            <NA>        <NA>           <NA>
## 213        <NA>           <NA>            <NA>        <NA>           <NA>
## 3          <NA>           <NA>            <NA>        <NA>           <NA>
## 35         <NA>           <NA>            <NA>        <NA>           <NA>
##     insuff_aort_val insuff_aort TAPSE_na TAPSE rapp_E_E_na rapp_E_E rapp_E_A_na
```

```
## 1             <NA>        <NA>     <NA>  <NA>        <NA>     <NA>        <NA>
## 2             <NA>        <NA>     <NA>  <NA>        <NA>     <NA>        <NA>
## 210           <NA>        <NA>     <NA>  <NA>        <NA>     <NA>        <NA>
## 213           <NA>        <NA>     <NA>  <NA>        <NA>     <NA>        <NA>
## 3             <NA>        <NA>     <NA>  <NA>        <NA>     <NA>        <NA>
## 35            <NA>        <NA>     <NA>  <NA>        <NA>     <NA>        <NA>
##     rapp_E_A fraz_eiez_na fraz_eiez IVS_conc IVS_ecc  IVS massa_ventr_sx_na
## 1       <NA>         <NA>      <NA>     <NA>    <NA> <NA>              <NA>
## 2       <NA>         <NA>      <NA>     <NA>    <NA> <NA>              <NA>
## 210     <NA>         <NA>      <NA>     <NA>    <NA> <NA>              <NA>
## 213     <NA>         <NA>      <NA>     <NA>    <NA> <NA>              <NA>
## 3       <NA>         <NA>      <NA>     <NA>    <NA> <NA>              <NA>
## 35      <NA>         <NA>      <NA>     <NA>    <NA> <NA>              <NA>
##     massa_ventr_sx PP_na   PP SIV_na  SIV DTD_na  DTD flutter_atr_d_na
## 1             <NA>  <NA> <NA>   <NA> <NA>   <NA> <NA>             <NA>
## 2             <NA>  <NA> <NA>   <NA> <NA>   <NA> <NA>             <NA>
## 210           <NA>  <NA> <NA>   <NA> <NA>   <NA> <NA>             <NA>
## 213           <NA>  <NA> <NA>   <NA> <NA>   <NA> <NA>             <NA>
## 3             <NA>  <NA> <NA>   <NA> <NA>   <NA> <NA>             <NA>
## 35            <NA>  <NA> <NA>   <NA> <NA>   <NA> <NA>             <NA>
##     flutter_atr_d_val flutter_atr_d risp_ventr_d_na risp_ventr_d fib_atr_d
## 1                <NA>          <NA>            <NA>         <NA>      <NA>
## 2                <NA>          <NA>            <NA>         <NA>      <NA>
## 210              <NA>          <NA>            <NA>         <NA>      <NA>
## 213              <NA>          <NA>            <NA>         <NA>      <NA>
## 3                <NA>          <NA>            <NA>         <NA>      <NA>
## 35               <NA>          <NA>            <NA>         <NA>      <NA>
##     durata_d_na durata_d numero_d_na numero_d pause_d episodi_TV_d
## 1          <NA>     <NA>        <NA>     <NA>    <NA>         <NA>
## 2          <NA>     <NA>        <NA>     <NA>    <NA>         <NA>
## 210        <NA>     <NA>        <NA>     <NA>    <NA>         <NA>
## 213        <NA>     <NA>        <NA>     <NA>    <NA>         <NA>
## 3          <NA>     <NA>        <NA>     <NA>    <NA>         <NA>
## 35         <NA>     <NA>        <NA>     <NA>    <NA>         <NA>
##     num_BESV_d_na num_BESV_d num_BEV_d_na num_BEV_d ABPM ST_d_na ST_d freq_d
## 1            <NA>       <NA>         <NA>      <NA> <NA>    <NA> <NA>   <NA>
## 2            <NA>       <NA>         <NA>      <NA> <NA>    <NA> <NA>   <NA>
## 210          <NA>       <NA>         <NA>      <NA> <NA>    <NA> <NA>   <NA>
## 213          <NA>       <NA>         <NA>      <NA> <NA>    <NA> <NA>   <NA>
## 3            <NA>       <NA>         <NA>      <NA>    n    <NA> <NA>   <NA>
## 35           <NA>       <NA>         <NA>      <NA>    n    <NA> <NA>   <NA>
##     ritmo_sin_d_na ritmo_sin_d ECG_D_HOLTER freq_ventr_std_na freq_ventr_std
## 1              <NA>        <NA>         <NA>              <NA>           <NA>
## 2              <NA>        <NA>         <NA>              <NA>           <NA>
## 210            <NA>        <NA>         <NA>              <NA>           <NA>
## 213            <NA>        <NA>         <NA>              <NA>           <NA>
## 3              <NA>        <NA>            n              <NA>           <NA>
## 35             <NA>        <NA>            n              <NA>           <NA>
##     flutter_atr_std risp_ventr_std_na risp_ventr_std fib_atr_std segni_IVS_std
## 1              <NA>              <NA>           <NA>        <NA>          <NA>
## 2              <NA>              <NA>           <NA>        <NA>          <NA>
## 210            <NA>              <NA>           <NA>        <NA>          <NA>
## 213            <NA>              <NA>           <NA>        <NA>          <NA>
## 3                 n              <NA>           <NA>           n             n
```

```
## 35               n             <NA>          <NA>           n             n
##     onda_T_std ST_std_na ST_std_val ST_std QTc_std_na QTc_std QT_std_na QT_std
## 1         <NA>      <NA>       <NA>   <NA>       <NA>    <NA>      <NA>   <NA>
## 2         <NA>      <NA>       <NA>   <NA>       <NA>    <NA>      <NA>   <NA>
## 210       <NA>      <NA>       <NA>   <NA>       <NA>    <NA>      <NA>   <NA>
## 213       <NA>      <NA>       <NA>   <NA>       <NA>    <NA>      <NA>   <NA>
## 3            1      <NA>       <NA>      1       <NA>  446.00      <NA> 402.00
## 35           1      <NA>       <NA>      1       <NA>  446.00      <NA> 402.00
##     QRS_std_na QRS_std PQ_std_na PQ_std freq_std_na freq_std ritmo_sin_std
## 1         <NA>    <NA>      <NA>   <NA>        <NA>     <NA>          <NA>
## 2         <NA>    <NA>      <NA>   <NA>        <NA>     <NA>          <NA>
## 210       <NA>    <NA>      <NA>   <NA>        <NA>     <NA>          <NA>
## 213       <NA>    <NA>      <NA>   <NA>        <NA>     <NA>          <NA>
## 3         <NA>   96.00      <NA> 132.00        <NA>    74.00             y
## 35        <NA>   96.00      <NA> 132.00        <NA>    74.00             y
##     ECG_STD tip_evento_na tip_evento eventi_cv TSD_OC_score TSD_OC_score_na
## 1      <NA>          <NA>       <NA>      <NA>          NaN            <NA>
## 2      <NA>          <NA>       <NA>      <NA>          NaN            <NA>
## 210    <NA>          <NA>       <NA>      <NA>          NaN            <NA>
## 213    <NA>          <NA>       <NA>      <NA>          NaN            <NA>
## 3         y          <NA>       <NA>         n          NaN            <NA>
## 35        y          <NA>       <NA>         n          NaN            <NA>
##     VAS_diff_motorie_score VAS_diff_motorie_score_na VAS_dolore_score
## 1                      NaN                      <NA>             NaN
## 2                      NaN                      <NA>             NaN
## 210                    NaN                      <NA>             NaN
## 213                    NaN                      <NA>             NaN
## 3                      NaN                      <NA>             NaN
## 35                     NaN                      <NA>             NaN
##     VAS_dolore_score_na FSS_score FSS_score_na CBA_VE_score_na CBA_VE_ansia
## 1                  <NA>      <NA>         <NA>            <NA>         <NA>
## 2                  <NA>      <NA>         <NA>            <NA>         <NA>
## 210                <NA>      <NA>         <NA>            <NA>         <NA>
## 213                <NA>      <NA>         <NA>            <NA>         <NA>
## 3                  <NA>      <NA>         <NA>            <NA>         <NA>
## 35                 <NA>      <NA>         <NA>            <NA>         <NA>
##     CBA_VE_ansia_na CBA_VE_benessere CBA_VE_benessere_na CBA_VE_cambiamento_pos
## 1              <NA>             <NA>               <NA>                   <NA>
## 2              <NA>             <NA>               <NA>                   <NA>
## 210            <NA>             <NA>               <NA>                   <NA>
## 213            <NA>             <NA>               <NA>                   <NA>
## 3              <NA>             <NA>               <NA>                   <NA>
## 35             <NA>             <NA>               <NA>                   <NA>
##     CBA_VE_cambiamento_pos_na CBA_VE_depressione CBA_VE_depressione_na
## 1                        <NA>              <NA>                 <NA>
## 2                        <NA>              <NA>                 <NA>
## 210                      <NA>              <NA>                 <NA>
## 213                      <NA>              <NA>                 <NA>
## 3                        <NA>              <NA>                 <NA>
## 35                       <NA>              <NA>                 <NA>
##     CBA_VE_score CBA_VE_disagio_psicologico CBA_VE_disagio_psicologico_na
## 1           <NA>                       <NA>                          <NA>
## 2           <NA>                       <NA>                          <NA>
## 210         <NA>                       <NA>                          <NA>
```

```
## 213         <NA>                      <NA>                          <NA>
## 3           <NA>                      <NA>                          <NA>
## 35          <NA>                      <NA>                          <NA>
##     PGWBI_score_na PGWBI_ansia PGWBI_ansia_na PGWBI_depressione
## 1             <NA>         NaN           <NA>              NaN
## 2             <NA>         NaN           <NA>              NaN
## 210           <NA>         NaN           <NA>              NaN
## 213           <NA>         NaN           <NA>              NaN
## 3             <NA>         NaN           <NA>              NaN
## 35            <NA>         NaN           <NA>              NaN
##     PGWBI_depressione_na PGWBI_pos_benessere PGWBI_pos_benessere_na
## 1                  <NA>                NaN                   <NA>
## 2                  <NA>                NaN                   <NA>
## 210                <NA>                NaN                   <NA>
## 213                <NA>                NaN                   <NA>
## 3                  <NA>                NaN                   <NA>
## 35                 <NA>                NaN                   <NA>
##     PGWBI_autocontr PGWBI_autocontr_na PGWBI_salute_gen PGWBI_salute_gen_na
## 1               NaN               <NA>              NaN                <NA>
## 2               NaN               <NA>              NaN                <NA>
## 210             NaN               <NA>              NaN                <NA>
## 213             NaN               <NA>              NaN                <NA>
## 3               NaN               <NA>              NaN                <NA>
## 35              NaN               <NA>              NaN                <NA>
##     PGWBI_vitalita PGWBI_vitalita_na PGWBI_punteggio_tot PGWBI_punteggio_tot_na
## 1              NaN              <NA>                 NaN                   <NA>
## 2              NaN              <NA>                 NaN                   <NA>
## 210            NaN              <NA>                 NaN                   <NA>
## 213            NaN              <NA>                 NaN                   <NA>
## 3              NaN              <NA>                 NaN                   <NA>
## 35             NaN              <NA>                 NaN                   <NA>
##     abit_alim abit_alim_na comp_alim comp_alim_na fumo tip_fumatore
## 1        <NA>         <NA>      <NA>         <NA> <NA>         <NA>
## 2        <NA>         <NA>      <NA>         <NA> <NA>         <NA>
## 210      <NA>         <NA>      <NA>         <NA> <NA>         <NA>
## 213      <NA>         <NA>      <NA>         <NA> <NA>         <NA>
## 3        <NA>         <NA>      <NA>         <NA> <NA>         <NA>
## 35       <NA>         <NA>      <NA>         <NA> <NA>         <NA>
##     periodo_fumo periodo_fumo_na alcool periodo_alcool periodo_alcool_na
## 1           <NA>            <NA>   <NA>           <NA>              <NA>
## 2           <NA>            <NA>   <NA>           <NA>              <NA>
## 210         <NA>            <NA>   <NA>           <NA>              <NA>
## 213         <NA>            <NA>   <NA>           <NA>              <NA>
## 3           <NA>            <NA>   <NA>           <NA>              <NA>
## 35          <NA>            <NA>   <NA>           <NA>              <NA>
##     abuso_sost tip_abuso_sost tip_abuso_sost_na periodo_abuso_sost
## 1         <NA>           <NA>              <NA>               <NA>
## 2         <NA>           <NA>              <NA>               <NA>
## 210       <NA>           <NA>              <NA>               <NA>
## 213       <NA>           <NA>              <NA>               <NA>
## 3         <NA>           <NA>              <NA>               <NA>
## 35        <NA>           <NA>              <NA>               <NA>
##     periodo_abuso_sost_na YFAS_score YFAS_score_na Moynihan_score
## 1                    <NA>       <NA>          <NA>            NaN
```

```
## 2                    <NA>       <NA>          <NA>            NaN
## 210                  <NA>       <NA>          <NA>            NaN
## 213                  <NA>       <NA>          <NA>            NaN
## 3                    <NA>       <NA>          <NA>            NaN
## 35                   <NA>       <NA>          <NA>            NaN
##     Moynihan_score_na problema_eta altezza_step1 problema_BMI     X     Y
## 1                <NA>      nessuno           172      nessuno 169.3 152.6
## 2                <NA>      nessuno           172      nessuno 152.6 150.2
## 210              <NA>      nessuno           172      nessuno 166.9 150.7
## 213              <NA>      nessuno           172      nessuno 150.7 150.0
## 3                <NA>      nessuno           164      nessuno 148.0 138.3
## 35               <NA>      nessuno           164      nessuno 138.3 122.5
```

```
dim(transformed_df)
```

```
## [1] 2874  551
```

```
df<- transformed_df
```

Rimozione NaN

Elimino le colonne che hanno più del 90% di valori nulli

```
nan_perc <- colMeans(is.na(df))

# Mantieni solo le colonne con meno del 90% di valori NA
df <- df[, nan_perc < 0.9]
dim(df)
```

```
## [1] 2874  228
```

L'operazione ha eliminato 23 colonne

Applico funzione di ottimizzazione

```
# Funzione per sostituire stringhe vuote e "na" con NA
replace_empty_with_na <- function(df) {
  df[df == "" | df == "na"] <- NA
  return(df)
}

# Definisci la funzione per la greedy search
greedy_search_remove_nan <- function(df) {

  # Prima, sostituiamo eventuali stringhe vuote o "na" con NA
  df <- replace_empty_with_na(df)

  # Continua fino a quando ci sono valori NA nel DataFrame
  while (sum(is.na(df)) > 0) {
    # Conta quanti valori non-NA ci sono per riga e per colonna
    row_non_nan_counts <- rowSums(!is.na(df))
    col_non_nan_counts <- colSums(!is.na(df))

    # Trova l'indice della riga e della colonna con meno valori non-NA
    row_to_remove <- which.min(row_non_nan_counts)
    col_to_remove <- which.min(col_non_nan_counts)

    # Conta i valori non-NA se rimuoviamo la riga o la colonna
```

```r
    remaining_non_nan_if_row_removed <- sum(!is.na(df[-row_to_remove, ]))
    remaining_non_nan_if_col_removed <- sum(!is.na(df[, -col_to_remove]))

    # Scegli se rimuovere la riga o la colonna basandoti su quale preserva più valori non-NA
    if (remaining_non_nan_if_row_removed >= remaining_non_nan_if_col_removed) {
      df <- df[-row_to_remove, ]  # Rimuovi la riga
    } else {
      df <- df[, -col_to_remove]  # Rimuovi la colonna
    }
  }

  return(df)
}

df_cleaned <- greedy_search_remove_nan(df)

print(df_cleaned)
```

```
##         id step  data birth_date              birth_place gender eta sdo_code
## 86      98    1 20240      -1681              Milano (MI)      f  60 20152647
## 8610    98    1 20240      -1681              Milano (MI)      f  60 20152647
## 8611    98    1 20240      -1681              Milano (MI)      f  60 20152647
## 8612    98    1 20240      -1681              Milano (MI)      f  60 20152647
## 8613    98    1 20240      -1681              Milano (MI)      f  60 20152647
## 107    121    1 20242      -3109         Oppido Mamertina      m  64 20152812
## 10710  121    1 20242      -3109         Oppido Mamertina      m  64 20152812
## 112    126    1 20249      -2082              Milano (MI)      m  61 20152814
## 207    225    1 20286      -1275             Carrara (MS)      m  59 20153484
## 2071   225    1 20286      -1275             Carrara (MS)      m  59 20153484
## 2072   225    1 20286      -1275             Carrara (MS)      m  59 20153484
## 2073   225    1 20286      -1275             Carrara (MS)      m  59 20153484
## 422    445    1 20395      -3014       Oppido Lucano (PZ)      f  64 20155399
## 4221   445    1 20395      -3014       Oppido Lucano (PZ)      f  64 20155399
## 456    481    1 20404      -3358            Ravanusa (AG)      m  65 20155584
## 4561   481    1 20404      -3358            Ravanusa (AG)      m  65 20155584
## 510    535    1 20439      -8686 Civitella di Romagna (FC)      f  80 20156158
## 5101   535    1 20439      -8686 Civitella di Romagna (FC)      f  80 20156158
## 529    554    1 20451      -6099             Massafra (TA)      f  73 20156335
## 5291   554    1 20451      -6099             Massafra (TA)      f  73 20156335
## 5292   554    1 20451      -6099             Massafra (TA)      f  73 20156335
## 5293   554    1 20451      -6099             Massafra (TA)      f  73 20156335
## 5294   554    1 20451      -6099             Massafra (TA)      f  73 20156335
## 5295   554    1 20451      -6099             Massafra (TA)      f  73 20156335
## 5296   554    1 20451      -6099             Massafra (TA)      f  73 20156335
## 5297   554    1 20451      -6099             Massafra (TA)      f  73 20156335
## 5298   554    1 20451      -6099             Massafra (TA)      f  73 20156335
## 5299   554    1 20451      -6099             Massafra (TA)      f  73 20156335
## 52910  554    1 20451      -6099             Massafra (TA)      f  73 20156335
## 640    669    1 20508      -4135           Marigliano (NA)      m  67 20160931
## 6401   669    1 20508      -4135           Marigliano (NA)      m  67 20160931
## 666    695    1 20520      -4574              Messina (ME)      f  69 20161133
## 6661   695    1 20520      -4574              Messina (ME)      f  69 20161133
## 6662   695    1 20520      -4574              Messina (ME)      f  69 20161133
## 6663   695    1 20520      -4574              Messina (ME)      f  69 20161133
```

```
## 6664   695    1 20520      -4574             Messina (ME)      f  69 20161133
## 766    798    1 20572      -1889              Lauria (PZ)      m  61 20162019
## 7661   798    1 20572      -1889              Lauria (PZ)      m  61 20162019
## 787    819    1 20579      -8002         Novi Ligure (AL)      m  78 20162155
## 7871   819    1 20579      -8002         Novi Ligure (AL)      m  78 20162155
## 789    821    1 20584      13649   Port Harcourt (NIGERIA)      m  19 20162223
## 7891   821    1 20584      13649   Port Harcourt (NIGERIA)      m  19 20162223
## 792    824    1 20583       4097              Milano (MI)      m  45 20162210
## 805    837    1 20590      -1245              Milano (MI)      f  60 20162328
## 8051   837    1 20590      -1245              Milano (MI)      f  60 20162328
## 826    858    1 20598      -3859             Legnano (MI)      m  67 20162468
## 904    939    1 20635      -6358            vergiate (VA)      f  74 20163154
## 931    967    1 20649        651           Tripoli (LIBIA)      f  55 20163412
## 9311   967    1 20649        651           Tripoli (LIBIA)      f  55 20163412
## 948    985    1 20663        219             Grantola (VA)      m  56 20163728
## 9481   985    1 20663        219             Grantola (VA)      m  56 20163728
## 965   1002    1 20682        451    Besana in Brianza (MB)      m  55 20163940
## 979   1019    1 20688      -3004              Milano (MI)      f  65 20164050
## 9791  1019    1 20688      -3004              Milano (MI)      f  65 20164050
## 1010  1053    1 20710      -4481             Manerbio (BS)      m  69 20164462
## 1025  1068    1 20713      -3040              Verona (VR)      f  65 20164533
## 1028  1071    1 20713       8529        Salvador (BRASILE)      f  33 20164538
## 1050  1094    1 20724      -3942            Masserano (BI)      m  68 20164721
## 1073  1118    1 20745      -3280             Condofuri (RC)      f  66 20165090
## 10731 1118    1 20745      -3280             Condofuri (RC)      f  66 20165090
## 1085  1130    1 20738       1390              Fabrizia (VV)      f  53 20164966
## 1100  1145    1 20786       -381              Crotone (KR)      m  58 20165770
## 11001 1145    1 20786       -381              Crotone (KR)      m  58 20165770
## 1125  1171    1 20800        603              Milano (MI)      m  55 20165999
## 11251 1171    1 20800        603              Milano (MI)      m  55 20165999
## 1130  1176    1 20809      -7329            Mazzarino (CL)      f  77 20166190
## 11301 1176    1 20809      -7329            Mazzarino (CL)      f  77 20166190
## 1131  1177    1 20815      -7232                  Vicenza      m  77 20166256
## 11311 1177    1 20815      -7232                  Vicenza      m  77 20166256
## 1132  1178    1 20801      -4397              Venezia (VE)      m  69 20166037
## 11321 1178    1 20801      -4397              Venezia (VE)      m  69 20166037
## 1145  1191    1 20823        134          Asmara (ERITREA)      m  57 20170064
## 1211  1261    1 20901      -3026       Lozzo Atestino (PD)      f  66 20171445
## 12111 1261    1 20901      -3026       Lozzo Atestino (PD)      f  66 20171445
## 1223  1273    1 20913       -694              Cosenza (CS)      m  59 20171618
## 1247  1297    1 20928        640              Bergamo (BG)      m  56 20171869
## 1250  1300    1 20929      -6515              Centola (SA)      m  75 20171911
## 1279  1329    1 20948      -3874      Porto Recanati (MC)      f  68 20172166
## 1307  1357    1 20969      -3138 Borgofranco d'Ivrea (TO)      m  66 20172548
## 1318  1368    1 20979      -2032               Desio (MI)      f  63 20172730
## 13181 1368    1 20979      -2032               Desio (MI)      f  63 20172730
## 13182 1368    1 20979      -2032               Desio (MI)      f  63 20172730
## 1319  1369    1 20983      -4694                 Opi (AQ)      f  70 20172784
## 1335  1385    1 20989      -4589       Villa Carcina (BS)      f  70 20172881
## 1338  1388    1 20993      -1536     Ascoli Satriano (FG)      f  62 20172974
## 13381 1388    1 20993      -1536     Ascoli Satriano (FG)      f  62 20172974
## 1341  1391    1 20998       -252        Gravina di Puglia      m  58 20173027
## 13411 1391    1 20998       -252        Gravina di Puglia      m  58 20173027
## 1343  1393    1 20996      -3995            Caravate (VA)      m  68 20173017
```

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## 1356  1406    1 21005      -2991      Gravellona Toce (NO)      m  66 20173149
## 13561 1406    1 21005      -2991      Gravellona Toce (NO)      m  66 20173149
## 13562 1406    1 21005      -2991      Gravellona Toce (NO)      m  66 20173149
## 1369  1420    1 20648      -5094                Como (CO)      f  70 20163384
## 13691 1420    1 20648      -5094                Como (CO)      f  70 20163384
## 1377  1428    1 21089      -9600                  Milano       m  84 20174629
## 13771 1428    1 21089      -9600                  Milano       m  84 20174629
## 1386  1437    1 21095        -35           Chivasso (TO)      m  58 20174726
## 1390  1441    1 21095       2509                  Empoli       m  51 20174732
## 1394  1445    1 20730      21154       Valprato Soana (TO)      f  -1 20164807
## 1400  1452    1 21103        981              Adria (RO)      m  55 20174865
## 1429  1481    1 21115      -3398             Portici (NA)      m  67 20175069
## 1439  1493    1 20767       -470           Vercelli (VC)      m  58 20165470
## 14391 1493    1 20767       -470           Vercelli (VC)      m  58 20165470
## 14392 1493    1 20767       -470           Vercelli (VC)      m  58 20165470
## 14393 1493    1 20767       -470           Vercelli (VC)      m  58 20165470
## 1477  1531    1 21131       1302            Oppeano (VR)      m  54 20175348
## 1492  1546    1 21137       -178                  Torino       m  58 20175458
## 1586  1641    1 21166      -4783              Gurro (NO)      f  71 20175945
## 1612  1667    1 21186      -6502      Gravellona Toce (VB)      f  76    20189
## 16121 1667    1 21186      -6502      Gravellona Toce (VB)      f  76    20189
## 1620  1675    1 21187      -2470             Rosate (MI)      m  65   201840
## 1627  1683    1 21196       5905                 Palermo      f  42  2018202
## 1631  1687    1 21201      -3901                 Francia      f  69  2018290
## 1659  1715    1 21215      -1279          Gravedona (CO)      f  62  2018523
## 1670  1726    1 21214        990               Venezuela      f  55  2018489
## 1686  1742    1 21012      -1516          Ferrandina (MT)      f  62 20173295
## 16861 1742    1 21012      -1516          Ferrandina (MT)      f  62 20173295
## 16862 1742    1 21012      -1516          Ferrandina (MT)      f  62 20173295
## 16863 1742    1 21012      -1516          Ferrandina (MT)      f  62 20173295
## 1691  1747    1 21228        104             Arborio (VC)      m  58  2018743
## 16911 1747    1 21228        104             Arborio (VC)      m  58  2018743
## 1701  1759    1 21228      -1222                 Napoli       m  61  2018744
## 17013 1759    1 21228      -1222                 Napoli       m  61  2018744
## 1710  1768    1 21236      -1187          Cerignola (FG)      m  61  2018900
## 1711  1769    1 21238         18                   Lodi      m  58  2018932
## 1714  1772    1 21242       3911                  Lucca      m  47  2018972
## 17141 1772    1 21242       3911                  Lucca      m  47  2018972
## 1722  1782    1 21244      -2876                Austria      m  66 20181035
## 1725  1785    1 21241      -3471           Marsala (TP)      m  68  2018970
## 1729  1789    1 21217      -4786       Taglio di Po (RO)      f  71  2018966
## 1730  1790    1 21241      -2324                Paternò      f  65 20181102
## 17301 1790    1 21241      -2324                Paternò      f  65 20181102
## 1771  1831    1 21269      -4085                 Genova      m  69 20181468
## 1780  1841    1 21270       -642                 Savona      f  60 20181497
## 1810  1871    1 21297       -650                 Torino      m  60 20181962
## 1811  1872    1 21294      -5358                 Genova      m  73 20181937
## 1817  1878    1 21298       -848                Trapani      m  61 20181996
## 1823  1884    1 21304      -3163                Sondrio      f  67 20182077
## 1859  1921    1 21319       -635                 Milano      m  60 20182323
## 1860  1922    1 21318      -7027    Oppido Mamertina (RC)      m  78 20182302
## 1861  1923    1 21320        730        Acqui Terme (AL)      f  56 20182342
## 1862  1924    1 21313      -4510           Melizzano (BN)      f  71 20182221
## 18621 1924    1 21313      -4510           Melizzano (BN)      f  71 20182221
```

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## 1891  1953    1 21341       1477                 Cittiglio      m  54 20182717
##       qualification job_category                      patient_key dm
## 86                4            4 396be8c779a469ad4c72051375b0f57b  n
## 8610              4            4 396be8c779a469ad4c72051375b0f57b  n
## 8611              4            4 396be8c779a469ad4c72051375b0f57b  n
## 8612              4            4 396be8c779a469ad4c72051375b0f57b  n
## 8613              4            4 396be8c779a469ad4c72051375b0f57b  n
## 107               4           12 0515976fb224d3378c50add481515e4b  n
## 10710             4           12 0515976fb224d3378c50add481515e4b  n
## 112               2           12 13dccb3291f4960e3a198e44c4e391bd  n
## 207               3           12 d466c2fba8d93d74394378c41d0d1f02  y
## 2071              3           12 d466c2fba8d93d74394378c41d0d1f02  y
## 2072              3           12 d466c2fba8d93d74394378c41d0d1f02  y
## 2073              3           12 d466c2fba8d93d74394378c41d0d1f02  y
## 422               2           14 2da9e7e802baabd55297fa8384e7fd26  y
## 4221              2           14 2da9e7e802baabd55297fa8384e7fd26  y
## 456               5            2 e775bb7c33bb6f0bf8e6a8f84c30db47  n
## 4561              5            2 e775bb7c33bb6f0bf8e6a8f84c30db47  n
## 510               4           12 722b1d50993b1ceeaf61a8167ebe7f8f  n
## 5101              4           12 722b1d50993b1ceeaf61a8167ebe7f8f  n
## 529               2           12 c0d36c39c8951c3dba59b21dcad5203f  n
## 5291              2           12 c0d36c39c8951c3dba59b21dcad5203f  n
## 5292              2           12 c0d36c39c8951c3dba59b21dcad5203f  n
## 5293              2           12 c0d36c39c8951c3dba59b21dcad5203f  n
## 5294              2           12 c0d36c39c8951c3dba59b21dcad5203f  n
## 5295              2           12 c0d36c39c8951c3dba59b21dcad5203f  n
## 5296              2           12 c0d36c39c8951c3dba59b21dcad5203f  n
## 5297              2           12 c0d36c39c8951c3dba59b21dcad5203f  n
## 5298              2           12 c0d36c39c8951c3dba59b21dcad5203f  n
## 5299              2           12 c0d36c39c8951c3dba59b21dcad5203f  n
## 52910             2           12 c0d36c39c8951c3dba59b21dcad5203f  n
## 640               3           12 9a8f1ea7188523823043657cb27c88b2  n
## 6401              3           12 9a8f1ea7188523823043657cb27c88b2  n
## 666               3           12 7c27f063285322758c930f1228e79363  n
## 6661              3           12 7c27f063285322758c930f1228e79363  n
## 6662              3           12 7c27f063285322758c930f1228e79363  n
## 6663              3           12 7c27f063285322758c930f1228e79363  n
## 6664              3           12 7c27f063285322758c930f1228e79363  n
## 766               5            2 838ad2911237abfa33c45e8344d8d8a9  y
## 7661              5            2 838ad2911237abfa33c45e8344d8d8a9  y
## 787               4           12 d262f4217cdd5854cb7e6244b239f007  n
## 7871              4           12 d262f4217cdd5854cb7e6244b239f007  n
## 789               3           10 f75aebc4468c55bdaa0877563dcd8b54  n
## 7891              3           10 f75aebc4468c55bdaa0877563dcd8b54  n
## 792               3           15 12fd81881bf575779c54d08ad5c15a90  n
## 805               5           15 5754acc3b907cfc653e740762d052665  n
## 8051              5           15 5754acc3b907cfc653e740762d052665  n
## 826               3           12 a68cee5fceeddede04772c0bd8a8fe72  n
## 904               2           12 337ddc08e17e9f1783fc485f29f245eb  n
## 931               2           11 f673033c3570b32d05876a939bcd4a8f  n
## 9311              2           11 f673033c3570b32d05876a939bcd4a8f  n
## 948               3           10 4080435ab79ffa184a0c632b04dbae31  y
## 9481              3           10 4080435ab79ffa184a0c632b04dbae31  y
## 965               3            7 4f752164a6d1907a6bd03e2958fa121b  n
```

```
## 979              5           1 940e3fc97b9274e15366ccdaa31cdb03  n
## 9791             5           1 940e3fc97b9274e15366ccdaa31cdb03  n
## 1010             3          12 39ff9032208356913ad6a80def680a65  n
## 1025             3          12 38432742a2da19495cf13dfe66a21187  n
## 1028             3          14 ffe9edbda5b36eab4e5950c4ddd181fa  n
## 1050             4           5 2f60af94a311b9fe40e407464fe53c41  n
## 1073             3          12 a3e07fba2071b477b2884beb5340f6b7  y
## 10731            3          12 a3e07fba2071b477b2884beb5340f6b7  y
## 1085             3           9 f09c11d72980d4256bb1f2bf8c0309a7  n
## 1100             3          12 73a22249f53ec33a7661af70dca370a4  y
## 11001            3          12 73a22249f53ec33a7661af70dca370a4  y
## 1125             3          15 1ae67757966de0553bdd2d6801f4d2a2  y
## 11251            3          15 1ae67757966de0553bdd2d6801f4d2a2  y
## 1130             3          12 6fedc7ba780c3a098c130a8924041375  n
## 11301            3          12 6fedc7ba780c3a098c130a8924041375  n
## 1131             5          12 1788a2ac7d1cc96041528e4ca3e3a5c0  n
## 11311            5          12 1788a2ac7d1cc96041528e4ca3e3a5c0  n
## 1132             5           2 88eedb0ce00bfda4703343949bbfa62c  n
## 11321            5           2 88eedb0ce00bfda4703343949bbfa62c  n
## 1145             4           4 f8ccf3ec3595f43a77de81f3d7915d93  n
## 1211             4          12 5e47165c92d5c3d19d87a181133a40f4  n
## 12111            4          12 5e47165c92d5c3d19d87a181133a40f4  n
## 1223             5           2 0e68d752cc75a035c142906946ce7931  n
## 1247             4          10 1303fe86b2c7d5eaae27c289180fd5a8  n
## 1250             2          12 67e74af7a50b29d2f289b536eb4c468a  n
## 1279             4          12 14fec4a3177e7c043988e6f0afc875d4  n
## 1307             4          12 b6ca6c5761a449595b5d309b78e74b7a  n
## 1318             3          14 55f6f44a873541731b5ec73626eeee41  y
## 13181            3          14 55f6f44a873541731b5ec73626eeee41  y
## 13182            3          14 55f6f44a873541731b5ec73626eeee41  y
## 1319             2          12 ad778aaf50f1822c8c739f5db13e818f  y
## 1335             4          12 f369d1fd626dc5254fe9c4920ae80979  n
## 1338             3          12 8f81c1f1cd2ace1986a5aca373a96be6  n
## 13381            3          12 8f81c1f1cd2ace1986a5aca373a96be6  n
## 1341             2          12 fe3b5bd04576d68480430b8c19644e49  n
## 13411            2          12 fe3b5bd04576d68480430b8c19644e49  n
## 1343             4          12 f3dbc897930be62b38d471bbb5f18836  n
## 1356             3          12 48ab74dfa8e715dea2e89e80cf59dbcc  n
## 13561            3          12 48ab74dfa8e715dea2e89e80cf59dbcc  n
## 13562            3          12 48ab74dfa8e715dea2e89e80cf59dbcc  n
## 1369             4          12 5bc7e827289f57326c56d672df778d7a  y
## 13691            4          12 5bc7e827289f57326c56d672df778d7a  y
## 1377             3          12 17489397043c70d259fc9d89f38497bf  y
## 13771            3          12 17489397043c70d259fc9d89f38497bf  y
## 1386             3          15 a3848c901b784e87fe9260dadae89c98  y
## 1390             3          15 0123dceed1cdeddd3523e61775e936be  y
## 1394             2          12 8f00c554a99a888483a54eadbac03163  n
## 1400             3          15 77d417125292f8fd7dbbbd71114a5cbf  n
## 1429             3          12 8473678eb9c2e4e86531681afd5538a5  y
## 1439             4          10 a5d408f54f3dae5da42a9d88526de399  n
## 14391            4          10 a5d408f54f3dae5da42a9d88526de399  n
## 14392            4          10 a5d408f54f3dae5da42a9d88526de399  n
## 14393            4          10 a5d408f54f3dae5da42a9d88526de399  n
## 1477             3          15 72b6f3b542fc283a7187da64aef613f8  n
```

```
## 1492              3           15 dd8ea5d6e97af0d5ea85f292a1f4c2b4  n
## 1586              3           12 0b1bc63de09959c4b07e0ef185c65292  y
## 1612              4           12 33d36fa83508d600d6be5d5ef6a05958  y
## 16121             4           12 33d36fa83508d600d6be5d5ef6a05958  y
## 1620              4           15 35ca81265d9a5fbbac840559c9e6a76e  y
## 1627              3           10 651e7ed4dc4a656c84e6e6b5acb37106  n
## 1631              4           12 23566d0eb6ce1b5a866cfb001116990e  n
## 1659              5            4 0b839deaacd44c7653dc66d82e61b275  n
## 1670              4           10 2f6106a3eca826419691fd6d3e94d21a  n
## 1686              2           14 43d25adb1203f98f90700ab1c6f2cdf1  n
## 16861             2           14 43d25adb1203f98f90700ab1c6f2cdf1  n
## 16862             2           14 43d25adb1203f98f90700ab1c6f2cdf1  n
## 16863             2           14 43d25adb1203f98f90700ab1c6f2cdf1  n
## 1691              3            7 ea19d8fb6b85c1c4c468eede6bf63d99  n
## 16911             3            7 ea19d8fb6b85c1c4c468eede6bf63d99  n
## 1701              4           20 1daf10e7d580a9ad0553022050828942  y
## 17013             4           20 1daf10e7d580a9ad0553022050828942  y
## 1710              3           12 d8ad2b9135a17e78b983f189e00d1941  n
## 1711              4           14 07df64215009a2f7801f7a22e81e3618  n
## 1714              3            5 3bc9c2454219d61c116ddc49007b2cd9  n
## 17141             3            5 3bc9c2454219d61c116ddc49007b2cd9  n
## 1722              4            4 5a4c727681969ba5abd1cc46100b654c  n
## 1725              2           12 bf18f43c63f895a497a7c1c1cc42dcb5  n
## 1729              2            9 5444486217916a98fbb885e66fe26e4c  y
## 1730              2           14 92481808fb9a9852b86bd1b781860a02  y
## 17301             2           14 92481808fb9a9852b86bd1b781860a02  y
## 1771              4           12 236c1d3608458b66a6b16f0eda0b7d40  n
## 1780              3            9 9f6848598300491b7f860e73a5750ec5  n
## 1810              5            2 3290952ee5bce02e359d2974538c660e  y
## 1811              5           12 fe6aceafbbb3676bf86b02dbc75a364e  n
## 1817              2           14 dd37b796fe9b262bf5e80de43cdc9d81  y
## 1823              4           12 5d671a56007397eb986418a9b65c77cc  y
## 1859              4            5 9725327e0cd5759692526a9772184ecd  y
## 1860              2           12 3fe65655ebb359f51c171fd509345807  y
## 1861              4           14 f289a16af4341479b1db6ad7b569878f  n
## 1862              2            9 2f383ee8e309fdf476cbdc78b673e042  y
## 18621             2            9 2f383ee8e309fdf476cbdc78b673e042  y
## 1891              3            7 e502268de0e4ee3b77ef2885f4f083cd  y
##       ret_diab_nprolif ret_diab_prolif nefr_inc insuf_ren_cr neurop_diab BPCO
## 86                   n               n       n            n           n    n
## 8610                 n               n       n            n           n    n
## 8611                 n               n       n            n           n    n
## 8612                 n               n       n            n           n    n
## 8613                 n               n       n            n           n    n
## 107                  n               n       n            n           n    n
## 10710                n               n       n            n           n    n
## 112                  n               n       n            y           n    n
## 207                  n               n       n            n           n    n
## 2071                 n               n       n            n           n    n
## 2072                 n               n       n            n           n    n
## 2073                 n               n       n            n           n    n
## 422                  n               n       n            n           n    y
## 4221                 n               n       n            n           n    y
## 456                  n               n       n            n           n    y
```

```
## 4561              n          n          n          n          n    y
## 510               n          n          n          n          n    y
## 5101              n          n          n          n          n    y
## 529               n          n          n          n          n    n
## 5291              n          n          n          n          n    n
## 5292              n          n          n          n          n    n
## 5293              n          n          n          n          n    n
## 5294              n          n          n          n          n    n
## 5295              n          n          n          n          n    n
## 5296              n          n          n          n          n    n
## 5297              n          n          n          n          n    n
## 5298              n          n          n          n          n    n
## 5299              n          n          n          n          n    n
## 52910             n          n          n          n          n    n
## 640               n          n          n          n          n    y
## 6401              n          n          n          n          n    y
## 666               n          n          n          n          n    n
## 6661              n          n          n          n          n    n
## 6662              n          n          n          n          n    n
## 6663              n          n          n          n          n    n
## 6664              n          n          n          n          n    n
## 766               n          n          n          n          n    n
## 7661              n          n          n          n          n    n
## 787               n          n          n          y          n    n
## 7871              n          n          n          y          n    n
## 789               n          n          n          n          n    n
## 7891              n          n          n          n          n    n
## 792               n          n          n          n          n    n
## 805               n          n          n          n          n    n
## 8051              n          n          n          n          n    n
## 826               n          n          n          n          n    n
## 904               n          n          n          n          n    n
## 931               n          n          n          n          n    n
## 9311              n          n          n          n          n    n
## 948               n          n          n          n          n    y
## 9481              n          n          n          n          n    y
## 965               n          n          n          n          n    n
## 979               n          n          n          n          n    n
## 9791              n          n          n          n          n    n
## 1010              n          n          n          n          n    n
## 1025              n          n          n          n          n    n
## 1028              n          n          n          n          n    n
## 1050              n          n          n          n          n    n
## 1073              y          n          n          y          n    n
## 10731             y          n          n          y          n    n
## 1085              n          n          n          n          n    n
## 1100              n          n          n          y          n    n
## 11001             n          n          n          y          n    n
## 1125              n          n          n          n          n    n
## 11251             n          n          n          n          n    n
## 1130              n          n          n          n          n    n
## 11301             n          n          n          n          n    n
## 1131              n          n          n          n          n    y
## 11311             n          n          n          n          n    y
```

```
## 1132          n    n    n    n    n    n
## 11321         n    n    n    n    n    n
## 1145          n    n    n    n    n    n
## 1211          n    n    n    n    n    n
## 12111         n    n    n    n    n    n
## 1223          n    n    n    n    n    n
## 1247          n    n    n    n    n    n
## 1250          n    n    n    n    n    n
## 1279          n    n    n    n    n    n
## 1307          n    n    n    n    n    n
## 1318          n    n    n    n    n    n
## 13181         n    n    n    n    n    n
## 13182         n    n    n    n    n    n
## 1319          n    n    n    y    y    y
## 1335          n    n    n    n    n    n
## 1338          n    n    n    n    n    n
## 13381         n    n    n    n    n    n
## 1341          n    n    n    n    n    y
## 13411         n    n    n    n    n    y
## 1343          n    n    n    n    n    n
## 1356          n    n    n    n    n    y
## 13561         n    n    n    n    n    y
## 13562         n    n    n    n    n    y
## 1369          n    n    n    y    n    n
## 13691         n    n    n    y    n    n
## 1377          y    n    n    n    y    y
## 13771         y    n    n    n    y    y
## 1386          n    n    n    n    n    n
## 1390          n    n    n    n    n    n
## 1394          n    n    n    n    n    n
## 1400          n    n    n    n    n    n
## 1429          n    n    n    n    n    n
## 1439          n    n    n    n    n    n
## 14391         n    n    n    n    n    n
## 14392         n    n    n    n    n    n
## 14393         n    n    n    n    n    n
## 1477          n    n    n    n    n    n
## 1492          n    n    n    n    n    n
## 1586          n    n    n    n    n    n
## 1612          n    n    n    n    n    n
## 16121         n    n    n    n    n    n
## 1620          n    n    n    n    n    y
## 1627          n    n    n    n    n    n
## 1631          n    n    n    n    n    n
## 1659          n    n    n    n    n    n
## 1670          y    n    n    n    n    n
## 1686          n    n    n    n    n    n
## 16861         n    n    n    n    n    n
## 16862         n    n    n    n    n    n
## 16863         n    n    n    n    n    n
## 1691          n    n    n    n    n    n
## 16911         n    n    n    n    n    n
## 1701          n    n    n    n    n    y
## 17013         n    n    n    n    n    y
```

```
## 1710                n             n       n           n          n    n
## 1711                n             n       n           n          n    n
## 1714                n             n       n           n          n    n
## 17141               n             n       n           n          n    n
## 1722                n             n       n           n          n    n
## 1725                n             n       n           n          n    n
## 1729                n             n       n           n          n    n
## 1730                n             n       n           n          n    n
## 17301               n             n       n           n          n    n
## 1771                n             n       n           n          n    n
## 1780                n             n       n           n          n    n
## 1810                n             n       n           n          y    n
## 1811                n             n       n           n          n    n
## 1817                n             n       y           n          y    y
## 1823                n             n       n           n          n    n
## 1859                n             n       n           n          n    n
## 1860                n             n       n           y          n    y
## 1861                n             n       n           n          n    n
## 1862                n             n       n           n          n    n
## 18621               n             n       n           n          n    n
## 1891                n             n       n           n          n    n
##       insuf_resp_cr OSAS steat_ep cirr_ep cardiop_isc cardiop_dil
## 86                n    n       n       n           n           n
## 8610              n    n       n       n           n           n
## 8611              n    n       n       n           n           n
## 8612              n    n       n       n           n           n
## 8613              n    n       n       n           n           n
## 107               n    n       n       n           y           n
## 10710             n    n       n       n           y           n
## 112               n    n       n       n           n           n
## 207               n    n       n       n           y           n
## 2071              n    n       n       n           y           n
## 2072              n    n       n       n           y           n
## 2073              n    n       n       n           y           n
## 422               n    n       n       n           n           n
## 4221              n    n       n       n           n           n
## 456               n    y       n       n           n           n
## 4561              n    y       n       n           n           n
## 510               n    n       n       n           n           n
## 5101              n    n       n       n           n           n
## 529               n    y       n       n           n           n
## 5291              n    y       n       n           n           n
## 5292              n    y       n       n           n           n
## 5293              n    y       n       n           n           n
## 5294              n    y       n       n           n           n
## 5295              n    y       n       n           n           n
## 5296              n    y       n       n           n           n
## 5297              n    y       n       n           n           n
## 5298              n    y       n       n           n           n
## 5299              n    y       n       n           n           n
## 52910             n    y       n       n           n           n
## 640               n    y       n       n           y           n
## 6401              n    y       n       n           y           n
## 666               n    n       n       n           n           n
```

```
## 6661              n    n        n        n          n          n
## 6662              n    n        n        n          n          n
## 6663              n    n        n        n          n          n
## 6664              n    n        n        n          n          n
## 766               n    n        n        n          n          n
## 7661              n    n        n        n          n          n
## 787               n    n        n        n          n          n
## 7871              n    n        n        n          n          n
## 789               n    n        y        n          n          n
## 7891              n    n        y        n          n          n
## 792               n    n        n        n          y          y
## 805               n    n        n        n          n          y
## 8051              n    n        n        n          n          y
## 826               n    n        n        n          n          n
## 904               n    n        n        n          n          n
## 931               n    n        n        n          n          n
## 9311              n    n        n        n          n          n
## 948               n    y        n        n          n          n
## 9481              n    y        n        n          n          n
## 965               n    n        n        n          y          n
## 979               n    n        n        n          n          n
## 9791              n    n        n        n          n          n
## 1010              n    n        y        n          y          n
## 1025              n    n        n        n          n          n
## 1028              n    n        n        n          n          n
## 1050              n    n        n        n          n          n
## 1073              n    n        n        n          y          y
## 10731             n    n        n        n          y          y
## 1085              n    n        n        n          n          y
## 1100              n    y        n        n          n          n
## 11001             n    y        n        n          n          n
## 1125              n    y        n        n          y          n
## 11251             n    y        n        n          y          n
## 1130              n    y        n        n          n          n
## 11301             n    y        n        n          n          n
## 1131              n    n        n        n          y          n
## 11311             n    n        n        n          y          n
## 1132              n    n        n        n          n          n
## 11321             n    n        n        n          n          n
## 1145              n    n        y        n          n          n
## 1211              n    y        n        n          n          n
## 12111             n    y        n        n          n          n
## 1223              n    y        n        n          y          n
## 1247              n    y        n        n          y          n
## 1250              n    n        n        n          y          n
## 1279              n    n        n        n          y          n
## 1307              n    n        n        n          n          n
## 1318              n    n        n        n          n          n
## 13181             n    n        n        n          n          n
## 13182             n    n        n        n          n          n
## 1319              n    y        n        n          n          n
## 1335              n    n        y        n          n          n
## 1338              n    n        n        n          n          n
## 13381             n    n        n        n          n          n
```

```
## 1341              n    y        n        n          n          n
## 13411             n    y        n        n          n          n
## 1343              n    n        n        n          n          n
## 1356              n    y        y        n          n          n
## 13561             n    y        y        n          n          n
## 13562             n    y        y        n          n          n
## 1369              n    n        y        n          n          n
## 13691             n    n        y        n          n          n
## 1377              n    n        n        n          y          n
## 13771             n    n        n        n          y          n
## 1386              n    n        n        n          y          n
## 1390              n    n        n        n          y          n
## 1394              n    n        n        n          n          n
## 1400              n    n        n        n          n          n
## 1429              n    y        y        n          y          n
## 1439              n    n        y        n          n          n
## 14391             n    n        y        n          n          n
## 14392             n    n        y        n          n          n
## 14393             n    n        y        n          n          n
## 1477              n    n        n        n          n          n
## 1492              n    y        n        n          n          n
## 1586              n    n        n        n          n          n
## 1612              n    y        n        n          n          n
## 16121             n    y        n        n          n          n
## 1620              n    y        n        n          n          y
## 1627              n    n        n        n          n          n
## 1631              n    n        n        n          n          n
## 1659              n    y        n        n          n          n
## 1670              n    n        y        n          n          n
## 1686              n    n        n        n          y          n
## 16861             n    n        n        n          y          n
## 16862             n    n        n        n          y          n
## 16863             n    n        n        n          y          n
## 1691              n    n        n        n          y          n
## 16911             n    n        n        n          y          n
## 1701              n    y        n        n          y          n
## 17013             n    y        n        n          y          n
## 1710              n    y        n        n          y          n
## 1711              n    y        n        n          n          n
## 1714              n    y        y        n          n          n
## 17141             n    y        y        n          n          n
## 1722              n    y        n        n          n          n
## 1725              y    n        n        n          y          n
## 1729              n    n        n        n          y          n
## 1730              n    n        n        n          y          n
## 17301             n    n        n        n          y          n
## 1771              n    y        y        n          n          n
## 1780              n    n        n        n          y          n
## 1810              n    y        n        n          y          n
## 1811              n    y        n        n          y          n
## 1817              y    y        n        n          y          y
## 1823              n    n        y        n          y          n
## 1859              n    n        n        n          y          n
## 1860              y    n        n        n          y          n
```

```
## 1861              n    n        n       n           n           n
## 1862              n    y        n       n           n           n
## 18621             n    y        n       n           n           n
## 1891              n    n        n       n           n           n
##       cardiop_iper_ostr valv_patia pat_osteo_dis dep psic DCA iper_art ipogon
## 86                    n          n             n   n    n   n        y      n
## 8610                  n          n             n   n    n   n        y      n
## 8611                  n          n             n   n    n   n        y      n
## 8612                  n          n             n   n    n   n        y      n
## 8613                  n          n             n   n    n   n        y      n
## 107                   n          n             n   n    n   n        n      n
## 10710                 n          n             n   n    n   n        n      n
## 112                   n          n             n   y    n   n        y      n
## 207                   n          n             y   n    n   n        y      n
## 2071                  n          n             y   n    n   n        y      n
## 2072                  n          n             y   n    n   n        y      n
## 2073                  n          n             y   n    n   n        y      n
## 422                   n          y             n   n    n   n        y      n
## 4221                  n          y             n   n    n   n        y      n
## 456                   n          n             n   n    n   n        y      n
## 4561                  n          n             n   n    n   n        y      n
## 510                   n          n             n   n    n   n        y      n
## 5101                  n          n             n   n    n   n        y      n
## 529                   n          n             y   n    n   n        y      n
## 5291                  n          n             y   n    n   n        y      n
## 5292                  n          n             y   n    n   n        y      n
## 5293                  n          n             y   n    n   n        y      n
## 5294                  n          n             y   n    n   n        y      n
## 5295                  n          n             y   n    n   n        y      n
## 5296                  n          n             y   n    n   n        y      n
## 5297                  n          n             y   n    n   n        y      n
## 5298                  n          n             y   n    n   n        y      n
## 5299                  n          n             y   n    n   n        y      n
## 52910                 n          n             y   n    n   n        y      n
## 640                   n          n             n   n    n   n        y      n
## 6401                  n          n             n   n    n   n        y      n
## 666                   n          y             n   n    n   n        y      n
## 6661                  n          y             n   n    n   n        y      n
## 6662                  n          y             n   n    n   n        y      n
## 6663                  n          y             n   n    n   n        y      n
## 6664                  n          y             n   n    n   n        y      n
## 766                   n          y             n   n    n   n        y      n
## 7661                  n          y             n   n    n   n        y      n
## 787                   n          n             n   n    n   n        y      n
## 7871                  n          n             n   n    n   n        y      n
## 789                   n          n             n   n    n   n        n      n
## 7891                  n          n             n   n    n   n        n      n
## 792                   n          n             n   n    n   n        n      n
## 805                   n          n             n   n    y   n        y      n
## 8051                  n          n             n   n    y   n        y      n
## 826                   n          n             y   n    n   n        y      n
## 904                   n          y             y   y    y   n        y      n
## 931                   n          y             n   n    n   n        n      n
## 9311                  n          y             n   n    n   n        n      n
```

```
## 948          n    n    n    n    n    n    y    n
## 9481         n    n    n    n    n    n    y    n
## 965          n    n    n    n    n    n    y    n
## 979          n    n    n    n    n    n    y    n
## 9791         n    n    n    n    n    n    y    n
## 1010         n    n    n    n    n    n    y    n
## 1025         n    n    y    n    n    n    y    n
## 1028         n    n    n    n    y    n    n    n
## 1050         n    y    n    y    n    n    y    n
## 1073         n    n    n    n    n    n    y    n
## 10731        n    n    n    n    n    n    y    n
## 1085         n    y    n    y    n    n    y    n
## 1100         n    n    y    n    n    n    y    n
## 11001        n    n    y    n    n    n    y    n
## 1125         n    n    n    n    n    n    y    n
## 11251        n    n    n    n    n    n    y    n
## 1130         n    y    n    n    n    n    y    n
## 11301        n    y    n    n    n    n    y    n
## 1131         n    n    n    n    n    n    y    n
## 11311        n    n    n    n    n    n    y    n
## 1132         n    n    n    n    n    n    y    n
## 11321        n    n    n    n    n    n    y    n
## 1145         n    n    n    n    n    n    n    n
## 1211         n    n    n    n    n    n    y    n
## 12111        n    n    n    n    n    n    y    n
## 1223         n    n    n    n    n    y    y    n
## 1247         n    n    n    y    n    n    y    n
## 1250         n    n    n    n    n    n    n    n
## 1279         n    y    y    n    n    n    y    n
## 1307         n    n    y    n    n    n    y    n
## 1318         n    n    n    y    n    n    y    n
## 13181        n    n    n    y    n    n    y    n
## 13182        n    n    n    y    n    n    y    n
## 1319         n    y    y    n    n    n    y    n
## 1335         n    n    y    n    n    n    y    n
## 1338         n    y    n    y    n    n    n    n
## 13381        n    y    n    y    n    n    n    n
## 1341         n    n    y    y    n    n    y    n
## 13411        n    n    y    y    n    n    y    n
## 1343         n    n    n    n    n    n    y    n
## 1356         n    n    n    n    n    n    y    n
## 13561        n    n    n    n    n    n    y    n
## 13562        n    n    n    n    n    n    y    n
## 1369         n    n    n    n    y    n    y    n
## 13691        n    n    n    n    y    n    y    n
## 1377         n    y    y    n    n    n    y    n
## 13771        n    y    y    n    n    n    y    n
## 1386         n    n    n    n    n    n    y    n
## 1390         n    n    n    n    n    n    n    n
## 1394         n    n    y    y    n    n    y    n
## 1400         n    n    n    n    n    n    y    n
## 1429         n    n    n    n    n    n    y    n
## 1439         n    n    n    n    n    n    n    n
## 14391        n    n    n    n    n    n    n    n
```

```
## 14392                n          n            n   n    n   n        n      n
## 14393                n          n            n   n    n   n        n      n
## 1477                 n          n            n   n    n   n        y      n
## 1492                 n          n            y   n    n   n        y      n
## 1586                 n          n            n   n    n   n        y      n
## 1612                 n          n            n   y    n   n        y      n
## 16121                n          n            n   y    n   n        y      n
## 1620                 n          n            y   y    n   n        y      n
## 1627                 n          n            n   n    n   n        n      n
## 1631                 n          n            y   y    n   n        n      n
## 1659                 y          y            n   y    n   n        n      n
## 1670                 n          n            y   n    n   n        n      n
## 1686                 n          n            n   n    n   n        y      n
## 16861                n          n            n   n    n   n        y      n
## 16862                n          n            n   n    n   n        y      n
## 16863                n          n            n   n    n   n        y      n
## 1691                 n          n            n   y    n   n        y      n
## 16911                n          n            n   y    n   n        y      n
## 1701                 n          n            n   n    n   n        y      n
## 17013                n          n            n   n    n   n        y      n
## 1710                 n          n            n   n    n   n        y      n
## 1711                 n          n            n   n    n   n        y      n
## 1714                 n          y            y   n    n   n        n      n
## 17141                n          y            y   n    n   n        n      n
## 1722                 n          n            n   y    n   n        n      n
## 1725                 n          y            n   n    n   n        y      n
## 1729                 n          n            n   n    n   n        y      n
## 1730                 n          y            n   n    n   n        y      n
## 17301                n          y            n   n    n   n        y      n
## 1771                 n          n            n   n    n   n        y      n
## 1780                 n          n            n   n    n   n        n      n
## 1810                 n          n            n   n    n   n        y      n
## 1811                 n          n            n   n    n   y        y      n
## 1817                 n          n            n   n    n   n        y      n
## 1823                 n          n            n   y    n   n        n      n
## 1859                 n          n            n   n    n   n        y      n
## 1860                 n          n            y   n    n   n        n      n
## 1861                 n          n            n   n    n   n        y      n
## 1862                 n          n            n   y    n   n        y      n
## 18621                n          n            n   y    n   n        y      n
## 1891                 n          n            n   n    n   n        y      n
##       PCO prev_chirurg_bar altezza      BMI circ_vita circ_fian
## 86      n               n   164.0 41.27008       118       135
## 8610    n               n   164.0 41.27008       118       135
## 8611    n               n   164.0 41.27008       118       135
## 8612    n               n   164.0 41.27008       118       135
## 8613    n               n   164.0 41.27008       118       135
## 107     n               n   167.0 36.39428       115       103
## 10710   n               n   167.0 36.39428       115       103
## 112     n               n   171.0 34.19856       125       105
## 207     n               n   169.0 38.23396       125       113
## 2071    n               n   169.0 38.23396       125       113
## 2072    n               n   169.0 38.23396       125       113
## 2073    n               n   169.0 38.23396       125       113
```

```
## 422     n               n   147.7 43.36408       125       125
## 4221    n               n   147.7 43.36408       125       125
## 456     n               n   166.0 35.20105       124       109
## 4561    n               n   166.0 35.20105       124       109
## 510     n               n   159.6 41.10370       128       135
## 5101    n               n   159.6 41.10370       128       135
## 529     n               n   150.8 38.12558       116       119
## 5291    n               n   150.8 38.12558       116       119
## 5292    n               n   150.8 38.12558       116       119
## 5293    n               n   150.8 38.12558       116       119
## 5294    n               n   150.8 38.12558       116       119
## 5295    n               n   150.8 38.12558       116       119
## 5296    n               n   150.8 38.12558       116       119
## 5297    n               n   150.8 38.12558       116       119
## 5298    n               n   150.8 38.12558       116       119
## 5299    n               n   150.8 38.12558       116       119
## 52910   n               n   150.8 38.12558       116       119
## 640     n               n   175.0 39.24898       125       115
## 6401    n               n   175.0 39.24898       125       115
## 666     n               n   160.0 39.06250       119       129
## 6661    n               n   160.0 39.06250       119       129
## 6662    n               n   160.0 39.06250       119       129
## 6663    n               n   160.0 39.06250       119       129
## 6664    n               n   160.0 39.06250       119       129
## 766     n               n   151.0 45.74361       123       133
## 7661    n               n   151.0 45.74361       123       133
## 787     n               n   174.0 42.93830       147       129
## 7871    n               n   174.0 42.93830       147       129
## 789     n               n   173.0 42.26670       122       128
## 7891    n               n   173.0 42.26670       122       128
## 792     n               n   175.5 39.77240       133       113
## 805     n               n   165.2 38.95051       109       124
## 8051    n               n   165.2 38.95051       109       124
## 826     n               n   178.0 44.91226       145       133
## 904     n               n   160.0 52.34375       127       160
## 931     n               n   156.0 41.09139       122       130
## 9311    n               n   156.0 41.09139       122       130
## 948     n               n   168.0 51.79989       148       140
## 9481    n               n   168.0 51.79989       148       140
## 965     n               n   160.0 39.57031       123       124
## 979     n               n   158.0 37.49399       107       120
## 9791    n               n   158.0 37.49399       107       120
## 1010    n               n   168.0 38.15901       131       106
## 1025    n               n   157.0 41.78669       130       110
## 1028    n               n   164.0 32.60708       108       104
## 1050    n               n   175.0 47.80408       145       143
## 1073    n               n   156.2 31.64137       111       105
## 10731   n               n   156.2 31.64137       111       105
## 1085    n               n   160.0 41.40625       113       132
## 1100    n               n   172.0 48.20173       148       130
## 11001   n               n   172.0 48.20173       148       130
## 1125    n               n   172.0 34.88372       115       112
## 11251   n               n   172.0 34.88372       115       112
## 1130    n               n   153.7 42.83835       119       121
```

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## 11301   n               n   153.7 42.83835       119       121
## 1131    n               n   169.3 38.06369       128       122
## 11311   n               n   169.3 38.06369       128       122
## 1132    n               n   184.0 47.64296       150       136
## 11321   n               n   184.0 47.64296       150       136
## 1145    n               n   183.0 35.83266       119       118
## 1211    n               n   151.0 37.71764       120       100
## 12111   n               n   151.0 37.71764       120       100
## 1223    n               n   176.5 38.55259       132       120
## 1247    n               n   168.0 52.72109       155       143
## 1250    n               n   164.0 36.17638       119       115
## 1279    n               n   154.5 39.92417       118       125
## 1307    n               n   182.0 41.87296       140       120
## 1318    n               n   165.0 49.62351       128       146
## 13181   n               n   165.0 49.62351       128       146
## 13182   n               n   165.0 49.62351       128       146
## 1319    n               n   152.0 47.35111       118       133
## 1335    n               n   162.0 45.64853       135       152
## 1338    n               n   158.1 34.44605       102       114
## 13381   n               n   158.1 34.44605       102       114
## 1341    n               n   171.9 39.72980       135       120
## 13411   n               n   171.9 39.72980       135       120
## 1343    n               n   177.3 30.57074       114       109
## 1356    n               n   166.6 36.74939       122       106
## 13561   n               n   166.6 36.74939       122       106
## 13562   n               n   166.6 36.74939       122       106
## 1369    n               n   147.0 41.78814       110       132
## 13691   n               n   147.0 41.78814       110       132
## 1377    n               n   162.0 42.29538       136       133
## 13771   n               n   162.0 42.29538       136       133
## 1386    n               n   163.0 40.91234       106       113
## 1390    n               n   182.2 44.19095       132       120
## 1394    n               n   157.2 35.61046       105       113
## 1400    n               n   165.6 38.43439       119       118
## 1429    n               n   165.4 38.19841       119       115
## 1439    n               n   178.0 53.30766       156       163
## 14391   n               n   178.0 53.30766       156       163
## 14392   n               n   178.0 53.30766       156       163
## 14393   n               n   178.0 53.30766       156       163
## 1477    n               n   175.9 39.59172       121       123
## 1492    n               n   169.7 56.18428       156       150
## 1586    n               n   165.0 37.53903       128       135
## 1612    n               n   159.0 38.28962       122       124
## 16121   n               n   159.0 38.28962       122       124
## 1620    n               n   179.8 47.14174       130       133
## 1627    n               n   149.7 37.66161        98       120
## 1631    n               n   169.0 30.81125        86       107
## 1659    n               y   166.0 39.59210       103       110
## 1670    n               n   157.0 58.50136       111       138
## 1686    n               n   151.0 41.00697       120       122
## 16861   n               n   151.0 41.00697       120       122
## 16862   n               n   151.0 41.00697       120       122
## 16863   n               n   151.0 41.00697       120       122
## 1691    n               n   176.3 48.42079       150       120
```

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## 16911   n               n   176.3 48.42079       150       120
## 1701    n               n   164.5 34.99598       113       120
## 17013   n               n   164.5 34.99598       113       120
## 1710    n               n   162.0 43.74333       128       118
## 1711    n               n   165.6 58.70907       148       138
## 1714    n               n   180.0 42.03704       141       123
## 17141   n               n   180.0 42.03704       141       123
## 1722    n               y   178.3 38.21850       139       115
## 1725    n               n   162.3 33.33170       108       104
## 1729    n               n   156.0 35.95496       107       110
## 1730    n               n   147.0 50.30311       128       131
## 17301   n               n   147.0 50.30311       128       131
## 1771    n               n   174.3 37.65575       125       114
## 1780    n               n   154.3 41.28779       119       127
## 1810    n               n   166.1 36.24605       111       113
## 1811    n               n   177.0 40.82479       124       118
## 1817    n               y   180.0 45.06173       150       138
## 1823    n               n   169.2 39.95998       120       134
## 1859    n               n   172.0 38.97377       128       119
## 1860    n               n   158.0 43.26230       131       122
## 1861    n               n   162.0 44.12437       124       136
## 1862    n               n   149.3 46.61181       130       121
## 18621   n               n   149.3 46.61181       130       121
## 1891    n               n   170.5 36.11940       113       118
##       rapporto_vita_fian PAS PAD freq_card rapporto_vita_alt bioimped fm_kg
## 86                 0.874 120  80        62             0.719        y  55.2
## 8610               0.874 120  80        62             0.719        y  55.2
## 8611               0.874 120  80        62             0.719        y  55.2
## 8612               0.874 120  80        62             0.719        y  55.2
## 8613               0.874 120  80        62             0.719        y  55.2
## 107                1.116 145  85        72             0.688        y  38.3
## 10710              1.116 145  85        72             0.688        y  38.3
## 112                1.190 140  90        77             0.730        y  39.5
## 207                1.106 130  70        56             0.739        y  41.7
## 2071               1.106 130  70        56             0.739        y  41.7
## 2072               1.106 130  70        56             0.739        y  41.7
## 2073               1.106 130  70        56             0.739        y  41.7
## 422                1.000 190 100        83             0.846        y  49.8
## 4221               1.000 190 100        83             0.846        y  49.8
## 456                1.137 150  80        82             0.746        y  38.8
## 4561               1.137 150  80        82             0.746        y  38.8
## 510                0.948 150  70        83             0.802        y  54.3
## 5101               0.948 150  70        83             0.802        y  54.3
## 529                0.974 140  70        66             0.769        y  43.0
## 5291               0.974 140  70        66             0.769        y  43.0
## 5292               0.974 140  70        66             0.769        y  43.0
## 5293               0.974 140  70        66             0.769        y  43.0
## 5294               0.974 140  70        66             0.769        y  43.0
## 5295               0.974 140  70        66             0.769        y  43.0
## 5296               0.974 140  70        66             0.769        y  43.0
## 5297               0.974 140  70        66             0.769        y  43.0
## 5298               0.974 140  70        66             0.769        y  43.0
## 5299               0.974 140  70        66             0.769        y  43.0
## 52910              0.974 140  70        66             0.769        y  43.0
```

```
## 640          1.086 140  85        63          0.714        y  48.4
## 6401         1.086 140  85        63          0.714        y  48.4
## 666          0.922 130  80        59          0.743        y  51.3
## 6661         0.922 130  80        59          0.743        y  51.3
## 6662         0.922 130  80        59          0.743        y  51.3
## 6663         0.922 130  80        59          0.743        y  51.3
## 6664         0.922 130  80        59          0.743        y  51.3
## 766          0.924 130  85        63          0.814        y  57.8
## 7661         0.924 130  85        63          0.814        y  57.8
## 787          1.139 140  70        69          0.844        y  55.0
## 7871         1.139 140  70        69          0.844        y  55.0
## 789          0.953 130  80        78          0.705        y  46.6
## 7891         0.953 130  80        78          0.705        y  46.6
## 792          1.176 120  70        73          0.757        y  57.3
## 805          0.879 130  75        56          0.659        y  50.5
## 8051         0.879 130  75        56          0.659        y  50.5
## 826          1.090 190 100        73          0.814        y  62.7
## 904          0.793 160  90        63          0.793        y  82.5
## 931          0.938 120  70        78          0.782        y  56.8
## 9311         0.938 120  70        78          0.782        y  56.8
## 948          1.057 150  80        96          0.880        y  61.1
## 9481         1.057 150  80        96          0.880        y  61.1
## 965          0.991 145  80        69          0.768        y  29.0
## 979          0.891 140  90        74          0.677        y  49.6
## 9791         0.891 140  90        74          0.677        y  49.6
## 1010         1.235 155  90        95          0.779        y  35.7
## 1025         1.181 185 110        76          0.828        y  55.6
## 1028         1.038 145  80        90          0.658        y  40.3
## 1050         1.013 150 100        90          0.828        y  67.5
## 1073         1.057 160  80        71          0.710        y  33.8
## 10731        1.057 160  80        71          0.710        y  33.8
## 1085         0.856 130  70        84          0.706        y  55.1
## 1100         1.138 150  85        89          0.860        y  41.6
## 11001        1.138 150  85        89          0.860        y  41.6
## 1125         1.026 140  80        68          0.668        y  37.6
## 11251        1.026 140  80        68          0.668        y  37.6
## 1130         0.983 160  80        77          0.774        y  52.9
## 11301        0.983 160  80        77          0.774        y  52.9
## 1131         1.049 150  80        72          0.756        y  47.4
## 11311        1.049 150  80        72          0.756        y  47.4
## 1132         1.102 130  80        70          0.815        y  70.6
## 11321        1.102 130  80        70          0.815        y  70.6
## 1145         1.008 150  90       101          0.650        y  39.6
## 1211         1.200 160  90        54          0.794        y  40.9
## 12111        1.200 160  90        54          0.794        y  40.9
## 1223         1.100 130  80        82          0.747        y  46.4
## 1247         1.083 150 100        90          0.922        y  66.1
## 1250         1.034 115  75        53          0.725        y  34.9
## 1279         0.944 140  80        83          0.763        y  49.1
## 1307         1.166 140  90       100          0.769        y  75.9
## 1318         0.876 130  80        76          0.775        y  78.8
## 13181        0.876 130  80        76          0.775        y  78.8
## 13182        0.876 130  80        76          0.775        y  78.8
## 1319         0.887 150  90        75          0.776        y  48.6
```

```
## 1335          0.888 140  85        78          0.833       y  66.7
## 1338          0.894 110  80        75          0.645       y  40.9
## 13381         0.894 110  80        75          0.645       y  40.9
## 1341          1.125 120  80        60          0.785       y  43.4
## 13411         1.125 120  80        60          0.785       y  43.4
## 1343          1.045 150  80        76          0.642       y  38.2
## 1356          1.150 140  90        81          0.732       y  36.7
## 13561         1.150 140  90        81          0.732       y  36.7
## 13562         1.150 140  90        81          0.732       y  36.7
## 1369          0.833 135  80       100          0.748       y  45.9
## 13691         0.833 135  80       100          0.748       y  45.9
## 1377          1.022 140  80        80          0.839       y  46.4
## 13771         1.022 140  80        80          0.839       y  46.4
## 1386          0.938 160  90        72          0.650       y  42.5
## 1390          1.100 120  80        92          0.724       y  53.1
## 1394          0.929 170 100        76          0.667       y  35.6
## 1400          1.008 140  80        74          0.718       y  42.1
## 1429          1.034 180  90        70          0.719       y  44.1
## 1439          0.957 150 100        93          0.876       y  64.5
## 14391         0.957 150 100        93          0.876       y  64.5
## 14392         0.957 150 100        93          0.876       y  64.5
## 14393         0.957 150 100        93          0.876       y  64.5
## 1477          0.983 125  80        67          0.687       y  33.0
## 1492          1.040 140  70        95          0.919       y  75.9
## 1586          0.948 150  90       110          0.775       y  56.0
## 1612          0.983 120  80        72          0.767       y  39.8
## 16121         0.983 120  80        72          0.767       y  39.8
## 1620          0.977 160  90        77          0.723       y  72.9
## 1627          0.816 130  80        89          0.654       y  39.7
## 1631          0.803 130  80        80          0.508       y  41.7
## 1659          0.936 110  75        74          0.620       y  59.5
## 1670          0.804 125  80        64          0.707       y  81.2
## 1686          0.983 145  90        76          0.794       y  51.5
## 16861         0.983 145  90        76          0.794       y  51.5
## 16862         0.983 145  90        76          0.794       y  51.5
## 16863         0.983 145  90        76          0.794       y  51.5
## 1691          1.250 130  90        75          0.850       y  66.6
## 16911         1.250 130  90        75          0.850       y  66.6
## 1701          0.941 150  90        73          0.686       y  42.6
## 17013         0.941 150  90        73          0.686       y  42.6
## 1710          1.084 160  80        51          0.790       y  37.0
## 1711          1.072 225 120        98          0.893       y  73.1
## 1714          1.146 150  80        83          0.783       y  56.3
## 17141         1.146 150  80        83          0.783       y  56.3
## 1722          1.208 130  80        77          0.779       y  56.8
## 1725          1.038 130  70        96          0.665       y  32.3
## 1729          0.972 120  80        78          0.685       y  46.7
## 1730          0.977 140  70        86          0.870       y  59.5
## 17301         0.977 140  70        86          0.870       y  59.5
## 1771          1.096 145  90        71          0.717       y  42.3
## 1780          0.937 100  60        84          0.771       y  47.0
## 1810          0.982 140  75        75          0.668       y  33.3
## 1811          1.050 120  80        82          0.700       y  53.7
## 1817          1.086 120  80        76          0.833       y  70.0
```

```
## 1823              0.895 140  80        76             0.709        y  60.9
## 1859              1.075 130  80        69             0.744        y  44.2
## 1860              1.073 140  70        70             0.829        y  53.5
## 1861              0.911 150 100        68             0.765        y  60.0
## 1862              1.074 140  70        77             0.870        y  60.2
## 18621             1.074 140  70        77             0.870        y  60.2
## 1891              0.957 140  80        74             0.662        y  34.8
##       fm_perc ffm_kg ffm_perc massa_musc_kg massa_musc_perc acqua_extra
## 86       49.9   55.4     50.1          28.1            25.4        24.2
## 8610     49.9   55.4     50.1          28.1            25.4        24.2
## 8611     49.9   55.4     50.1          28.1            25.4        24.2
## 8612     49.9   55.4     50.1          28.1            25.4        24.2
## 8613     49.9   55.4     50.1          28.1            25.4        24.2
## 107      37.9   62.7     62.1          43.0            42.6        22.0
## 10710    37.9   62.7     62.1          43.0            42.6        22.0
## 112      40.4   58.5     59.6          28.8            29.4        28.9
## 207      38.9   65.5     61.1          41.5            38.7        23.1
## 2071     38.9   65.5     61.1          41.5            38.7        23.1
## 2072     38.9   65.5     61.1          41.5            38.7        23.1
## 2073     38.9   65.5     61.1          41.5            38.7        23.1
## 422      52.8   44.6     47.2          29.1            30.8        16.7
## 4221     52.8   44.6     47.2          29.1            30.8        16.7
## 456      40.8   56.1     59.2          38.1            40.2        20.0
## 4561     40.8   56.1     59.2          38.1            40.2        20.0
## 510      52.2   49.8     47.8          33.8            32.5        17.7
## 5101     52.2   49.8     47.8          33.8            32.5        17.7
## 529      49.6   43.7     50.4          21.9            25.2        21.3
## 5291     49.6   43.7     50.4          21.9            25.2        21.3
## 5292     49.6   43.7     50.4          21.9            25.2        21.3
## 5293     49.6   43.7     50.4          21.9            25.2        21.3
## 5294     49.6   43.7     50.4          21.9            25.2        21.3
## 5295     49.6   43.7     50.4          21.9            25.2        21.3
## 5296     49.6   43.7     50.4          21.9            25.2        21.3
## 5297     49.6   43.7     50.4          21.9            25.2        21.3
## 5298     49.6   43.7     50.4          21.9            25.2        21.3
## 5299     49.6   43.7     50.4          21.9            25.2        21.3
## 52910    49.6   43.7     50.4          21.9            25.2        21.3
## 640      40.2   72.0     59.8          37.3            31.0        34.2
## 6401     40.2   72.0     59.8          37.3            31.0        34.2
## 666      51.7   47.9     48.3          26.2            26.4        21.7
## 6661     51.7   47.9     48.3          26.2            26.4        21.7
## 6662     51.7   47.9     48.3          26.2            26.4        21.7
## 6663     51.7   47.9     48.3          26.2            26.4        21.7
## 6664     51.7   47.9     48.3          26.2            26.4        21.7
## 766      55.3   46.7     44.7          28.3            27.1        19.1
## 7661     55.3   46.7     44.7          28.3            27.1        19.1
## 787      42.3   75.0     57.7          49.6            38.1        27.6
## 7871     42.3   75.0     57.7          49.6            38.1        27.6
## 789      36.8   79.9     63.2          51.5            40.7        27.6
## 7891     36.8   79.9     63.2          51.5            40.7        27.6
## 792      47.3   63.7     52.7          43.2            35.7        22.7
## 805      47.5   55.8     52.5          33.2            31.3        21.1
## 8051     47.5   55.8     52.5          33.2            31.3        21.1
## 826      44.3   79.0     55.7          31.4            22.2        44.4
```

```
## 904      62.7   49.2     37.3          15.9          12.1         31.5
## 931      56.2   44.2     43.8          28.9          28.7         15.0
## 9311     56.2   44.2     43.8          28.9          28.7         15.0
## 948      42.0   84.3     58.0          52.6          36.2         30.3
## 9481     42.0   84.3     58.0          52.6          36.2         30.3
## 965      28.7   72.3     71.3          40.7          40.2         28.9
## 979      53.9   42.5     46.1          27.4          29.7         16.2
## 9791     53.9   42.5     46.1          27.4          29.7         16.2
## 1010     33.2   71.7     66.8          37.5          34.9         33.8
## 1025     54.4   46.5     45.6          27.0          26.4         19.9
## 1028     45.6   48.0     54.4          30.9          35.0         16.6
## 1050     46.6   77.5     53.4          45.6          31.4         32.7
## 1073     44.0   43.1     56.0          29.1          37.9         15.4
## 10731    44.0   43.1     56.0          29.1          37.9         15.4
## 1085     51.7   51.4     48.3          33.9          31.8         17.3
## 1100     29.4   99.8     70.6          37.9          26.8         52.0
## 11001    29.4   99.8     70.6          37.9          26.8         52.0
## 1125     36.5   65.4     63.5          20.6          20.0         38.3
## 11251    36.5   65.4     63.5          20.6          20.0         38.3
## 1130     52.3   48.2     47.7          22.8          22.6         24.4
## 11301    52.3   48.2     47.7          22.8          22.6         24.4
## 1131     43.8   60.9     56.2          30.7          28.4         29.5
## 11311    43.8   60.9     56.2          30.7          28.4         29.5
## 1132     44.5   87.8     55.5          31.1          19.6         52.0
## 11321    44.5   87.8     55.5          31.1          19.6         52.0
## 1145     33.2   79.8     66.8          45.2          37.9         31.7
## 1211     48.0   44.4     52.0          28.2          33.1         17.2
## 12111    48.0   44.4     52.0          28.2          33.1         17.2
## 1223     38.7   73.5     61.3          47.2          39.4         25.4
## 1247     44.5   82.5     55.5          55.6          37.4         26.9
## 1250     35.9   62.5     64.1          35.8          36.8         27.1
## 1279     51.8   45.7     48.2          26.7          28.2         19.4
## 1307     55.1   62.0     44.9          33.9          24.6         28.0
## 1318     59.2   54.3     40.8          32.6          24.5         22.4
## 13181    59.2   54.3     40.8          32.6          24.5         22.4
## 13182    59.2   54.3     40.8          32.6          24.5         22.4
## 1319     44.5   60.8     55.5          20.5          18.8         36.7
## 1335     55.5   53.5     44.5          33.4          27.8         21.2
## 1338     48.7   43.1     51.3          29.0          34.5         15.5
## 13381    48.7   43.1     51.3          29.0          34.5         15.5
## 1341     37.0   73.9     63.0          50.2          42.8         23.8
## 13411    37.0   73.9     63.0          50.2          42.8         23.8
## 1343     39.7   58.1     60.3          35.9          37.3         23.2
## 1356     36.0   65.0     64.0          39.5          38.9         26.5
## 13561    36.0   65.0     64.0          39.5          38.9         26.5
## 13562    36.0   65.0     64.0          39.5          38.9         26.5
## 1369     51.7   42.8     48.3          22.6          25.5         20.0
## 13691    51.7   42.8     48.3          22.6          25.5         20.0
## 1377     42.6   62.6     57.4          33.9          31.1         28.6
## 13771    42.6   62.6     57.4          33.9          31.1         28.6
## 1386     39.7   64.4     60.3          41.3          38.6         22.4
## 1390     36.5   92.4     63.5          53.9          37.0         35.6
## 1394     40.3   52.6     59.7          25.0          28.4         26.6
## 1400     40.2   62.6     59.8          35.7          34.1         24.7
```

```
## 1429     41.8   61.4     58.2          38.4            36.4        24.2
## 1439     38.4  103.4     61.6          52.4            31.2        45.3
## 14391    38.4  103.4     61.6          52.4            31.2        45.3
## 14392    38.4  103.4     61.6          52.4            31.2        45.3
## 14393    38.4  103.4     61.6          52.4            31.2        45.3
## 1477     27.1   88.9     72.9          55.8            45.8        31.7
## 1492     47.0   85.6     53.0          44.1            27.3        37.0
## 1586     54.8   46.2     45.2          28.7            28.1        18.4
## 1612     41.5   56.0     58.5          40.9            42.7        17.9
## 16121    41.5   56.0     58.5          40.9            42.7        17.9
## 1620     48.3   78.2     51.7          44.8            29.6        33.9
## 1627     47.6   43.6     52.4          27.9            33.5        15.2
## 1631     47.1   46.9     52.9          34.0            38.3        15.2
## 1659     54.6   49.5     45.4          25.4            23.3        23.7
## 1670     56.3   63.0     43.7          27.2            18.8        30.8
## 1686     55.1   42.0     44.9          23.8            25.5        18.4
## 16861    55.1   42.0     44.9          23.8            25.5        18.4
## 16862    55.1   42.0     44.9          23.8            25.5        18.4
## 16863    55.1   42.0     44.9          23.8            25.5        18.4
## 1691     44.3   83.9     55.7          47.7            31.7        33.2
## 16911    44.3   83.9     55.7          47.7            31.7        33.2
## 1701     44.9   52.1     55.1          32.6            34.4        20.6
## 17013    44.9   52.1     55.1          32.6            34.4        20.6
## 1710     32.3   77.3     67.7          35.1            30.7        40.4
## 1711     46.0   85.9     54.0          38.7            24.3        40.9
## 1714     41.4   79.9     58.6          52.5            38.6        26.9
## 17141    41.4   79.9     58.6          52.5            38.6        26.9
## 1722     46.7   64.7     53.3          34.6            38.4        30.0
## 1725     36.8   55.5     63.2          31.4            35.7        24.4
## 1729     53.4   40.8     46.6          23.3            26.6        17.7
## 1730     54.7   49.2     45.3          19.5            17.9        27.8
## 17301    54.7   49.2     45.3          19.5            17.9        27.8
## 1771     37.0   72.1     63.0          42.8            37.4        30.1
## 1780     47.8   51.3     52.2          32.4            33.0        18.1
## 1810     33.3   66.7     66.7          37.6            37.6        26.7
## 1811     42.3   73.1     57.7          41.3            32.5        32.2
## 1817     47.9   76.1     52.1          27.0            18.5        40.9
## 1823     53.9   52.1     46.1          28.6            25.4        23.5
## 1859     38.4   71.1     61.6          41.0            35.6        27.7
## 1860     49.6   54.2     50.4          29.2            27.1        24.9
## 1861     51.8   55.8     48.2          30.7            26.6        22.8
## 1862     58.0   43.7     42.0          24.2            23.3        19.5
## 18621    58.0   43.7     42.0          24.2            23.3        19.5
## 1891     33.2   70.2     66.8          41.1            39.1        27.0
##       acqua_intra calorim_ind harris_benedict eritroc ematocr  emo vol_glob
## 86           16.3           y         1739.33    4.70    43.6 14.2     92.8
## 8610         16.3           y         1739.33    4.70    43.6 14.2     92.8
## 8611         16.3           y         1739.33    4.70    43.6 14.2     92.8
## 8612         16.3           y         1739.33    4.70    43.6 14.2     92.8
## 8613         16.3           y         1739.33    4.70    43.6 14.2     92.8
## 107          28.2           y         1872.29    5.66    35.8 10.7     63.2
## 10710        28.2           y         1872.29    5.66    35.8 10.7     63.2
## 112          17.9           y         1885.40    5.05    37.1 11.4     73.5
## 207          24.8           n         2015.07    4.73    43.7 14.6     92.5
```

```
## 2071        24.8          n        2015.07    4.73    43.7 14.6     92.5
## 2072        24.8          n        2015.07    4.73    43.7 14.6     92.5
## 2073        24.8          n        2015.07    4.73    43.7 14.6     92.5
## 422         19.0          y        1533.65    4.45    39.1 12.6     87.9
## 4221        19.0          y        1533.65    4.45    39.1 12.6     87.9
## 456         24.9          y        1791.99    5.32    47.3 14.9     88.8
## 4561        24.9          y        1791.99    5.32    47.3 14.9     88.8
## 510         22.1          n        1582.11    4.63    41.2 13.4     88.9
## 5101        22.1          n        1582.11    4.63    41.2 13.4     88.9
## 529         13.7          n        1426.43    4.34    39.0 12.8     90.0
## 5291        13.7          n        1426.43    4.34    39.0 12.8     90.0
## 5292        13.7          n        1426.43    4.34    39.0 12.8     90.0
## 5293        13.7          n        1426.43    4.34    39.0 12.8     90.0
## 5294        13.7          n        1426.43    4.34    39.0 12.8     90.0
## 5295        13.7          n        1426.43    4.34    39.0 12.8     90.0
## 5296        13.7          n        1426.43    4.34    39.0 12.8     90.0
## 5297        13.7          n        1426.43    4.34    39.0 12.8     90.0
## 5298        13.7          n        1426.43    4.34    39.0 12.8     90.0
## 5299        13.7          n        1426.43    4.34    39.0 12.8     90.0
## 52910       13.7          n        1426.43    4.34    39.0 12.8     90.0
## 640         23.4          y        2141.94    4.86    45.1 14.6     92.8
## 6401        23.4          y        2141.94    4.86    45.1 14.6     92.8
## 666         16.6          n        1589.33    4.69    41.5 13.3     88.6
## 6661        16.6          n        1589.33    4.69    41.5 13.3     88.6
## 6662        16.6          n        1589.33    4.69    41.5 13.3     88.6
## 6663        16.6          n        1589.33    4.69    41.5 13.3     88.6
## 6664        16.6          n        1589.33    4.69    41.5 13.3     88.6
## 766         18.3          n        1843.72    4.78    40.7 13.1     85.1
## 7661        18.3          n        1843.72    4.78    40.7 13.1     85.1
## 787         32.4          n        2196.79    3.86    37.1 11.8     96.1
## 7871        32.4          n        2196.79    3.86    37.1 11.8     96.1
## 789         30.9          y        2550.26    5.19    44.6 14.4     85.9
## 7891        30.9          y        2550.26    5.19    44.6 14.4     85.9
## 792         28.3          y        2325.05    5.12    48.5 15.6     94.8
## 805         19.7          n        1701.28    4.69    39.5 12.9     84.2
## 8051        19.7          n        1701.28    4.69    39.5 12.9     84.2
## 826         18.8          y        2466.93    4.70    42.8 13.7     91.0
## 904          7.8          n        1891.11    3.47    30.7 10.0     88.7
## 931         17.4          y        1647.40    3.93    36.1 11.6     91.9
## 9311        17.4          y        1647.40    3.93    36.1 11.6     91.9
## 948         31.4          n        2544.61    4.97    42.2 14.1     84.9
## 9481        31.4          n        2544.61    4.97    42.2 14.1     84.9
## 965         24.0          y        1888.52    4.96    47.7 15.7     96.2
## 979         17.8          y        1543.13    4.53    42.0 13.6     92.7
## 9791        17.8          y        1543.13    4.53    42.0 13.6     92.7
## 1010        23.6          y        1928.49    4.59    40.2 12.6     87.6
## 1025        17.3          y        1626.50    4.06    37.5 11.9     92.4
## 1028        18.6          y        1642.75    4.67    40.9 13.1     87.6
## 1050        29.3          n        2501.29    5.07    46.7 15.4     92.2
## 1073        19.1          y        1378.29    4.00    36.7 11.7     91.6
## 10731       19.1          y        1378.29    4.00    36.7 11.7     91.6
## 1085        20.3          y        1721.52    4.82    39.8 12.9     82.6
## 1100        21.0          y        2501.82    3.88    32.0  9.5     82.5
## 11001       21.0          y        2501.82    3.88    32.0  9.5     82.5
```

```
## 1125          9.5          y          1974.97    4.77    42.9 14.0     89.9
## 11251         9.5          y          1974.97    4.77    42.9 14.0     89.9
## 1130         14.1          n          1547.08    5.18    45.2 14.4     87.3
## 11301        14.1          n          1547.08    5.18    45.2 14.4     87.3
## 1131         19.2          n          1900.03    4.80    42.9 13.9     89.4
## 11311        19.2          n          1900.03    4.80    42.9 13.9     89.4
## 1132         18.3          y          2744.17    5.26    50.8 16.5     96.5
## 11321        18.3          y          2744.17    5.26    50.8 16.5     96.5
## 1145         26.7          y          2253.98    5.61    47.9 15.8     85.4
## 1211         18.3          y          1452.83    4.20    38.3 12.4     91.2
## 12111        18.3          y          1452.83    4.20    38.3 12.4     91.2
## 1223         28.4          y          2202.32    4.55    41.2 13.7     90.7
## 1247         33.5          y          2580.27    5.72    54.6 17.9     95.4
## 1250         22.9          y          1718.29    4.47    40.9 13.4     91.5
## 1279         17.1          y          1538.89    3.79    32.1 10.2     84.5
## 1307         21.6          y          2437.68    4.26    41.8 14.2     98.1
## 1318         21.0          y          1957.63    4.47    40.7 13.9     40.7
## 13181        21.0          y          1957.63    4.47    40.7 13.9     40.7
## 13182        21.0          y          1957.63    4.47    40.7 13.9     40.7
## 1319         11.9          y          1655.09    3.99    35.1 11.2     87.8
## 1335         21.6          n          1773.04    5.12    43.4 14.2     84.8
## 1338         19.0          n          1485.62    4.45    33.0 10.5     74.3
## 13381        19.0          n          1485.62    4.45    33.0 10.5     74.3
## 1341         30.3          y          2148.91    5.55    47.3 15.8     85.3
## 13411        30.3          y          2148.91    5.55    47.3 15.8     85.3
## 1343         23.3          y          1816.19    3.91    38.8 12.9     99.3
## 1356         25.5          n          2303.96    4.44    43.7 14.5     98.4
## 13561        25.5          n          2303.96    4.44    43.7 14.5     98.4
## 13562        25.5          n          2303.96    4.44    43.7 14.5     98.4
## 1369         14.3          n          1463.18    4.35    39.5 12.5     90.9
## 13691        14.3          n          1463.18    4.35    39.5 12.5     90.9
## 1377         21.4          y          1835.15    3.91    38.6 12.9     98.6
## 13771        21.4          y          1835.15    3.91    38.6 12.9     98.6
## 1386         24.5          y          1991.56    4.89    46.2 15.2     94.6
## 1390         32.0          n          2656.81    4.98    44.2 14.1     88.8
## 1394         15.5          n          1787.34    3.78    36.5 11.8     96.4
## 1400         21.2          y          1972.94    6.45    42.4 13.2     65.8
## 1429         24.9          y          1878.29    4.75    43.5 14.5     91.6
## 1439         30.4          n          2885.96    4.67    42.6 13.6     91.3
## 14391        30.4          n          2885.96    4.67    42.6 13.6     91.3
## 14392        30.4          n          2885.96    4.67    42.6 13.6     91.3
## 14393        30.4          n          2885.96    4.67    42.6 13.6     91.3
## 1477         33.4          y          2266.09    4.70    44.1 14.5     93.9
## 1492         25.7          y          2746.81    4.56    41.6 13.6     91.1
## 1586         18.6          y          1605.59    4.13    37.0 12.1     89.6
## 1612         26.9          y          1524.15    4.28    39.9 13.1     93.3
## 16121        26.9          y          1524.15    4.28    39.9 13.1     93.3
## 1620         28.6          y          2628.06    4.88    43.5 14.3     89.1
## 1627         16.7          y          1547.34    4.24    39.5 12.9     93.1
## 1631         22.3          y          1491.21    4.01    36.6 12.3     91.3
## 1659         15.9          y          1720.18    4.52    42.4 14.5     94.0
## 1670         15.3          y          2067.27    4.57    40.7 13.6     89.0
## 1686         15.2          y          1543.26    4.41    39.7 13.0     89.9
## 16861        15.2          y          1543.26    4.41    39.7 13.0     89.9
```

```
## 16862        15.2           y         1543.26    4.41    39.7 13.0     89.9
## 16863        15.2           y         1543.26    4.41    39.7 13.0     89.9
## 1691         28.2           y         2631.81    5.11    47.5 15.7     92.9
## 16911        28.2           y         2631.81    5.11    47.5 15.7     92.9
## 1701         21.1           y         1779.99    5.49    50.0 16.8     91.1
## 17013        21.1           y         1779.99    5.49    50.0 16.8     91.1
## 1710         21.5           y         2043.09    4.96    42.0 14.6     84.6
## 1711         22.0           y         2715.20    4.79    41.1 13.8     85.9
## 1714         31.6           y         2522.05    4.81    42.9 14.7     89.3
## 17141        31.6           y         2522.05    4.81    42.9 14.7     89.3
## 1722         21.8           y         2183.15    4.94    42.6 14.8     86.3
## 1725         20.0           y         1633.63    5.27    44.0 14.7     83.5
## 1729         14.9           y         1448.37    4.64    37.0 12.5     79.7
## 1730         11.6           y         1667.20    5.18    40.4 12.9     78.1
## 17301        11.6           y         1667.20    5.18    40.4 12.9     78.1
## 1771         27.6           y         2045.31    4.40    42.8 14.7     97.4
## 1780         19.5           y         1604.62    4.63    39.8 13.5     86.0
## 1810         22.1           y         1867.51    5.17    45.7 15.2     88.3
## 1811         26.3           y         2223.74    4.62    42.7 14.4     92.5
## 1817         14.8           y         2568.39    3.84    32.3 10.3     84.1
## 1823         18.2           y         1753.41    4.94    42.5 14.2     86.1
## 1859         24.3           y         2107.06    5.23    48.0 16.3     91.9
## 1860         18.5           n         1821.30    5.01    43.2 14.3     86.1
## 1861         18.1           y         1800.24    4.65    42.5 14.1     91.3
## 1862         15.4           y         1597.50    4.40    40.1 13.7     91.1
## 18621        15.4           y         1597.50    4.40    40.1 13.7     91.1
## 1891         24.4           y         1998.89    4.49    39.9 13.3     88.9
##       leuco piastr VES AST ALT gammaGT uric creatin micr_album col_tot HDL LDL
## 86      8.4    220   8  16  15      12 10.0    1.10         3.0     210  68 137
## 8610    8.4    220   8  16  15      12 10.0    1.10         3.0     210  68 137
## 8611    8.4    220   8  16  15      12 10.0    1.10         3.0     210  68 137
## 8612    8.4    220   8  16  15      12 10.0    1.10         3.0     210  68 137
## 8613    8.4    220   8  16  15      12 10.0    1.10         3.0     210  68 137
## 107    11.0    237  26  41  41      31  5.7    0.90         4.0     171  30 121
## 10710  11.0    237  26  41  41      31  5.7    0.90         4.0     171  30 121
## 112     8.1    246   8  15  14      21  5.7    1.60         0.0     144  28  93
## 207     8.1    265   7  20  29      22  6.5    0.90        11.0     159  45  85
## 2071    8.1    265   7  20  29      22  6.5    0.90        11.0     159  45  85
## 2072    8.1    265   7  20  29      22  6.5    0.90        11.0     159  45  85
## 2073    8.1    265   7  20  29      22  6.5    0.90        11.0     159  45  85
## 422     6.5    218  23  25  23      23  8.9    0.80         3.0     160  43 101
## 4221    6.5    218  23  25  23      23  8.9    0.80         3.0     160  43 101
## 456     8.8    194  10  14  15      23  6.8    1.70         6.0     166  53 108
## 4561    8.8    194  10  14  15      23  6.8    1.70         6.0     166  53 108
## 510     4.9    156  32  27  29      58  4.7    0.80         1.0     156  44 111
## 5101    4.9    156  32  27  29      58  4.7    0.80         1.0     156  44 111
## 529     6.3    105  12  22  21      29  5.8    0.70         3.0     175  65  95
## 5291    6.3    105  12  22  21      29  5.8    0.70         3.0     175  65  95
## 5292    6.3    105  12  22  21      29  5.8    0.70         3.0     175  65  95
## 5293    6.3    105  12  22  21      29  5.8    0.70         3.0     175  65  95
## 5294    6.3    105  12  22  21      29  5.8    0.70         3.0     175  65  95
## 5295    6.3    105  12  22  21      29  5.8    0.70         3.0     175  65  95
## 5296    6.3    105  12  22  21      29  5.8    0.70         3.0     175  65  95
## 5297    6.3    105  12  22  21      29  5.8    0.70         3.0     175  65  95
```

```
## 5298    6.3   105  12  22  21    29  5.8   0.70     3.0   175  65  95
## 5299    6.3   105  12  22  21    29  5.8   0.70     3.0   175  65  95
## 52910   6.3   105  12  22  21    29  5.8   0.70     3.0   175  65  95
## 640     5.7   140  31  18  14    22  4.9   0.90     3.0   141  44  89
## 6401    5.7   140  31  18  14    22  4.9   0.90     3.0   141  44  89
## 666     5.7   153  26  22  16    11  6.4   0.90     0.0   210  52 145
## 6661    5.7   153  26  22  16    11  6.4   0.90     0.0   210  52 145
## 6662    5.7   153  26  22  16    11  6.4   0.90     0.0   210  52 145
## 6663    5.7   153  26  22  16    11  6.4   0.90     0.0   210  52 145
## 6664    5.7   153  26  22  16    11  6.4   0.90     0.0   210  52 145
## 766     7.7   225  21  14  19    23  7.2   0.90   138.0   164  52  91
## 7661    7.7   225  21  14  19    23  7.2   0.90   138.0   164  52  91
## 787     8.5   151  26  11  13    27  7.6   2.30   256.0    72  27  34
## 7871    8.5   151  26  11  13    27  7.6   2.30   256.0    72  27  34
## 789     7.0   347   3  19  31    43  6.8   0.80     4.0   161  34 116
## 7891    7.0   347   3  19  31    43  6.8   0.80     4.0   161  34 116
## 792     8.7   172  25  55  90   107  9.8   0.60    64.0   258  28 179
## 805     4.9   191  14  13  15    22  6.2   1.00     6.0   207  34 148
## 8051    4.9   191  14  13  15    22  6.2   1.00     6.0   207  34 148
## 826     8.1   188  37  17  17    41  5.1   1.10     5.0   187  61 126
## 904     5.2   175  37  17   8    11  9.2   0.90     8.1   121  70  49
## 931     6.5   160  38  24  33   205 10.7   1.70     4.0   191  31 102
## 9311    6.5   160  38  24  33   205 10.7   1.70     4.0   191  31 102
## 948     7.9   169  26  32  37    39  7.4   0.50     9.0   162  44 107
## 9481    7.9   169  26  32  37    39  7.4   0.50     9.0   162  44 107
## 965     7.1   211  29  22  24    47  9.1   1.00    59.0   303  35 239
## 979     7.1   271  12  21  20    27  4.4   0.70     0.0   141  61  69
## 9791    7.1   271  12  21  20    27  4.4   0.70     0.0   141  61  69
## 1010    6.4   184  21  28  37    32  7.5   0.80     4.0   168  50 106
## 1025    5.9   215  17  15  13    14  5.0   0.80     2.0   259  41 206
## 1028    6.4   210   9  29  53    70  4.2   0.60    27.0   174  34 127
## 1050    6.2   176   4  38  57    61  7.9   0.80    70.0   164  48 100
## 1073    7.2   181  40  16  17    23  9.5   1.80    29.0   210  51 116
## 10731   7.2   181  40  16  17    23  9.5   1.80    29.0   210  51 116
## 1085    8.4   212  31  20  25    18  7.2   0.80     2.0   212  47 148
## 1100    7.0   259  82  13  11    83  6.9   2.40  3225.0   127  44  64
## 11001   7.0   259  82  13  11    83  6.9   2.40  3225.0   127  44  64
## 1125    9.3   230  19  28  51   103  8.2   0.90     7.0   147  25  87
## 11251   9.3   230  19  28  51   103  8.2   0.90     7.0   147  25  87
## 1130    6.3   126  27  18  19    15  4.7   0.90     3.0   164  43 108
## 11301   6.3   126  27  18  19    15  4.7   0.90     3.0   164  43 108
## 1131    5.7   152  13  20  26    23  7.3   0.87     3.0   159  50  94
## 11311   5.7   152  13  20  26    23  7.3   0.87     3.0   159  50  94
## 1132    6.2   152  15  13  14    23  8.4   0.80     4.0   187  46 121
## 11321   6.2   152  15  13  14    23  8.4   0.80     4.0   187  46 121
## 1145    7.1   138   7  53  58    39  5.5   0.93     7.0   183  36 131
## 1211    5.0   243  17  16  20    18  6.5   0.72     1.0   164  57 103
## 12111   5.0   243  17  16  20    18  6.5   0.72     1.0   164  57 103
## 1223    5.6   197  10  20  20    26  6.7   0.86     3.0   160  32 100
## 1247    8.4   211   5  17  21    29  8.5   0.80    21.0   147  42  94
## 1250    4.8   160  24  21  15    18  5.8   1.72     2.0   143  31  88
## 1279    6.9   240  38  16  11    14  3.3   0.87     5.0   124  53 121
## 1307    6.2   229  33  23  17    38  6.9   0.77     7.0   176  74 100
## 1318   10.0   228  30  17  19    23  8.4   0.65     2.0   134  44  71
```

```
## 13181  10.0    228  30  17  19      23  8.4    0.65       2.0     134  44  71
## 13182  10.0    228  30  17  19      23  8.4    0.65       2.0     134  44  71
## 1319    5.7    223  49  14  11      13  6.6    0.99      13.0     184  36 132
## 1335    4.8    129  28  25  33      20  6.5    0.73       3.0     248  48 182
## 1338    7.5    246  43  36  42      25  7.4    0.90       6.0     240  60 173
## 13381   7.5    246  43  36  42      25  7.4    0.90       6.0     240  60 173
## 1341    7.2    204   3  24  19      17  7.3    1.07      93.0     134  31  79
## 13411   7.2    204   3  24  19      17  7.3    1.07      93.0     134  31  79
## 1343    2.7    101   8  46  40     116  5.8    1.21       1.0     147  32  90
## 1356    6.5    226  26  45  37     174 10.0    0.94      13.0     226  52 155
## 13561   6.5    226  26  45  37     174 10.0    0.94      13.0     226  52 155
## 13562   6.5    226  26  45  37     174 10.0    0.94      13.0     226  52 155
## 1369    7.4    179  25  23  16      26  3.3    1.40       1.0     136  44  87
## 13691   7.4    179  25  23  16      26  3.3    1.40       1.0     136  44  87
## 1377    5.8    125  46  14  13      19  6.8    1.07      13.0     238  58 174
## 13771   5.8    125  46  14  13      19  6.8    1.07      13.0     238  58 174
## 1386    9.7    275  13  42  69      39  7.4    0.97      11.0     173  40 117
## 1390    6.3    185  18  45  45      31  6.3    0.94       2.0     169  39 110
## 1394    6.5    274  16  19  15      21  5.9    0.90       4.0     170  90  80
## 1400    8.1    204  17  18  16      16  6.4    0.74       5.0     179  32 135
## 1429    7.5    230  12  35  52      24  7.8    1.15      17.0     163  42 110
## 1439   10.0    289  38  20  22      37  6.7    1.00       5.0     176  38 120
## 14391  10.0    289  38  20  22      37  6.7    1.00       5.0     176  38 120
## 14392  10.0    289  38  20  22      37  6.7    1.00       5.0     176  38 120
## 14393  10.0    289  38  20  22      37  6.7    1.00       5.0     176  38 120
## 1477    8.7    177  30  35  18      30  7.1    1.45       8.0     428  42 345
## 1492    9.8    245  27  19  27      35  6.9    0.74       3.0     188  50 120
## 1586    6.7    287  32  16  18      14  7.2    1.42      48.0     173  52 111
## 1612    4.9    202  23  10  10      15  6.1    0.71       2.0     184  40 107
## 16121   4.9    202  23  10  10      15  6.1    0.71       2.0     184  40 107
## 1620    7.7    177  35  21  24      24  5.7    0.90       5.0     209  42 146
## 1627    8.5    354  32  15  17      23  5.7    0.70       4.0     235  66 165
## 1631    3.9    183  12  14   5      10  3.4    0.61       2.0     223  64 154
## 1659    5.9    249  40  17  16      19  6.5    0.72       4.0     158  37 105
## 1670    6.6    183  21  17  17      19  6.7    0.63       2.0     145  47  91
## 1686    5.5    202   5  19  23      75  3.1    0.67     151.0     167  90  63
## 16861   5.5    202   5  19  23      75  3.1    0.67     151.0     167  90  63
## 16862   5.5    202   5  19  23      75  3.1    0.67     151.0     167  90  63
## 16863   5.5    202   5  19  23      75  3.1    0.67     151.0     167  90  63
## 1691    7.4    146  43  30  38      19  7.4    0.85      10.0     133  33  88
## 16911   7.4    146  43  30  38      19  7.4    0.85      10.0     133  33  88
## 1701    6.5    158   4  16  18      24  5.3    0.89      95.0     163  43 107
## 17013   6.5    158   4  16  18      24  5.3    0.89      95.0     163  43 107
## 1710    6.0    212  11  23  27      23  9.3    0.98       5.0      99  31  53
## 1711    7.5    248  47  14  15      31  6.3    0.69       6.0     206  54 132
## 1714    8.2    195  26  23  26      16  6.5    0.85       8.0     191  39 142
## 17141   8.2    195  26  23  26      16  6.5    0.85       8.0     191  39 142
## 1722    6.0    141   5  19  21      20  7.0    0.67       6.0     194  30 144
## 1725    6.7    196  40  24  17      38  6.8    1.02       8.0     153  43  88
## 1729    4.7    195  33  15  20      16  7.4    0.61       6.0     222  45 152
## 1730    8.8    260  68  16  14      19  6.3    0.72      13.0     156  66  71
## 17301   8.8    260  68  16  14      19  6.3    0.72      13.0     156  66  71
## 1771    9.7    227  26  31  31      64  4.7    0.73      10.0     217  46 146
## 1780    7.9    267  55  25  32      49  7.7    0.76       2.0     239  58 165
```

```
## 1810    6.0    189  20  34  33      92  4.2    1.13       57.0     153  40  89
## 1811    4.7    158  17  17  13      20  7.0    0.93        7.0     149  38  89
## 1817    5.4    171  47  11   7      16  4.9    3.47      501.0      81  20  44
## 1823    8.0    316  17  24  28      20  4.9    0.76        0.0     170  40 116
## 1859    7.3    175  22  18  17      16  4.5    0.78        1.0     121  45  55
## 1860    9.5    153   8  15  15      15  7.5    1.47       27.0     145  34  81
## 1861    4.4    204  21  27  25      13  5.5    0.66        1.0     191  56 123
## 1862    9.1    191  39  18  13      17  6.3    0.76        5.0     222  54 152
## 18621   9.1    191  39  18  13      17  6.3    0.76        5.0     222  54 152
## 1891    6.1    165  15  60  83      72  5.2    0.79        9.0     165  53  91
##       trigl glic_bas insulinem_bas emo_gli calcemia sodio pot prot_C_reat   TSH
## 86      117       94          16.0      35      9.9   144 3.7          0.3  4.43
## 8610    117       94          16.0      35      9.9   144 3.7          0.3  4.43
## 8611    117       94          16.0      35      9.9   144 3.7          0.3  4.43
## 8612    117       94          16.0      35      9.9   144 3.7          0.3  4.43
## 8613    117       94          16.0      35      9.9   144 3.7          0.3  4.43
## 107     189       90          24.7      39      9.0   141 4.5          0.3  1.41
## 10710   189       90          24.7      39      9.0   141 4.5          0.3  1.41
## 112     192      118          10.5      45      9.1   146 4.7          0.1  1.16
## 207     284      100          18.6      35      9.5   141 4.2          0.0  1.74
## 2071    284      100          18.6      35      9.5   141 4.2          0.0  1.74
## 2072    284      100          18.6      35      9.5   141 4.2          0.0  1.74
## 2073    284      100          18.6      35      9.5   141 4.2          0.0  1.74
## 422     164      109          27.5      52      8.3   141 4.3          0.3  5.98
## 4221    164      109          27.5      52      8.3   141 4.3          0.3  5.98
## 456      78      127          13.4      51      9.8   144 4.5          0.8  1.66
## 4561     78      127          13.4      51      9.8   144 4.5          0.8  1.66
## 510      85       93           3.1      38      9.0   141 4.5          0.7  6.02
## 5101     85       93           3.1      38      9.0   141 4.5          0.7  6.02
## 529     150      104          11.0      40      9.6   143 4.0          0.2  4.91
## 5291    150      104          11.0      40      9.6   143 4.0          0.2  4.91
## 5292    150      104          11.0      40      9.6   143 4.0          0.2  4.91
## 5293    150      104          11.0      40      9.6   143 4.0          0.2  4.91
## 5294    150      104          11.0      40      9.6   143 4.0          0.2  4.91
## 5295    150      104          11.0      40      9.6   143 4.0          0.2  4.91
## 5296    150      104          11.0      40      9.6   143 4.0          0.2  4.91
## 5297    150      104          11.0      40      9.6   143 4.0          0.2  4.91
## 5298    150      104          11.0      40      9.6   143 4.0          0.2  4.91
## 5299    150      104          11.0      40      9.6   143 4.0          0.2  4.91
## 52910   150      104          11.0      40      9.6   143 4.0          0.2  4.91
## 640     100      107           9.8      43      8.9   144 4.4          0.1  0.91
## 6401    100      107           9.8      43      8.9   144 4.4          0.1  0.91
## 666      95       92          11.3      40      9.0   140 3.8          0.4  0.58
## 6661     95       92          11.3      40      9.0   140 3.8          0.4  0.58
## 6662     95       92          11.3      40      9.0   140 3.8          0.4  0.58
## 6663     95       92          11.3      40      9.0   140 3.8          0.4  0.58
## 6664     95       92          11.3      40      9.0   140 3.8          0.4  0.58
## 766     147      133          14.2      72      9.6   143 4.0          0.7  7.11
## 7661    147      133          14.2      72      9.6   143 4.0          0.7  7.11
## 787     112      115          19.2      42      8.2   145 4.3          1.2  0.80
## 7871    112      115          19.2      42      8.2   145 4.3          1.2  0.80
## 789     143       81          24.8      25      9.5   140 4.6          0.3  3.54
## 7891    143       81          24.8      25      9.5   140 4.6          0.3  3.54
## 792     309      106          24.1      46      9.6   140 3.7          0.7  1.99
```

```
## 805     198      109          17.9      34     11.0   146 3.1          0.4  1.67
## 8051    198      109          17.9      34     11.0   146 3.1          0.4  1.67
## 826      78      142          21.3      51      9.6   138 3.8          0.5  2.44
## 904      81       86           8.1      38      8.7   137 4.3          0.2  1.07
## 931     388      313          26.0      99      9.4   135 6.0          2.3  2.54
## 9311    388      313          26.0      99      9.4   135 6.0          2.3  2.54
## 948     161      157          26.2      53      9.6   139 4.1          0.5  1.75
## 9481    161      157          26.2      53      9.6   139 4.1          0.5  1.75
## 965     207      102          34.3      39      9.3   142 4.1          0.1  1.61
## 979      73       87          10.1      40      9.2   144 4.2          0.1  1.82
## 9791     73       87          10.1      40      9.2   144 4.2          0.1  1.82
## 1010    155      110          20.0      42      9.4   142 4.1          0.3  1.63
## 1025    126       89           9.3      36      9.3   142 4.9          0.1  1.98
## 1028     98      188          22.6      85      9.7   140 3.9          0.5  8.17
## 1050    132      125          21.2      44     10.1   141 4.8          0.2  1.24
## 1073    256       96           3.8      68      9.9   138 4.8          0.1  0.87
## 10731   256       96           3.8      68      9.9   138 4.8          0.1  0.87
## 1085    132       91          21.5      35      9.9   143 4.0          0.6  2.08
## 1100    127       82           3.6      46      7.8   142 4.0          2.4  1.00
## 11001   127       82           3.6      46      7.8   142 4.0          2.4  1.00
## 1125    245      156           9.8      53      9.5   139 4.1          0.3  2.58
## 11251   245      156           9.8      53      9.5   139 4.1          0.3  2.58
## 1130    101      121          21.6      41      9.6   142 3.7          0.1  1.52
## 11301   101      121          21.6      41      9.6   142 3.7          0.1  1.52
## 1131    104      105          18.3      30      9.0   143 3.5          0.0  2.09
## 11311   104      105          18.3      30      9.0   143 3.5          0.0  2.09
## 1132    184       87           8.8      33      9.5   142 3.7          0.3  1.84
## 11321   184       87           8.8      33      9.5   142 3.7          0.3  1.84
## 1145    186      113          18.1      33      8.6   146 3.3          0.3  1.00
## 1211     86      102          11.5      43      9.5   141 4.3          0.1  0.74
## 12111    86      102          11.5      43      9.5   141 4.3          0.1  0.74
## 1223    256      123          35.0      42      9.2   136 4.4          0.0  1.41
## 1247    122       98          22.8      50      9.4   142 4.4          1.3  0.83
## 1250    150       89          10.6      32      8.6   142 3.7          3.0  1.10
## 1279    143       99           9.8      39      8.8   143 4.3          0.6  0.92
## 1307     84       92          25.5      37      9.5   140 3.9          0.1  1.28
## 1318    240      150          35.6      54     10.2   140 3.9          0.6  2.56
## 13181   240      150          35.6      54     10.2   140 3.9          0.6  2.56
## 13182   240      150          35.6      54     10.2   140 3.9          0.6  2.56
## 1319    140      143           6.2      60      8.8   143 4.5          0.6  6.40
## 1335    143      104          20.6      38      9.8   142 3.8          0.4  2.23
## 1338    188       90           7.0      44      9.2   145 4.0          0.1  1.21
## 13381   188       90           7.0      44      9.2   145 4.0          0.1  1.21
## 1341    198      106          21.8      36      9.5   144 3.5          0.2  3.08
## 13411   198      106          21.8      36      9.5   144 3.5          0.2  3.08
## 1343    233      113          18.4      35      9.5   139 4.3          0.3  2.91
## 1356    183      109          14.2      45      9.6   141 4.5          0.2  2.16
## 13561   183      109          14.2      45      9.6   141 4.5          0.2  2.16
## 13562   183      109          14.2      45      9.6   141 4.5          0.2  2.16
## 1369    110      199          10.0      40      9.2   141 4.5          0.7  3.00
## 13691   110      199          10.0      40      9.2   141 4.5          0.7  3.00
## 1377     79      178           9.9      52      9.2   139 4.4          0.3  2.05
## 13771    79      178           9.9      52      9.2   139 4.4          0.3  2.05
## 1386    130      137           5.9      64      9.9   142 4.2          0.7  1.34
```

```
## 1390    122      148          14.3      72      9.5   142 4.3          0.8  1.41
## 1394     63      109           7.6      35      9.6   140 3.9          1.1  1.04
## 1400    128       97          13.7      36      9.1   140 3.5          0.3  1.47
## 1429    167      152          72.0      42     10.0   141 4.6          0.2  1.79
## 1439    136      109          15.6      41      9.4   140 4.0          0.9  1.05
## 14391   136      109          15.6      41      9.4   140 4.0          0.9  1.05
## 14392   136      109          15.6      41      9.4   140 4.0          0.9  1.05
## 14393   136      109          15.6      41      9.4   140 4.0          0.9  1.05
## 1477    290       87           9.9      40      9.7   142 4.3          0.5 97.99
## 1492    161       94          14.4      34      8.9   143 4.1          0.4  2.81
## 1586    124      164          21.2      73      9.6   140 4.4          0.3  0.17
## 1612    296      128          10.4      51      9.6   144 4.6          0.3  1.29
## 16121   296      128          10.4      51      9.6   144 4.6          0.3  1.29
## 1620    240      134          21.6      57      9.4   142 3.9          0.3  1.26
## 1627     81       95          11.7      38      8.4   140 4.3          1.1  1.63
## 1631    103       87           6.8      33      9.1   139 4.2          0.1  3.30
## 1659    151      105          20.6      35      9.2   139 4.3          0.4  0.02
## 1670    111       93           7.5      38      8.9   142 4.0          1.2  2.51
## 1686     90      103          17.9      36      9.5   136 4.4          0.3  1.22
## 16861    90      103          17.9      36      9.5   136 4.4          0.3  1.22
## 16862    90      103          17.9      36      9.5   136 4.4          0.3  1.22
## 16863    90      103          17.9      36      9.5   136 4.4          0.3  1.22
## 1691    116       96          27.5      36      9.2   142 3.8         36.0  1.42
## 16911   116       96          27.5      36      9.2   142 3.8         36.0  1.42
## 1701    142      172           9.9      52      9.3   140 4.4          0.1  2.30
## 17013   142      172           9.9      52      9.3   140 4.4          0.1  2.30
## 1710    109      102          11.3      48      9.7   144 3.5          0.3  1.64
## 1711    119       97          11.1      40      8.7   143 3.9          1.5  0.80
## 1714    144       92          20.3      37      8.8   140 4.0          1.6  0.20
## 17141   144       92          20.3      37      8.8   140 4.0          1.6  0.20
## 1722    159       99          25.7      36      8.8   143 4.2          0.1  1.71
## 1725    179       94          15.1      45      9.4   141 4.4          0.5  1.06
## 1729    205      159          16.1      64      9.8   141 4.0          0.9  4.16
## 1730    106      154           6.3      56      9.3   141 4.6          0.6  3.05
## 17301   106      154           6.3      56      9.3   141 4.6          0.6  3.05
## 1771    221       96          23.6      42      9.2   147 4.0          0.2  1.00
## 1780    184       93          12.8      45      9.5   145 4.7          2.0  1.50
## 1810    146      150           7.5      70      9.8   143 5.0          0.1  3.20
## 1811    177      104          13.9      39      9.2   146 3.8          0.1  2.64
## 1817    105      136           6.1      40      8.9   139 4.1          1.4  2.43
## 1823    169      142          34.4      48      9.6   143 4.5          0.6  5.76
## 1859    134      192          19.1      60      9.4   146 4.0          0.3  1.19
## 1860    202      208          21.2      63      9.5   145 4.7          0.8  1.65
## 1861     63      101           9.8      37      8.9   146 4.4          0.2  1.40
## 1862    140      155          32.5      57      9.5   144 4.8          3.8  0.32
## 18621   140      155          32.5      57      9.5   144 4.8          3.8  0.32
## 1891    158      183          29.4      70      9.7   141 4.2          0.1  2.30
##       calcifed neutrofili neutrofili_val linfociti linfociti_val monociti
## 86         9.0         63            5.3        26           2.2        7
## 8610       9.0         63            5.3        26           2.2        7
## 8611       9.0         63            5.3        26           2.2        7
## 8612       9.0         63            5.3        26           2.2        7
## 8613       9.0         63            5.3        26           2.2        7
## 107       14.5         66            7.2        23           2.5        8
```

```
## 10710    14.5         66           7.2         23          2.5         8
## 112      33.8         69           5.6         17          1.4         8
## 207      11.9         50           4.0         40          3.2         9
## 2071     11.9         50           4.0         40          3.2         9
## 2072     11.9         50           4.0         40          3.2         9
## 2073     11.9         50           4.0         40          3.2         9
## 422       9.0         46           3.0         41          2.7        10
## 4221      9.0         46           3.0         41          2.7        10
## 456      29.9         55           4.9         29          2.5        10
## 4561     29.9         55           4.9         29          2.5        10
## 510       9.0         64           3.1         27          1.3         8
## 5101      9.0         64           3.1         27          1.3         8
## 529       9.0         44           2.8         44          2.8         9
## 5291      9.0         44           2.8         44          2.8         9
## 5292      9.0         44           2.8         44          2.8         9
## 5293      9.0         44           2.8         44          2.8         9
## 5294      9.0         44           2.8         44          2.8         9
## 5295      9.0         44           2.8         44          2.8         9
## 5296      9.0         44           2.8         44          2.8         9
## 5297      9.0         44           2.8         44          2.8         9
## 5298      9.0         44           2.8         44          2.8         9
## 5299      9.0         44           2.8         44          2.8         9
## 52910     9.0         44           2.8         44          2.8         9
## 640      19.2         51           2.9         35          2.0         8
## 6401     19.2         51           2.9         35          2.0         8
## 666      11.1         63           3.6         27          1.6         8
## 6661     11.1         63           3.6         27          1.6         8
## 6662     11.1         63           3.6         27          1.6         8
## 6663     11.1         63           3.6         27          1.6         8
## 6664     11.1         63           3.6         27          1.6         8
## 766       9.0         52           4.0         37          2.9         7
## 7661      9.0         52           4.0         37          2.9         7
## 787      21.2         75           6.4         13          1.1         7
## 7871     21.2         75           6.4         13          1.1         7
## 789      13.5         51           3.6         38          2.6         9
## 7891     13.5         51           3.6         38          2.6         9
## 792      15.5         36           3.1         51          4.5         9
## 805       9.0         56           2.8         30          1.5         7
## 8051      9.0         56           2.8         30          1.5         7
## 826       9.0         54           4.4         33          2.7        10
## 904      19.1         43           2.2         44          2.4        10
## 931      15.2         64           4.1         24          1.6         8
## 9311     15.2         64           4.1         24          1.6         8
## 948      26.2         60           4.7         29          2.3         8
## 9481     26.2         60           4.7         29          2.3         8
## 965      16.8         46           3.3         40          2.8        11
## 979       9.0         53           3.8         34          2.5        10
## 9791      9.0         53           3.8         34          2.5        10
## 1010     16.3         69           4.4         22          1.4         7
## 1025      9.0         46           2.7         36          2.1        12
## 1028      9.0         43           2.7         42          2.7         9
## 1050     17.4         56           3.5         31          2.0         7
## 1073     16.7         48           3.5         33          2.4         9
## 10731    16.7         48           3.5         33          2.4         9
```

```
## 1085      9.0         61          5.1         29          2.4         7
## 1100      9.0         75          5.3         11          0.8         9
## 11001     9.0         75          5.3         11          0.8         9
## 1125      9.1         49          4.6         40          3.7         7
## 11251     9.1         49          4.6         40          3.7         7
## 1130     20.3         58          3.7         33          2.1         6
## 11301    20.3         58          3.7         33          2.1         6
## 1131      9.0         47          2.7         33          1.9        12
## 11311     9.0         47          2.7         33          1.9        12
## 1132     33.0         57          3.5         29          1.8         8
## 11321    33.0         57          3.5         29          1.8         8
## 1145     14.5         55          3.9         31          2.2         7
## 1211     25.1         50          2.5         36          1.8         9
## 12111    25.1         50          2.5         36          1.8         9
## 1223     35.0         53          3.0         31          1.7        14
## 1247      9.0         62          5.2         28          2.4         7
## 1250      9.0         66          3.2         20          1.0        12
## 1279      9.0         64          4.4         25          1.8         7
## 1307      9.0         52          3.2         32          2.0        13
## 1318     12.4         64          6.4         29          2.9         5
## 13181    12.4         64          6.4         29          2.9         5
## 13182    12.4         64          6.4         29          2.9         5
## 1319      9.0         74          4.2         16          0.9         9
## 1335     15.7         57          2.7         31          1.5         9
## 1338     10.4         63          4.7         26          1.9         8
## 13381    10.4         63          4.7         26          1.9         8
## 1341     20.1         61          4.4         25          1.8        11
## 13411    20.1         61          4.4         25          1.8        11
## 1343     37.5         56          1.5         27          0.7        12
## 1356     24.1         60          3.8         25          1.6        13
## 13561    24.1         60          3.8         25          1.6        13
## 13562    24.1         60          3.8         25          1.6        13
## 1369      9.7         56          4.2         34          2.5         7
## 13691     9.7         56          4.2         34          2.5         7
## 1377     11.9         49          2.9         34          2.0        11
## 13771    11.9         49          2.9         34          2.0        11
## 1386     21.4         58          5.6         24          2.3        16
## 1390     20.3         68          4.2         24          1.5         7
## 1394     30.4         75          4.9         15          1.0         8
## 1400     18.5         55          4.4         35          2.8         8
## 1429     22.8         68          5.1         21          1.6         8
## 1439      9.0         57          5.7         29          2.9         9
## 14391     9.0         57          5.7         29          2.9         9
## 14392     9.0         57          5.7         29          2.9         9
## 14393     9.0         57          5.7         29          2.9         9
## 1477     13.8         35          3.0         54          4.7         8
## 1492     13.3         52          5.1         35          3.4         8
## 1586      9.0         60          4.0         26          2.0        10
## 1612      9.0         57          2.8         30          1.4         9
## 16121     9.0         57          2.8         30          1.4         9
## 1620     12.9         50          1.9         39          3.0         9
## 1627     10.5         55          4.7         34          2.9         8
## 1631     24.9         39          1.5         47          1.8         9
## 1659      9.0         58          3.4         29          1.7         9
```

```
## 1670       9.0         55            3.6        30            2.0       11
## 1686      14.2         56            3.1        33            1.8       10
## 16861     14.2         56            3.1        33            1.8       10
## 16862     14.2         56            3.1        33            1.8       10
## 16863     14.2         56            3.1        33            1.8       10
## 1691       8.6         66            4.9        21            1.5        8
## 16911      8.6         66            4.9        21            1.5        8
## 1701      16.6         51            3.3        36            2.3       10
## 17013     16.6         51            3.3        36            2.3       10
## 1710       6.4         57            3.4        30            1.8        9
## 1711       9.6         66            4.9        24            1.8        7
## 1714      13.5         67            5.5        19            1.5       11
## 17141     13.5         67            5.5        19            1.5       11
## 1722      17.5         62            3.7        24            1.4        9
## 1725       8.8         56            3.7        33            2.2        8
## 1729       7.1         54            2.6        33            1.6        8
## 1730       9.5         60            5.3        30            2.6        7
## 17301      9.5         60            5.3        30            2.6        7
## 1771       5.0         59            5.7        28            2.7       11
## 1780       9.0         63            5.0        26            2.0       10
## 1810      16.5         48            2.9        41            2.5        9
## 1811      21.1         61            2.9        24            1.1        9
## 1817       5.0         78            4.2        10            0.6        8
## 1823      51.7         58            4.6        29            2.4       11
## 1859      30.4         62            4.5        28            2.0        9
## 1860      17.1         71            6.7        17            1.6        8
## 1861       7.1         44            1.9        45            2.0        9
## 1862       5.6         67            6.1        24            2.2        8
## 18621      5.6         67            6.1        24            2.2        8
## 1891      19.4         49            2.9        29            1.8       10
##       monociti_val basofili basofili_val other_tfa other_endocrine_agent
## 86             0.6        1          0.1         n                     y
## 8610           0.6        1          0.1         n                     y
## 8611           0.6        1          0.1         n                     y
## 8612           0.6        1          0.1         n                     y
## 8613           0.6        1          0.1         n                     y
## 107            0.9        0          0.0         y                     n
## 10710          0.9        0          0.0         y                     n
## 112            0.7        1          0.1         y                     y
## 207            0.7        0          0.0         y                     n
## 2071           0.7        0          0.0         y                     n
## 2072           0.7        0          0.0         y                     n
## 2073           0.7        0          0.0         y                     n
## 422            0.7        1          0.0         y                     y
## 4221           0.7        1          0.0         y                     y
## 456            0.9        1          0.1         y                     n
## 4561           0.9        1          0.1         y                     n
## 510            0.4        0          0.0         y                     y
## 5101           0.4        0          0.0         y                     y
## 529            0.6        0          0.0         y                     n
## 5291           0.6        0          0.0         y                     n
## 5292           0.6        0          0.0         y                     n
## 5293           0.6        0          0.0         y                     n
## 5294           0.6        0          0.0         y                     n
```

```
## 5295          0.6         0           0.0         y                   n
## 5296          0.6         0           0.0         y                   n
## 5297          0.6         0           0.0         y                   n
## 5298          0.6         0           0.0         y                   n
## 5299          0.6         0           0.0         y                   n
## 52910         0.6         0           0.0         y                   n
## 640           0.5         1           0.0         y                   n
## 6401          0.5         1           0.0         y                   n
## 666           0.5         1           0.0         y                   n
## 6661          0.5         1           0.0         y                   n
## 6662          0.5         1           0.0         y                   n
## 6663          0.5         1           0.0         y                   n
## 6664          0.5         1           0.0         y                   n
## 766           0.5         1           0.0         n                   y
## 7661          0.5         1           0.0         n                   y
## 787           0.6         1           0.1         n                   y
## 7871          0.6         1           0.1         n                   y
## 789           0.7         0           0.0         n                   n
## 7891          0.7         0           0.0         n                   n
## 792           0.8         0           0.0         y                   n
## 805           0.4         1           0.1         n                   n
## 8051          0.4         1           0.1         n                   n
## 826           0.8         0           0.0         y                   y
## 904           0.5         0           0.0         n                   y
## 931           0.5         1           0.1         y                   n
## 9311          0.5         1           0.1         y                   n
## 948           0.6         1           0.0         y                   n
## 9481          0.6         1           0.0         y                   n
## 965           0.8         1           0.0         y                   n
## 979           0.7         1           0.0         y                   n
## 9791          0.7         1           0.0         y                   n
## 1010          0.4         1           0.0         y                   n
## 1025          0.7         1           0.1         y                   n
## 1028          0.6         2           0.1         n                   y
## 1050          0.4         1           0.1         n                   n
## 1073          0.7         1           0.0         n                   n
## 10731         0.7         1           0.0         n                   n
## 1085          0.6         1           0.0         n                   n
## 1100          0.7         1           0.1         y                   n
## 11001         0.7         1           0.1         y                   n
## 1125          0.7         1           0.1         y                   n
## 11251         0.7         1           0.1         y                   n
## 1130          0.4         1           0.0         y                   y
## 11301         0.4         1           0.0         y                   y
## 1131          0.7         1           0.0         y                   n
## 11311         0.7         1           0.0         y                   n
## 1132          0.5         1           0.0         n                   n
## 11321         0.5         1           0.0         n                   n
## 1145          0.5         1           0.0         n                   n
## 1211          0.5         0           0.0         y                   y
## 12111         0.5         0           0.0         y                   y
## 1223          0.8         1           0.0         n                   y
## 1247          0.6         0           0.0         n                   n
## 1250          0.6         0           0.0         y                   n
```

```
## 1279          0.5         1           0.1         y                   n
## 1307          0.8         0           0.0         n                   n
## 1318          0.5         0           0.0         n                   y
## 13181         0.5         0           0.0         n                   y
## 13182         0.5         0           0.0         n                   y
## 1319          0.5         0           0.0         n                   n
## 1335          0.4         1           0.1         y                   y
## 1338          0.6         1           0.0         y                   y
## 13381         0.6         1           0.0         y                   y
## 1341          0.8         0           0.0         y                   n
## 13411         0.8         0           0.0         y                   n
## 1343          0.3         1           0.0         y                   n
## 1356          0.8         1           0.0         y                   n
## 13561         0.8         1           0.0         y                   n
## 13562         0.8         1           0.0         y                   n
## 1369          0.5         1           0.0         y                   y
## 13691         0.5         1           0.0         y                   y
## 1377          0.6         1           0.0         y                   n
## 13771         0.6         1           0.0         y                   n
## 1386          1.6         1           0.1         n                   n
## 1390          0.4         0           0.0         y                   n
## 1394          0.5         1           0.1         y                   y
## 1400          0.6         0           0.0         n                   y
## 1429          0.6         1           0.1         y                   n
## 1439          0.9         1           0.1         y                   n
## 14391         0.9         1           0.1         y                   n
## 14392         0.9         1           0.1         y                   n
## 14393         0.9         1           0.1         y                   n
## 1477          0.7         1           0.1         y                   n
## 1492          0.8         0           0.0         y                   n
## 1586          0.7         1           0.1         y                   n
## 1612          0.4         1           0.1         y                   n
## 16121         0.4         1           0.1         y                   n
## 1620          0.7         1           0.0         y                   n
## 1627          0.7         0           0.0         n                   n
## 1631          0.4         1           0.0         y                   n
## 1659          0.6         1           0.1         y                   n
## 1670          0.7         0           0.0         n                   n
## 1686          0.5         1           0.0         y                   n
## 16861         0.5         1           0.0         y                   n
## 16862         0.5         1           0.0         y                   n
## 16863         0.5         1           0.0         y                   n
## 1691          0.6         1           0.1         y                   n
## 16911         0.6         1           0.1         y                   n
## 1701          0.6         1           0.0         y                   y
## 17013         0.6         1           0.0         y                   y
## 1710          0.6         0           0.0         y                   n
## 1711          0.5         0           0.0         n                   n
## 1714          0.9         0           0.0         y                   y
## 17141         0.9         0           0.0         y                   y
## 1722          0.5         1           0.0         y                   n
## 1725          0.5         0           0.0         y                   n
## 1729          0.4         1           0.0         y                   y
## 1730          0.3         0           0.0         y                   n
```

```
## 17301          0.3        0          0.0         y                     n
## 1771           1.0        1          0.1         n                     n
## 1780           0.8        1          0.1         y                     y
## 1810           0.5        1          0.0         y                     n
## 1811           0.4        0          0.0         y                     y
## 1817           0.4        1          0.0         y                     n
## 1823           0.9        0          0.0         y                     y
## 1859           0.6        0          0.0         y                     y
## 1860           0.7        0          0.0         y                     n
## 1861           0.4        1          0.0         n                     n
## 1862           0.7        1          0.0         n                     y
## 18621          0.7        1          0.0         n                     y
## 1891           0.6        1          0.1         y                     n
##       insuline oral_antidiab corticost_per_musculo NSAIDs antipsychotic
## 86           n             n                     n      n             n
## 8610         n             n                     n      n             n
## 8611         n             n                     n      n             n
## 8612         n             n                     n      n             n
## 8613         n             n                     n      n             n
## 107          n             n                     n      y             n
## 10710        n             n                     n      y             n
## 112          n             n                     n      y             n
## 207          n             y                     n      n             n
## 2071         n             y                     n      n             n
## 2072         n             y                     n      n             n
## 2073         n             y                     n      n             n
## 422          n             y                     n      n             n
## 4221         n             y                     n      n             n
## 456          n             n                     n      n             n
## 4561         n             n                     n      n             n
## 510          n             n                     n      n             n
## 5101         n             n                     n      n             n
## 529          n             n                     n      y             n
## 5291         n             n                     n      y             n
## 5292         n             n                     n      y             n
## 5293         n             n                     n      y             n
## 5294         n             n                     n      y             n
## 5295         n             n                     n      y             n
## 5296         n             n                     n      y             n
## 5297         n             n                     n      y             n
## 5298         n             n                     n      y             n
## 5299         n             n                     n      y             n
## 52910        n             n                     n      y             n
## 640          n             n                     n      y             n
## 6401         n             n                     n      y             n
## 666          n             n                     n      n             n
## 6661         n             n                     n      n             n
## 6662         n             n                     n      n             n
## 6663         n             n                     n      n             n
## 6664         n             n                     n      n             n
## 766          y             y                     n      n             n
## 7661         y             y                     n      n             n
## 787          n             n                     n      n             n
## 7871         n             n                     n      n             n
```

```
## 789          n          n          n          n          n
## 7891         n          n          n          n          n
## 792          n          y          n          n          n
## 805          n          n          n          n          n
## 8051         n          n          n          n          n
## 826          n          n          n          y          n
## 904          n          n          n          n          y
## 931          n          n          n          n          n
## 9311         n          n          n          n          n
## 948          n          y          n          n          n
## 9481         n          y          n          n          n
## 965          n          n          n          n          n
## 979          n          n          n          n          n
## 9791         n          n          n          n          n
## 1010         n          n          n          n          n
## 1025         n          n          n          n          n
## 1028         n          n          n          n          y
## 1050         n          n          n          n          n
## 1073         y          n          n          n          n
## 10731        y          n          n          n          n
## 1085         n          n          n          n          n
## 1100         y          n          n          n          n
## 11001        y          n          n          n          n
## 1125         n          y          n          n          n
## 11251        n          y          n          n          n
## 1130         n          n          n          n          n
## 11301        n          n          n          n          n
## 1131         n          n          n          n          n
## 11311        n          n          n          n          n
## 1132         n          n          n          n          n
## 11321        n          n          n          n          n
## 1145         n          n          n          n          n
## 1211         n          n          n          n          n
## 12111        n          n          n          n          n
## 1223         n          n          n          n          n
## 1247         n          n          n          n          n
## 1250         n          n          n          n          n
## 1279         n          n          n          n          n
## 1307         n          n          n          n          n
## 1318         n          y          n          y          n
## 13181        n          y          n          y          n
## 13182        n          y          n          y          n
## 1319         y          y          n          n          n
## 1335         n          n          n          n          n
## 1338         n          n          n          n          n
## 13381        n          n          n          n          n
## 1341         n          n          n          n          n
## 13411        n          n          n          n          n
## 1343         n          n          n          n          n
## 1356         n          n          n          n          n
## 13561        n          n          n          n          n
## 13562        n          n          n          n          n
## 1369         y          n          n          n          y
## 13691        y          n          n          n          y
```

```
## 1377         y             n                    n      n             n
## 13771        y             n                    n      n             n
## 1386         y             y                    n      n             n
## 1390         y             y                    n      n             n
## 1394         n             n                    y      n             n
## 1400         n             n                    n      n             n
## 1429         n             y                    n      n             n
## 1439         n             n                    n      y             n
## 14391        n             n                    n      y             n
## 14392        n             n                    n      y             n
## 14393        n             n                    n      y             n
## 1477         n             n                    n      n             n
## 1492         n             n                    n      y             n
## 1586         y             n                    n      n             n
## 1612         n             y                    n      n             n
## 16121        n             y                    n      n             n
## 1620         n             n                    n      n             y
## 1627         n             n                    n      y             n
## 1631         n             n                    n      n             n
## 1659         n             n                    n      n             n
## 1670         n             n                    n      y             n
## 1686         n             n                    n      n             n
## 16861        n             n                    n      n             n
## 16862        n             n                    n      n             n
## 16863        n             n                    n      n             n
## 1691         n             n                    n      n             n
## 16911        n             n                    n      n             n
## 1701         n             y                    n      n             n
## 17013        n             y                    n      n             n
## 1710         n             n                    n      n             n
## 1711         n             n                    n      n             n
## 1714         n             y                    n      n             n
## 17141        n             y                    n      n             n
## 1722         n             n                    n      n             n
## 1725         n             n                    n      n             n
## 1729         n             y                    n      y             n
## 1730         y             n                    n      n             n
## 17301        y             n                    n      n             n
## 1771         n             n                    n      n             n
## 1780         n             n                    n      n             n
## 1810         y             n                    n      n             n
## 1811         n             n                    n      n             n
## 1817         y             n                    n      n             n
## 1823         n             y                    n      n             n
## 1859         n             y                    n      n             n
## 1860         y             n                    n      n             n
## 1861         n             n                    n      n             n
## 1862         y             n                    n      n             n
## 18621        y             n                    n      n             n
## 1891         n             y                    n      n             n
##       antianxiety_antiinsonnia antidepres combined_bronchodilators
## 86                           n          n                        n
## 8610                         n          n                        n
## 8611                         n          n                        n
```

```
## 8612                n          n          n
## 8613                n          n          n
## 107                 n          n          n
## 10710               n          n          n
## 112                 n          y          n
## 207                 n          n          n
## 2071                n          n          n
## 2072                n          n          n
## 2073                n          n          n
## 422                 y          n          n
## 4221                y          n          n
## 456                 n          n          y
## 4561                n          n          y
## 510                 n          n          n
## 5101                n          n          n
## 529                 n          n          n
## 5291                n          n          n
## 5292                n          n          n
## 5293                n          n          n
## 5294                n          n          n
## 5295                n          n          n
## 5296                n          n          n
## 5297                n          n          n
## 5298                n          n          n
## 5299                n          n          n
## 52910               n          n          n
## 640                 n          n          n
## 6401                n          n          n
## 666                 n          n          n
## 6661                n          n          n
## 6662                n          n          n
## 6663                n          n          n
## 6664                n          n          n
## 766                 n          n          n
## 7661                n          n          n
## 787                 n          n          n
## 7871                n          n          n
## 789                 n          n          n
## 7891                n          n          n
## 792                 n          n          n
## 805                 n          n          n
## 8051                n          n          n
## 826                 n          n          n
## 904                 n          n          n
## 931                 n          n          n
## 9311                n          n          n
## 948                 n          n          y
## 9481                n          n          y
## 965                 n          n          n
## 979                 n          n          n
## 9791                n          n          n
## 1010                n          n          n
## 1025                y          n          y
## 1028                n          n          n
```

```
## 1050                n          y          n
## 1073                n          n          n
## 10731               n          n          n
## 1085                n          n          n
## 1100                n          n          n
## 11001               n          n          n
## 1125                n          n          n
## 11251               n          n          n
## 1130                n          n          n
## 11301               n          n          n
## 1131                n          y          y
## 11311               n          y          y
## 1132                n          n          n
## 11321               n          n          n
## 1145                n          n          n
## 1211                y          n          n
## 12111               y          n          n
## 1223                y          n          n
## 1247                n          n          n
## 1250                n          n          n
## 1279                n          n          n
## 1307                n          n          n
## 1318                y          n          n
## 13181               y          n          n
## 13182               y          n          n
## 1319                n          y          n
## 1335                n          n          n
## 1338                n          y          y
## 13381               n          y          y
## 1341                n          n          y
## 13411               n          n          y
## 1343                n          n          n
## 1356                n          n          y
## 13561               n          n          y
## 13562               n          n          y
## 1369                y          n          n
## 13691               y          n          n
## 1377                n          n          n
## 13771               n          n          n
## 1386                n          n          n
## 1390                n          n          n
## 1394                n          n          n
## 1400                n          n          n
## 1429                n          n          n
## 1439                n          n          n
## 14391               n          n          n
## 14392               n          n          n
## 14393               n          n          n
## 1477                n          n          n
## 1492                n          n          n
## 1586                n          n          y
## 1612                y          y          n
## 16121               y          y          n
## 1620                n          y          n
```

```
## 1627                        n          n                     n
## 1631                        y          y                     n
## 1659                        n          y                     n
## 1670                        n          n                     n
## 1686                        y          n                     n
## 16861                       y          n                     n
## 16862                       y          n                     n
## 16863                       y          n                     n
## 1691                        n          y                     n
## 16911                       n          y                     n
## 1701                        n          n                     n
## 17013                       n          n                     n
## 1710                        n          n                     n
## 1711                        n          n                     n
## 1714                        n          n                     y
## 17141                       n          n                     y
## 1722                        n          y                     n
## 1725                        n          n                     n
## 1729                        y          n                     n
## 1730                        n          n                     n
## 17301                       n          n                     n
## 1771                        n          n                     n
## 1780                        n          n                     n
## 1810                        n          n                     n
## 1811                        n          n                     n
## 1817                        n          n                     y
## 1823                        y          y                     n
## 1859                        n          n                     n
## 1860                        n          n                     n
## 1861                        n          n                     n
## 1862                        n          y                     n
## 18621                       n          y                     n
## 1891                        n          n                     n
##       corticost_per_bronco methylxanthines anticholinergic beta_adrenergic
## 86                       n               n                n               n
## 8610                     n               n                n               n
## 8611                     n               n                n               n
## 8612                     n               n                n               n
## 8613                     n               n                n               n
## 107                      n               n                n               n
## 10710                    n               n                n               n
## 112                      n               n                n               n
## 207                      n               n                n               n
## 2071                     n               n                n               n
## 2072                     n               n                n               n
## 2073                     n               n                n               n
## 422                      n               n                y               y
## 4221                     n               n                y               y
## 456                      n               n                n               n
## 4561                     n               n                n               n
## 510                      n               n                n               y
## 5101                     n               n                n               y
## 529                      n               n                n               n
## 5291                     n               n                n               n
```

```
## 5292          n          n          n          n
## 5293          n          n          n          n
## 5294          n          n          n          n
## 5295          n          n          n          n
## 5296          n          n          n          n
## 5297          n          n          n          n
## 5298          n          n          n          n
## 5299          n          n          n          n
## 52910         n          n          n          n
## 640           n          n          n          n
## 6401          n          n          n          n
## 666           n          n          n          n
## 6661          n          n          n          n
## 6662          n          n          n          n
## 6663          n          n          n          n
## 6664          n          n          n          n
## 766           n          n          n          n
## 7661          n          n          n          n
## 787           n          n          n          n
## 7871          n          n          n          n
## 789           n          n          n          n
## 7891          n          n          n          n
## 792           n          n          n          n
## 805           n          n          n          n
## 8051          n          n          n          n
## 826           n          n          n          n
## 904           n          n          n          n
## 931           n          n          n          n
## 9311          n          n          n          n
## 948           n          n          y          n
## 9481          n          n          y          n
## 965           n          n          n          n
## 979           n          n          n          n
## 9791          n          n          n          n
## 1010          n          n          n          n
## 1025          n          n          n          y
## 1028          n          n          n          n
## 1050          n          n          n          n
## 1073          n          n          n          n
## 10731         n          n          n          n
## 1085          n          n          n          n
## 1100          n          n          n          n
## 11001         n          n          n          n
## 1125          n          n          n          n
## 11251         n          n          n          n
## 1130          n          n          n          y
## 11301         n          n          n          y
## 1131          n          n          n          n
## 11311         n          n          n          n
## 1132          n          n          n          n
## 11321         n          n          n          n
## 1145          n          n          n          n
## 1211          n          n          n          n
## 12111         n          n          n          n
```

```
## 1223              n              n              n              n
## 1247              n              n              n              n
## 1250              n              n              n              n
## 1279              n              n              n              n
## 1307              n              n              n              n
## 1318              n              n              n              n
## 13181             n              n              n              n
## 13182             n              n              n              n
## 1319              n              n              n              n
## 1335              n              n              n              n
## 1338              n              n              n              n
## 13381             n              n              n              n
## 1341              n              n              n              n
## 13411             n              n              n              n
## 1343              n              n              n              n
## 1356              n              n              n              n
## 13561             n              n              n              n
## 13562             n              n              n              n
## 1369              n              n              n              n
## 13691             n              n              n              n
## 1377              n              n              n              n
## 13771             n              n              n              n
## 1386              n              n              n              n
## 1390              n              n              n              n
## 1394              n              n              n              n
## 1400              n              n              n              n
## 1429              n              n              n              n
## 1439              n              n              n              n
## 14391             n              n              n              n
## 14392             n              n              n              n
## 14393             n              n              n              n
## 1477              n              n              n              n
## 1492              n              n              n              n
## 1586              n              n              n              n
## 1612              n              n              n              n
## 16121             n              n              n              n
## 1620              n              n              n              n
## 1627              n              n              n              n
## 1631              n              n              n              n
## 1659              n              n              n              n
## 1670              n              n              n              n
## 1686              n              n              n              n
## 16861             n              n              n              n
## 16862             n              n              n              n
## 16863             n              n              n              n
## 1691              n              n              n              n
## 16911             n              n              n              n
## 1701              n              n              n              n
## 17013             n              n              n              n
## 1710              n              n              n              n
## 1711              n              n              n              n
## 1714              n              n              y              n
## 17141             n              n              y              n
## 1722              n              n              n              n
```

```
## 1725                    n              n              n              n
## 1729                    n              n              n              n
## 1730                    n              n              n              n
## 17301                   n              n              n              n
## 1771                    n              n              n              n
## 1780                    n              n              n              n
## 1810                    n              n              n              n
## 1811                    n              n              y              n
## 1817                    n              n              n              n
## 1823                    n              n              n              n
## 1859                    n              n              n              n
## 1860                    n              n              n              n
## 1861                    n              n              n              n
## 1862                    n              n              n              n
## 18621                   n              n              n              n
## 1891                    n              n              n              n
##       other_anticoag oral_anticoag other_anti_platelets dipirydamole
## 86                 n              n                   n            n
## 8610               n              n                   n            n
## 8611               n              n                   n            n
## 8612               n              n                   n            n
## 8613               n              n                   n            n
## 107                n              n                   n            n
## 10710              n              n                   n            n
## 112                n              n                   n            n
## 207                n              n                   n            n
## 2071               n              n                   n            n
## 2072               n              n                   n            n
## 2073               n              n                   n            n
## 422                n              y                   n            n
## 4221               n              y                   n            n
## 456                n              n                   n            n
## 4561               n              n                   n            n
## 510                n              n                   n            n
## 5101               n              n                   n            n
## 529                n              n                   n            n
## 5291               n              n                   n            n
## 5292               n              n                   n            n
## 5293               n              n                   n            n
## 5294               n              n                   n            n
## 5295               n              n                   n            n
## 5296               n              n                   n            n
## 5297               n              n                   n            n
## 5298               n              n                   n            n
## 5299               n              n                   n            n
## 52910              n              n                   n            n
## 640                n              n                   n            n
## 6401               n              n                   n            n
## 666                n              y                   n            n
## 6661               n              y                   n            n
## 6662               n              y                   n            n
## 6663               n              y                   n            n
## 6664               n              y                   n            n
## 766                n              n                   n            n
```

```
## 7661          n          n          n          n
## 787           n          n          n          n
## 7871          n          n          n          n
## 789           n          n          n          n
## 7891          n          n          n          n
## 792           n          n          n          n
## 805           n          n          n          n
## 8051          n          n          n          n
## 826           n          n          n          n
## 904           n          n          n          n
## 931           n          n          n          n
## 9311          n          n          n          n
## 948           n          n          n          n
## 9481          n          n          n          n
## 965           n          n          n          n
## 979           n          n          n          n
## 9791          n          n          n          n
## 1010          n          n          n          n
## 1025          n          n          n          n
## 1028          n          n          n          n
## 1050          n          n          n          n
## 1073          n          y          n          n
## 10731         n          y          n          n
## 1085          n          n          n          n
## 1100          n          y          n          n
## 11001         n          y          n          n
## 1125          n          n          n          n
## 11251         n          n          n          n
## 1130          n          n          n          n
## 11301         n          n          n          n
## 1131          y          n          n          n
## 11311         y          n          n          n
## 1132          n          y          n          n
## 11321         n          y          n          n
## 1145          n          n          n          n
## 1211          n          n          n          n
## 12111         n          n          n          n
## 1223          n          n          n          n
## 1247          n          n          n          n
## 1250          n          n          n          n
## 1279          n          y          n          n
## 1307          n          n          n          n
## 1318          n          n          n          n
## 13181         n          n          n          n
## 13182         n          n          n          n
## 1319          n          n          n          n
## 1335          n          n          n          n
## 1338          n          n          n          n
## 13381         n          n          n          n
## 1341          n          y          n          n
## 13411         n          y          n          n
## 1343          n          n          n          n
## 1356          n          n          n          n
## 13561         n          n          n          n
```

```
## 13562              n            n                  n           n
## 1369               n            y                  n           n
## 13691              n            y                  n           n
## 1377               n            n                  n           n
## 13771              n            n                  n           n
## 1386               n            n                  n           n
## 1390               n            n                  n           n
## 1394               n            y                  n           n
## 1400               n            n                  n           n
## 1429               n            n                  n           n
## 1439               n            n                  n           n
## 14391              n            n                  n           n
## 14392              n            n                  n           n
## 14393              n            n                  n           n
## 1477               n            n                  n           n
## 1492               n            n                  n           n
## 1586               n            n                  n           n
## 1612               n            n                  n           n
## 16121              n            n                  n           n
## 1620               n            n                  n           n
## 1627               n            n                  n           n
## 1631               n            n                  n           n
## 1659               n            y                  n           n
## 1670               n            n                  n           n
## 1686               n            n                  n           n
## 16861              n            n                  n           n
## 16862              n            n                  n           n
## 16863              n            n                  n           n
## 1691               n            n                  n           n
## 16911              n            n                  n           n
## 1701               n            n                  n           n
## 17013              n            n                  n           n
## 1710               n            n                  n           n
## 1711               n            n                  n           n
## 1714               n            n                  n           n
## 17141              n            n                  n           n
## 1722               n            n                  n           n
## 1725               n            n                  n           n
## 1729               n            n                  y           n
## 1730               n            n                  n           n
## 17301              n            n                  n           n
## 1771               n            n                  n           n
## 1780               n            n                  y           n
## 1810               n            n                  n           n
## 1811               n            n                  n           n
## 1817               n            n                  n           n
## 1823               n            n                  n           n
## 1859               n            n                  n           n
## 1860               n            n                  n           n
## 1861               n            n                  n           n
## 1862               n            n                  n           n
## 18621              n            n                  n           n
## 1891               n            n                  n           n
##       clopidogrel ticlopidine acetyl_acid statin_ezetimibe other_lipid_low
```

```
## 86          n          n          n          n          n
## 8610        n          n          n          n          n
## 8611        n          n          n          n          n
## 8612        n          n          n          n          n
## 8613        n          n          n          n          n
## 107         n          n          y          n          n
## 10710       n          n          y          n          n
## 112         n          n          n          n          n
## 207         y          n          y          n          n
## 2071        y          n          y          n          n
## 2072        y          n          y          n          n
## 2073        y          n          y          n          n
## 422         n          n          n          n          n
## 4221        n          n          n          n          n
## 456         n          n          n          n          n
## 4561        n          n          n          n          n
## 510         n          n          n          n          n
## 5101        n          n          n          n          n
## 529         n          n          n          n          n
## 5291        n          n          n          n          n
## 5292        n          n          n          n          n
## 5293        n          n          n          n          n
## 5294        n          n          n          n          n
## 5295        n          n          n          n          n
## 5296        n          n          n          n          n
## 5297        n          n          n          n          n
## 5298        n          n          n          n          n
## 5299        n          n          n          n          n
## 52910       n          n          n          n          n
## 640         y          n          n          y          n
## 6401        y          n          n          y          n
## 666         n          n          n          n          n
## 6661        n          n          n          n          n
## 6662        n          n          n          n          n
## 6663        n          n          n          n          n
## 6664        n          n          n          n          n
## 766         n          n          n          n          n
## 7661        n          n          n          n          n
## 787         n          n          n          n          n
## 7871        n          n          n          n          n
## 789         n          n          n          n          n
## 7891        n          n          n          n          n
## 792         n          n          y          n          n
## 805         n          n          n          n          n
## 8051        n          n          n          n          n
## 826         n          n          n          n          n
## 904         n          n          y          n          n
## 931         n          n          n          n          n
## 9311        n          n          n          n          n
## 948         n          n          n          n          n
## 9481        n          n          n          n          n
## 965         y          n          y          n          y
## 979         n          n          y          n          n
## 9791        n          n          y          n          n
```

```
## 1010          n          n          y          n          n
## 1025          n          n          y          n          n
## 1028          n          n          n          n          n
## 1050          n          n          n          n          n
## 1073          n          n          y          n          n
## 10731         n          n          y          n          n
## 1085          n          n          n          n          n
## 1100          n          n          n          y          y
## 11001         n          n          n          y          y
## 1125          n          n          y          n          n
## 11251         n          n          y          n          n
## 1130          n          n          y          n          n
## 11301         n          n          y          n          n
## 1131          n          n          y          n          n
## 11311         n          n          y          n          n
## 1132          n          n          n          n          n
## 11321         n          n          n          n          n
## 1145          n          n          n          n          n
## 1211          n          n          y          n          n
## 12111         n          n          y          n          n
## 1223          n          n          y          n          y
## 1247          n          n          y          n          n
## 1250          n          n          y          n          n
## 1279          n          n          n          n          n
## 1307          n          n          n          n          n
## 1318          n          n          n          n          n
## 13181         n          n          n          n          n
## 13182         n          n          n          n          n
## 1319          y          n          n          n          n
## 1335          n          n          n          n          n
## 1338          n          n          y          n          n
## 13381         n          n          y          n          n
## 1341          n          n          n          n          n
## 13411         n          n          n          n          n
## 1343          n          n          y          n          n
## 1356          n          n          n          n          n
## 13561         n          n          n          n          n
## 13562         n          n          n          n          n
## 1369          n          n          n          n          n
## 13691         n          n          n          n          n
## 1377          n          y          n          n          n
## 13771         n          y          n          n          n
## 1386          n          n          y          n          y
## 1390          n          n          y          n          n
## 1394          n          n          n          n          n
## 1400          n          n          n          n          n
## 1429          n          n          y          n          n
## 1439          n          n          n          n          n
## 14391         n          n          n          n          n
## 14392         n          n          n          n          n
## 14393         n          n          n          n          n
## 1477          n          n          n          n          n
## 1492          n          n          y          n          n
## 1586          n          n          n          n          n
```

```
## 1612            n           n           y                n              n
## 16121           n           n           y                n              n
## 1620            n           n           y                n              y
## 1627            n           n           n                n              n
## 1631            n           n           n                n              n
## 1659            n           n           n                n              n
## 1670            n           n           n                n              n
## 1686            n           n           y                n              n
## 16861           n           n           y                n              n
## 16862           n           n           y                n              n
## 16863           n           n           y                n              n
## 1691            n           n           y                n              n
## 16911           n           n           y                n              n
## 1701            y           n           y                n              n
## 17013           y           n           y                n              n
## 1710            n           n           y                n              n
## 1711            n           n           n                n              n
## 1714            n           n           n                n              n
## 17141           n           n           n                n              n
## 1722            n           n           n                n              n
## 1725            y           n           y                y              n
## 1729            n           n           n                n              n
## 1730            n           n           y                n              n
## 17301           n           n           y                n              n
## 1771            n           n           n                n              y
## 1780            n           n           y                n              n
## 1810            y           n           n                y              n
## 1811            n           n           y                n              n
## 1817            y           n           y                n              n
## 1823            n           n           y                y              y
## 1859            y           n           y                n              n
## 1860            y           n           y                n              n
## 1861            n           n           n                n              n
## 1862            n           n           n                n              n
## 18621           n           n           n                n              n
## 1891            n           n           y                n              n
##       ezetimibe fibrate statine diur_pot_sp_diur BB_diur ARB_CCB ARB_diur
## 86            n       n       n                n       n       n        y
## 8610          n       n       n                n       n       n        y
## 8611          n       n       n                n       n       n        y
## 8612          n       n       n                n       n       n        y
## 8613          n       n       n                n       n       n        y
## 107           n       n       n                n       n       n        y
## 10710         n       n       n                n       n       n        y
## 112           n       n       y                n       n       n        n
## 207           n       n       y                n       n       n        n
## 2071          n       n       y                n       n       n        n
## 2072          n       n       y                n       n       n        n
## 2073          n       n       y                n       n       n        n
## 422           n       n       n                n       n       n        n
## 4221          n       n       n                n       n       n        n
## 456           n       n       n                n       y       n        n
## 4561          n       n       n                n       y       n        n
## 510           n       n       n                n       n       n        n
```

```
## 5101          n       n       n               n       n       n       n
## 529           n       n       y               n       n       n       n
## 5291          n       n       y               n       n       n       n
## 5292          n       n       y               n       n       n       n
## 5293          n       n       y               n       n       n       n
## 5294          n       n       y               n       n       n       n
## 5295          n       n       y               n       n       n       n
## 5296          n       n       y               n       n       n       n
## 5297          n       n       y               n       n       n       n
## 5298          n       n       y               n       n       n       n
## 5299          n       n       y               n       n       n       n
## 52910         n       n       y               n       n       n       n
## 640           n       n       n               n       n       n       n
## 6401          n       n       n               n       n       n       n
## 666           n       n       n               n       n       n       n
## 6661          n       n       n               n       n       n       n
## 6662          n       n       n               n       n       n       n
## 6663          n       n       n               n       n       n       n
## 6664          n       n       n               n       n       n       n
## 766           n       n       n               n       n       n       n
## 7661          n       n       n               n       n       n       n
## 787           n       n       y               n       n       n       n
## 7871          n       n       y               n       n       n       n
## 789           n       n       n               n       n       n       n
## 7891          n       n       n               n       n       n       n
## 792           n       y       y               n       n       n       n
## 805           n       n       n               n       n       n       n
## 8051          n       n       n               n       n       n       n
## 826           n       n       n               n       n       n       n
## 904           n       n       y               n       n       n       n
## 931           n       n       n               y       n       n       n
## 9311          n       n       n               y       n       n       n
## 948           n       n       n               n       n       n       n
## 9481          n       n       n               n       n       n       n
## 965           y       n       y               n       n       n       n
## 979           n       n       y               n       n       n       n
## 9791          n       n       y               n       n       n       n
## 1010          n       n       y               n       n       n       n
## 1025          n       n       n               n       n       n       n
## 1028          n       n       n               n       n       n       n
## 1050          n       n       n               n       n       n       y
## 1073          n       n       y               n       n       n       n
## 10731         n       n       y               n       n       n       n
## 1085          n       n       n               n       n       n       n
## 1100          n       n       n               n       n       n       n
## 11001         n       n       n               n       n       n       n
## 1125          n       n       y               n       n       n       n
## 11251         n       n       y               n       n       n       n
## 1130          n       n       y               n       n       n       y
## 11301         n       n       y               n       n       n       y
## 1131          n       n       n               n       n       n       n
## 11311         n       n       n               n       n       n       n
## 1132          n       n       n               n       n       n       n
## 11321         n       n       n               n       n       n       n
```

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## 1145          n       n       n               n       n       n       n
## 1211          n       n       y               n       n       n       n
## 12111         n       n       y               n       n       n       n
## 1223          n       n       y               y       n       n       n
## 1247          n       n       y               y       n       n       n
## 1250          n       y       y               n       n       n       n
## 1279          n       n       y               n       n       n       n
## 1307          n       n       n               n       n       n       n
## 1318          n       n       y               n       n       n       y
## 13181         n       n       y               n       n       n       y
## 13182         n       n       y               n       n       n       y
## 1319          n       n       n               n       n       n       n
## 1335          n       n       n               n       n       n       y
## 1338          n       n       y               n       n       n       n
## 13381         n       n       y               n       n       n       n
## 1341          n       n       y               n       n       n       y
## 13411         n       n       y               n       n       n       y
## 1343          n       n       n               n       n       n       y
## 1356          n       n       n               n       n       n       y
## 13561         n       n       n               n       n       n       y
## 13562         n       n       n               n       n       n       y
## 1369          n       n       y               n       n       n       y
## 13691         n       n       y               n       n       n       y
## 1377          n       n       n               n       n       n       n
## 13771         n       n       n               n       n       n       n
## 1386          n       n       y               n       n       n       n
## 1390          n       y       y               n       n       n       n
## 1394          n       n       n               n       n       n       n
## 1400          n       n       n               n       n       n       n
## 1429          n       n       y               n       n       n       n
## 1439          n       n       n               n       n       n       n
## 14391         n       n       n               n       n       n       n
## 14392         n       n       n               n       n       n       n
## 14393         n       n       n               n       n       n       n
## 1477          n       n       n               n       n       n       y
## 1492          n       n       n               n       n       n       n
## 1586          n       n       n               n       n       n       n
## 1612          n       n       y               n       n       n       n
## 16121         n       n       y               n       n       n       n
## 1620          n       n       y               n       n       n       n
## 1627          n       n       n               n       n       n       n
## 1631          n       n       n               n       n       n       n
## 1659          n       n       n               n       n       n       n
## 1670          n       n       n               n       n       n       n
## 1686          y       n       y               n       n       n       n
## 16861         y       n       y               n       n       n       n
## 16862         y       n       y               n       n       n       n
## 16863         y       n       y               n       n       n       n
## 1691          n       n       y               n       n       n       n
## 16911         n       n       y               n       n       n       n
## 1701          n       n       y               n       n       n       n
## 17013         n       n       y               n       n       n       n
## 1710          n       n       y               n       n       n       y
## 1711          n       n       n               n       n       n       n
```

```
## 1714          n       n       n               n       n       n        n
## 17141         n       n       n               n       n       n        n
## 1722          n       n       n               n       n       n        n
## 1725          n       n       y               n       n       n        n
## 1729          y       n       n               n       n       n        y
## 1730          n       n       y               n       n       n        n
## 17301         n       n       y               n       n       n        n
## 1771          n       n       n               n       n       n        y
## 1780          y       n       n               n       n       n        n
## 1810          n       n       n               n       n       n        n
## 1811          n       n       y               n       n       n        n
## 1817          n       y       n               n       n       n        n
## 1823          n       n       n               n       n       n        n
## 1859          n       n       y               n       n       n        y
## 1860          n       n       y               n       n       n        n
## 1861          n       n       n               n       n       n        n
## 1862          n       n       n               n       n       n        y
## 18621         n       n       n               n       n       n        y
## 1891          n       n       y               n       n       n        y
##       ACE_CCB ACE_diur other_antihyp diur CCB BB ARB ACE ecocardio
## 86          n        n             n    n   n  n   n   n         y
## 8610        n        n             n    n   n  n   n   n         y
## 8611        n        n             n    n   n  n   n   n         y
## 8612        n        n             n    n   n  n   n   n         y
## 8613        n        n             n    n   n  n   n   n         y
## 107         n        n             n    n   y  y   n   n         y
## 10710       n        n             n    n   y  y   n   n         y
## 112         n        n             y    y   n  n   y   n         y
## 207         n        n             n    n   y  n   y   n         y
## 2071        n        n             n    n   y  n   y   n         y
## 2072        n        n             n    n   y  n   y   n         y
## 2073        n        n             n    n   y  n   y   n         y
## 422         n        n             n    y   y  y   n   y         y
## 4221        n        n             n    y   y  y   n   y         y
## 456         n        n             y    n   n  n   y   n         y
## 4561        n        n             y    n   n  n   y   n         y
## 510         n        n             n    n   n  y   n   y         y
## 5101        n        n             n    n   n  y   n   y         y
## 529         n        y             n    n   n  n   n   n         y
## 5291        n        y             n    n   n  n   n   n         y
## 5292        n        y             n    n   n  n   n   n         y
## 5293        n        y             n    n   n  n   n   n         y
## 5294        n        y             n    n   n  n   n   n         y
## 5295        n        y             n    n   n  n   n   n         y
## 5296        n        y             n    n   n  n   n   n         y
## 5297        n        y             n    n   n  n   n   n         y
## 5298        n        y             n    n   n  n   n   n         y
## 5299        n        y             n    n   n  n   n   n         y
## 52910       n        y             n    n   n  n   n   n         y
## 640         n        n             n    n   n  y   n   y         y
## 6401        n        n             n    n   n  y   n   y         y
## 666         n        y             n    n   n  y   n   y         y
## 6661        n        y             n    n   n  y   n   y         y
## 6662        n        y             n    n   n  y   n   y         y
```

```
## 6663       n       y           n    n    n    y    n    y         y
## 6664       n       y           n    n    n    y    n    y         y
## 766        n       n           n    n    n    n    n    y         y
## 7661       n       n           n    n    n    n    n    y         y
## 787        n       n           n    y    y    n    n    y         y
## 7871       n       n           n    y    y    n    n    y         y
## 789        n       n           n    n    n    n    n    n         y
## 7891       n       n           n    n    n    n    n    n         y
## 792        n       n           n    y    n    y    n    y         y
## 805        n       y           y    n    y    y    n    y         y
## 8051       n       y           y    n    y    y    n    y         y
## 826        n       y           n    n    n    n    n    n         y
## 904        n       n           n    y    n    n    n    y         y
## 931        n       n           n    y    n    y    y    n         y
## 9311       n       n           n    y    n    y    y    n         y
## 948        n       y           n    n    n    n    n    n         y
## 9481       n       y           n    n    n    n    n    n         y
## 965        n       n           n    n    n    y    n    y         y
## 979        n       n           n    n    y    n    n    y         y
## 9791       n       n           n    n    y    n    n    y         y
## 1010       n       n           y    y    y    y    n    y         y
## 1025       n       n           n    n    n    n    y    n         y
## 1028       n       n           n    n    n    n    n    n         y
## 1050       n       n           n    n    n    n    n    n         y
## 1073       n       n           n    y    n    y    n    y         y
## 10731      n       n           n    y    n    y    n    y         y
## 1085       n       y           n    n    n    y    n    n         y
## 1100       n       n           y    y    y    n    n    n         y
## 11001      n       n           y    y    y    n    n    n         y
## 1125       n       y           n    y    n    y    n    n         y
## 11251      n       y           n    y    n    y    n    n         y
## 1130       n       n           n    n    n    n    n    n         y
## 11301      n       n           n    n    n    n    n    n         y
## 1131       n       y           n    n    n    n    n    n         y
## 11311      n       y           n    n    n    n    n    n         y
## 1132       n       y           n    y    n    y    n    n         y
## 11321      n       y           n    y    n    y    n    n         y
## 1145       n       n           n    n    n    n    n    n         y
## 1211       n       n           n    n    n    y    y    n         y
## 12111      n       n           n    n    n    y    y    n         y
## 1223       n       n           n    n    n    y    y    n         y
## 1247       n       n           n    n    n    y    n    y         y
## 1250       n       n           n    y    n    y    y    n         y
## 1279       n       n           n    n    y    y    y    n         y
## 1307       n       n           n    n    n    n    n    n         y
## 1318       n       n           n    n    y    n    n    n         y
## 13181      n       n           n    n    y    n    n    n         y
## 13182      n       n           n    n    y    n    n    n         y
## 1319       y       n           n    y    n    y    n    n         y
## 1335       n       n           n    n    n    n    n    n         y
## 1338       n       n           n    n    n    n    n    n         y
## 13381      n       n           n    n    n    n    n    n         y
## 1341       n       n           n    y    n    y    n    y         y
## 13411      n       n           n    y    n    y    n    y         y
```

```
## 1343       n       n           n   n   n   y   n   n       y
## 1356       n       n           n   n   n   n   n   n       y
## 13561      n       n           n   n   n   n   n   n       y
## 13562      n       n           n   n   n   n   n   n       y
## 1369       n       n           n   y   n   y   n   n       y
## 13691      n       n           n   y   n   y   n   n       y
## 1377       n       n           n   y   n   n   n   y       y
## 13771      n       n           n   y   n   n   n   y       y
## 1386       n       n           n   n   y   y   n   y       y
## 1390       n       n           n   n   n   y   n   n       y
## 1394       n       n           n   y   n   n   n   y       y
## 1400       n       y           n   n   n   n   n   n       y
## 1429       n       n           n   n   n   y   n   y       y
## 1439       n       n           n   n   n   n   n   n       y
## 14391      n       n           n   n   n   n   n   n       y
## 14392      n       n           n   n   n   n   n   n       y
## 14393      n       n           n   n   n   n   n   n       y
## 1477       n       n           n   n   n   n   n   n       y
## 1492       n       n           n   y   n   y   y   n       y
## 1586       n       y           n   n   y   n   n   n       y
## 1612       n       n           n   n   n   y   n   y       y
## 16121      n       n           n   n   n   y   n   y       y
## 1620       n       n           n   y   n   y   n   n       y
## 1627       n       n           n   n   n   n   n   n       y
## 1631       n       n           n   n   n   n   n   n       y
## 1659       n       n           n   n   n   y   n   n       y
## 1670       n       n           n   n   n   n   n   n       y
## 1686       n       n           n   n   n   n   n   y       y
## 16861      n       n           n   n   n   n   n   y       y
## 16862      n       n           n   n   n   n   n   y       y
## 16863      n       n           n   n   n   n   n   y       y
## 1691       n       n           n   n   n   y   n   y       y
## 16911      n       n           n   n   n   y   n   y       y
## 1701       n       n           n   n   n   y   n   y       y
## 17013      n       n           n   n   n   y   n   y       y
## 1710       n       n           y   n   n   y   n   n       y
## 1711       n       n           n   n   n   n   n   n       y
## 1714       n       n           n   y   n   n   n   n       y
## 17141      n       n           n   y   n   n   n   n       y
## 1722       n       n           n   n   n   n   n   n       y
## 1725       y       y           n   n   n   y   n   n       y
## 1729       n       n           n   n   n   y   n   n       y
## 1730       n       n           n   n   y   y   y   n       y
## 17301      n       n           n   n   y   y   y   n       y
## 1771       n       n           n   n   y   n   n   n       y
## 1780       n       n           n   n   n   y   n   n       y
## 1810       n       n           n   y   n   y   n   y       y
## 1811       n       n           y   y   y   n   y   n       y
## 1817       n       n           y   y   y   y   n   n       y
## 1823       n       n           n   y   n   y   n   n       y
## 1859       n       n           y   n   y   y   n   n       y
## 1860       n       n           n   y   y   y   y   n       y
## 1861       n       n           n   n   n   n   n   n       y
## 1862       n       n           n   n   n   n   n   n       y
```

```
## 18621       n        n             n    n   n  n   n   n        y
## 1891        n        n             n    n   n  n   y   n        y
##       stenosi_tricusp stenosi_mitr stenosi_aort insuff_mitr insuff_polm
## 86                  n           n           n          y           n
## 8610                n           n           n          y           n
## 8611                n           n           n          y           n
## 8612                n           n           n          y           n
## 8613                n           n           n          y           n
## 107                 n           n           n          n           n
## 10710               n           n           n          n           n
## 112                 n           n           n          n           n
## 207                 n           n           n          n           n
## 2071                n           n           n          n           n
## 2072                n           n           n          n           n
## 2073                n           n           n          n           n
## 422                 n           n           n          y           n
## 4221                n           n           n          y           n
## 456                 n           n           n          n           n
## 4561                n           n           n          n           n
## 510                 n           n           n          y           n
## 5101                n           n           n          y           n
## 529                 n           n           n          y           n
## 5291                n           n           n          y           n
## 5292                n           n           n          y           n
## 5293                n           n           n          y           n
## 5294                n           n           n          y           n
## 5295                n           n           n          y           n
## 5296                n           n           n          y           n
## 5297                n           n           n          y           n
## 5298                n           n           n          y           n
## 5299                n           n           n          y           n
## 52910               n           n           n          y           n
## 640                 n           n           n          y           n
## 6401                n           n           n          y           n
## 666                 n           n           n          y           n
## 6661                n           n           n          y           n
## 6662                n           n           n          y           n
## 6663                n           n           n          y           n
## 6664                n           n           n          y           n
## 766                 n           n           y          n           n
## 7661                n           n           y          n           n
## 787                 n           n           n          n           n
## 7871                n           n           n          n           n
## 789                 n           n           n          y           n
## 7891                n           n           n          y           n
## 792                 n           n           n          n           n
## 805                 n           n           n          y           n
## 8051                n           n           n          y           n
## 826                 n           n           n          n           n
## 904                 n           n           n          y           n
## 931                 n           y           n          y           n
## 9311                n           y           n          y           n
## 948                 n           n           n          n           n
## 9481                n           n           n          n           n
```

```
## 965             n       n       n       y       n
## 979             n       n       n       y       n
## 9791            n       n       n       y       n
## 1010            n       n       n       y       n
## 1025            n       n       n       n       n
## 1028            n       n       n       n       n
## 1050            n       n       n       y       n
## 1073            n       n       n       y       n
## 10731           n       n       n       y       n
## 1085            n       n       n       y       n
## 1100            n       n       n       y       n
## 11001           n       n       n       y       n
## 1125            n       n       n       n       n
## 11251           n       n       n       n       n
## 1130            n       n       n       n       n
## 11301           n       n       n       n       n
## 1131            n       n       n       n       n
## 11311           n       n       n       n       n
## 1132            n       n       n       n       n
## 11321           n       n       n       n       n
## 1145            n       n       n       y       n
## 1211            n       n       n       y       n
## 12111           n       n       n       y       n
## 1223            n       n       n       y       n
## 1247            n       n       n       n       n
## 1250            n       n       n       y       n
## 1279            n       n       n       n       n
## 1307            n       n       n       n       n
## 1318            n       n       n       n       n
## 13181           n       n       n       n       n
## 13182           n       n       n       n       n
## 1319            n       n       y       y       n
## 1335            n       n       n       y       n
## 1338            n       y       n       y       n
## 13381           n       y       n       y       n
## 1341            n       n       n       n       n
## 13411           n       n       n       n       n
## 1343            n       n       n       n       n
## 1356            n       n       n       y       n
## 13561           n       n       n       y       n
## 13562           n       n       n       y       n
## 1369            n       n       n       y       n
## 13691           n       n       n       y       n
## 1377            n       n       y       n       n
## 13771           n       n       y       n       n
## 1386            n       n       n       y       n
## 1390            n       n       n       n       n
## 1394            n       n       n       y       n
## 1400            n       n       n       n       n
## 1429            n       n       n       y       n
## 1439            n       n       n       y       n
## 14391           n       n       n       y       n
## 14392           n       n       n       y       n
## 14393           n       n       n       y       n
```

```
## 1477               n           n           n           y           n
## 1492               n           n           n           n           n
## 1586               n           n           n           n           n
## 1612               n           y           n           n           n
## 16121              n           y           n           n           n
## 1620               n           n           n           y           n
## 1627               n           n           n           y           n
## 1631               n           n           n           y           n
## 1659               n           n           n           y           n
## 1670               n           n           n           n           n
## 1686               n           n           n           n           n
## 16861              n           n           n           n           n
## 16862              n           n           n           n           n
## 16863              n           n           n           n           n
## 1691               n           n           n           y           n
## 16911              n           n           n           y           n
## 1701               n           n           n           y           n
## 17013              n           n           n           y           n
## 1710               n           n           n           y           n
## 1711               n           n           n           n           n
## 1714               n           n           n           y           n
## 17141              n           n           n           y           n
## 1722               n           n           n           y           n
## 1725               n           n           n           y           n
## 1729               n           n           n           y           n
## 1730               n           n           n           y           n
## 17301              n           n           n           y           n
## 1771               n           n           n           n           n
## 1780               n           n           n           y           n
## 1810               n           n           n           y           n
## 1811               n           n           n           y           n
## 1817               n           n           n           y           n
## 1823               n           n           n           y           n
## 1859               n           n           n           y           n
## 1860               n           n           y           y           n
## 1861               n           n           n           y           n
## 1862               n           n           n           n           n
## 18621              n           n           n           n           n
## 1891               n           n           n           y           n
##       insuff_aort IVS fib_atr_std segni_IVS_std ritmo_sin_std ECG_STD eventi_cv
## 86              n   y           n             n             y       y         n
## 8610            n   y           n             n             y       y         n
## 8611            n   y           n             n             y       y         n
## 8612            n   y           n             n             y       y         n
## 8613            n   y           n             n             y       y         n
## 107             n   y           n             n             y       y         y
## 10710           n   y           n             n             y       y         y
## 112             n   y           n             n             y       y         y
## 207             n   y           n             n             y       y         y
## 2071            n   y           n             n             y       y         y
## 2072            n   y           n             n             y       y         y
## 2073            n   y           n             n             y       y         y
## 422             n   y           n             n             y       y         y
## 4221            n   y           n             n             y       y         y
```

```
## 456          n  y          n          y          y          y          n
## 4561         n  y          n          y          y          y          n
## 510          n  y          y          n          n          y          y
## 5101         n  y          y          n          n          y          y
## 529          n  y          n          n          y          y          n
## 5291         n  y          n          n          y          y          n
## 5292         n  y          n          n          y          y          n
## 5293         n  y          n          n          y          y          n
## 5294         n  y          n          n          y          y          n
## 5295         n  y          n          n          y          y          n
## 5296         n  y          n          n          y          y          n
## 5297         n  y          n          n          y          y          n
## 5298         n  y          n          n          y          y          n
## 5299         n  y          n          n          y          y          n
## 52910        n  y          n          n          y          y          n
## 640          n  y          n          n          y          y          y
## 6401         n  y          n          n          y          y          y
## 666          y  y          n          n          y          y          y
## 6661         y  y          n          n          y          y          y
## 6662         y  y          n          n          y          y          y
## 6663         y  y          n          n          y          y          y
## 6664         y  y          n          n          y          y          y
## 766          y  y          n          n          y          y          n
## 7661         y  y          n          n          y          y          n
## 787          n  y          n          n          y          y          n
## 7871         n  y          n          n          y          y          n
## 789          n  n          n          n          y          y          n
## 7891         n  n          n          n          y          y          n
## 792          n  y          n          n          y          y          y
## 805          n  y          n          y          y          y          y
## 8051         n  y          n          y          y          y          y
## 826          n  n          n          n          y          y          n
## 904          y  y          n          n          y          y          y
## 931          n  n          n          n          y          y          n
## 9311         n  n          n          n          y          y          n
## 948          y  y          n          n          y          y          n
## 9481         y  y          n          n          y          y          n
## 965          n  y          n          n          y          y          y
## 979          y  y          n          n          y          y          y
## 9791         y  y          n          n          y          y          y
## 1010         n  y          n          y          y          y          y
## 1025         n  n          n          n          y          y          y
## 1028         n  n          n          n          y          y          n
## 1050         n  y          n          n          y          y          n
## 1073         n  y          n          n          n          y          y
## 10731        n  y          n          n          n          y          y
## 1085         y  y          n          y          y          y          n
## 1100         n  y          n          n          y          y          y
## 11001        n  y          n          n          y          y          y
## 1125         n  y          n          n          y          y          y
## 11251        n  y          n          n          y          y          y
## 1130         n  y          n          y          y          y          y
## 11301        n  y          n          y          y          y          y
## 1131         n  n          n          n          y          y          y
```

```
## 11311          n   n          n          n          y          y          y
## 1132           y   y          y          n          n          y          y
## 11321          y   y          y          n          n          y          y
## 1145           n   y          n          n          y          y          n
## 1211           n   y          n          y          y          y          n
## 12111          n   y          n          y          y          y          n
## 1223           y   y          n          n          y          y          y
## 1247           n   y          n          n          y          y          y
## 1250           y   y          n          n          n          y          y
## 1279           n   y          n          y          y          y          y
## 1307           n   y          n          n          y          y          n
## 1318           n   n          n          n          y          y          n
## 13181          n   n          n          n          y          y          n
## 13182          n   n          n          n          y          y          n
## 1319           y   n          n          n          y          y          n
## 1335           n   y          n          n          y          y          n
## 1338           n   y          n          n          y          y          y
## 13381          n   y          n          n          y          y          y
## 1341           n   y          n          y          y          y          y
## 13411          n   y          n          y          y          y          y
## 1343           n   y          n          n          y          y          y
## 1356           n   y          y          n          n          y          n
## 13561          n   y          y          n          n          y          n
## 13562          n   y          y          n          n          y          n
## 1369           y   y          y          n          n          y          y
## 13691          y   y          y          n          n          y          y
## 1377           n   y          n          n          y          y          y
## 13771          n   y          n          n          y          y          y
## 1386           y   y          n          n          y          y          y
## 1390           n   y          n          n          y          y          y
## 1394           n   n          y          n          n          y          y
## 1400           n   y          n          n          y          y          n
## 1429           n   y          n          n          y          y          n
## 1439           n   y          n          n          y          y          n
## 14391          n   y          n          n          y          y          n
## 14392          n   y          n          n          y          y          n
## 14393          n   y          n          n          y          y          n
## 1477           n   y          n          n          y          y          n
## 1492           n   y          n          n          y          y          n
## 1586           y   y          n          n          y          y          n
## 1612           n   y          n          n          y          y          n
## 16121          n   y          n          n          y          y          n
## 1620           n   y          n          n          y          y          y
## 1627           n   n          n          n          y          y          y
## 1631           y   y          n          y          y          y          n
## 1659           n   y          n          n          y          y          y
## 1670           n   n          n          n          y          y          n
## 1686           n   y          n          n          y          y          y
## 16861          n   y          n          n          y          y          y
## 16862          n   y          n          n          y          y          y
## 16863          n   y          n          n          y          y          y
## 1691           n   y          n          n          y          y          y
## 16911          n   y          n          n          y          y          y
## 1701           n   n          n          y          y          y          y
```

```
## 17013          n   n          n             y            y       y         y
## 1710           y   y          n             n            y       y         y
## 1711           n   y          n             y            y       y         n
## 1714           n   y          n             n            y       y         n
## 17141          n   y          n             n            y       y         n
## 1722           n   y          n             y            y       y         n
## 1725           y   y          n             n            y       y         y
## 1729           n   y          n             y            y       y         y
## 1730           y   y          n             n            y       y         y
## 17301          y   y          n             n            y       y         y
## 1771           n   y          n             n            y       y         y
## 1780           n   y          n             n            y       y         y
## 1810           n   y          n             n            y       y         y
## 1811           n   y          n             n            y       y         y
## 1817           n   y          n             n            y       y         y
## 1823           n   y          n             n            y       y         y
## 1859           n   y          n             n            y       y         y
## 1860           y   y          y             y            n       y         y
## 1861           n   y          n             n            y       y         n
## 1862           y   n          n             n            n       y         n
## 18621          y   n          n             n            n       y         n
## 1891           n   y          n             n            y       y         n
##              problema_eta altezza_step1 problema_BMI     X      Y
## 86              nessuno         164.0      nessuno 111.0 107.10
## 8610            nessuno         164.0      nessuno 107.1 103.50
## 8611            nessuno         164.0      nessuno 103.5  98.80
## 8612            nessuno         164.0      nessuno  98.8  97.10
## 8613            nessuno         164.0      nessuno  97.1  96.30
## 107             nessuno         167.0      nessuno 101.5  97.60
## 10710           nessuno         167.0      nessuno  97.6  95.20
## 112             nessuno         171.0      nessuno 100.0  95.00
## 207             nessuno         169.0      nessuno 109.2 103.90
## 2071            nessuno         169.0      nessuno 103.9 103.80
## 2072            nessuno         169.0      nessuno 103.8 103.00
## 2073            nessuno         169.0      nessuno 103.0 107.80
## 422             nessuno         147.7      nessuno  94.6  90.80
## 4221            nessuno         147.7      nessuno  90.8  91.00
## 456             nessuno         166.0      nessuno  97.0  91.40
## 4561            nessuno         166.0      nessuno  91.4  90.00
## 510             nessuno         159.6      nessuno 104.7  99.30
## 5101            nessuno         159.6      nessuno  99.3  99.40
## 529             nessuno         150.8      nessuno  86.7  82.30
## 5291            nessuno         150.8      nessuno  82.3  78.00
## 5292            nessuno         150.8      nessuno  78.0  75.80
## 5293            nessuno         150.8      nessuno  75.8  76.00
## 5294            nessuno         150.8      nessuno  76.0  76.90
## 5295            nessuno         150.8      nessuno  76.9  77.00
## 5296            nessuno         150.8      nessuno  77.0  77.20
## 5297            nessuno         150.8      nessuno  77.2  74.00
## 5298            nessuno         150.8      nessuno  74.0  75.00
## 5299            nessuno         150.8      nessuno  75.0  74.00
## 52910           nessuno         150.8      nessuno  74.0  74.50
## 640             nessuno         175.0      nessuno 120.2 112.00
## 6401            nessuno         175.0      nessuno 112.0 112.50
```

```
## 666              nessuno         160.0      nessuno 100.0  97.70
## 6661             nessuno         160.0      nessuno  97.7  92.00
## 6662             nessuno         160.0      nessuno  92.0  88.60
## 6663             nessuno         160.0      nessuno  88.6  87.40
## 6664             nessuno         160.0      nessuno  87.4  87.70
## 766              nessuno         151.0      nessuno 104.3  97.50
## 7661             nessuno         151.0      nessuno  97.5  88.90
## 787              nessuno         174.0      nessuno 130.0 124.30
## 7871             nessuno         174.0      nessuno 124.3 122.00
## 789              nessuno         173.0      nessuno 126.5 119.70
## 7891             nessuno         173.0      nessuno 119.7 118.60
## 792              nessuno         175.5      nessuno 122.5 118.00
## 805              nessuno         165.2      nessuno 106.3  99.30
## 8051             nessuno         165.2      nessuno  99.3  91.10
## 826              nessuno         178.0      nessuno 142.3 132.60
## 904              nessuno         160.0      nessuno 134.0 128.70
## 931              nessuno         156.0      nessuno 100.0 100.50
## 9311             nessuno         156.0      nessuno 100.5  90.00
## 948              nessuno         168.0      nessuno 146.2 137.10
## 9481             nessuno         168.0      nessuno 137.1 149.30
## 965              nessuno         160.0      nessuno 101.3  94.00
## 979              nessuno         158.0      nessuno  93.6  92.00
## 9791             nessuno         158.0      nessuno  92.0  79.10
## 1010             nessuno         168.0      nessuno 107.7  99.60
## 1025             nessuno         157.0      nessuno 103.0  96.50
## 1028             nessuno         164.0      nessuno  87.7  85.90
## 1050             nessuno         175.0      nessuno 146.4 138.90
## 1073             nessuno         156.2      nessuno  77.2  76.60
## 10731            nessuno         156.2      nessuno  76.6  77.70
## 1085             nessuno         160.0      nessuno 106.0 104.20
## 1100             nessuno         172.0      nessuno 142.6 128.50
## 11001            nessuno         172.0      nessuno 128.5 128.20
## 1125             nessuno         172.0      nessuno 103.2  98.40
## 11251            nessuno         172.0      nessuno  98.4  96.90
## 1130             nessuno         153.7      nessuno 101.2  99.30
## 11301            nessuno         153.7      nessuno  99.3  95.30
## 1131             nessuno         169.3      nessuno 109.1 103.40
## 11311            nessuno         169.3      nessuno 103.4 103.80
## 1132             nessuno         184.0      nessuno 161.3 157.40
## 11321            nessuno         184.0      nessuno 157.4 148.50
## 1145             nessuno         183.0      nessuno 120.0 113.10
## 1211             nessuno         151.0      nessuno  86.0  81.40
## 12111            nessuno         151.0      nessuno  81.4  75.70
## 1223             nessuno         176.5      nessuno 120.1 112.50
## 1247             nessuno         168.0      nessuno 148.8 137.20
## 1250             nessuno         164.0      nessuno  97.3  96.70
## 1279             nessuno         154.5      nessuno  95.3  92.30
## 1307             nessuno         182.0      nessuno 138.7 132.20
## 1318             nessuno         165.0      nessuno 135.1 127.00
## 13181            nessuno         165.0      nessuno 127.0 127.00
## 13182            nessuno         165.0      nessuno 127.0 127.40
## 1319             nessuno         152.0      nessuno 109.4 102.70
## 1335             nessuno         162.0      nessuno 119.8 117.60
## 1338             nessuno         158.1      nessuno  86.1  79.30
```

```
## 13381             nessuno         158.1      nessuno  79.3  72.80
## 1341              nessuno         171.9      nessuno 117.4 110.00
## 13411             nessuno         171.9      nessuno 110.0 113.35
## 1343              nessuno         177.3      nessuno  96.1  95.50
## 1356              nessuno         166.6      nessuno 102.0  97.40
## 13561             nessuno         166.6      nessuno  97.4 107.00
## 13562             nessuno         166.6      nessuno 107.0 104.70
## 1369              nessuno         147.0      nessuno  86.5  84.00
## 13691             nessuno         147.0      nessuno  84.0  84.00
## 1377              nessuno         162.0      nessuno 111.0  94.30
## 13771             nessuno         162.0      nessuno  94.3 102.50
## 1386              nessuno         163.0      nessuno 108.7 104.00
## 1390              nessuno         182.2      nessuno 146.7 133.40
## 1394  errore data nascita         157.2      nessuno  88.0  81.00
## 1400              nessuno         165.6      nessuno 105.4 100.20
## 1429              nessuno         165.4      nessuno 104.5 100.90
## 1439              nessuno         178.0      nessuno 168.9 157.00
## 14391             nessuno         178.0      nessuno 157.0 176.00
## 14392             nessuno         178.0      nessuno 176.0 181.60
## 14393             nessuno         178.0      nessuno 181.6 169.40
## 1477              nessuno         175.9      nessuno 122.5 115.20
## 1492              nessuno         169.7      nessuno 161.8 151.80
## 1586              nessuno         165.0      nessuno 102.2  99.80
## 1612              nessuno         159.0      nessuno  96.8  94.30
## 16121             nessuno         159.0      nessuno  94.3  89.30
## 1620              nessuno         179.8      nessuno 152.4 145.30
## 1627              nessuno         149.7      nessuno  84.4  79.90
## 1631              nessuno         169.0      nessuno  88.0  85.80
## 1659              nessuno         166.0      nessuno 109.1 102.60
## 1670              nessuno         157.0      nessuno 144.2 136.40
## 1686              nessuno         151.0      nessuno  93.5  89.10
## 16861             nessuno         151.0      nessuno  89.1  86.60
## 16862             nessuno         151.0      nessuno  86.6  84.30
## 16863             nessuno         151.0      nessuno  84.3  80.80
## 1691              nessuno         176.3      nessuno 150.5 141.50
## 16911             nessuno         176.3      nessuno 141.5 127.00
## 1701              nessuno         164.5      nessuno  94.7  92.80
## 17013             nessuno         164.5      nessuno  92.8  87.00
## 1710              nessuno         162.0      nessuno 114.8 108.90
## 1711              nessuno         165.6      nessuno 161.0 153.90
## 1714              nessuno         180.0      nessuno 136.2 129.30
## 17141             nessuno         180.0      nessuno 129.3 117.60
## 1722              nessuno         178.3      nessuno 121.5 115.20
## 1725              nessuno         162.3      nessuno  87.8  81.60
## 1729              nessuno         156.0      nessuno  87.5  84.00
## 1730              nessuno         147.0      nessuno 108.7 104.60
## 17301             nessuno         147.0      nessuno 104.6  99.70
## 1771              nessuno         174.3      nessuno 114.4 104.60
## 1780              nessuno         154.3      nessuno  98.3  92.40
## 1810              nessuno         166.1      nessuno 100.0  92.30
## 1811              nessuno         177.0      nessuno 127.9 121.50
## 1817              nessuno         180.0      nessuno 146.0 143.40
## 1823              nessuno         169.2      nessuno 114.4 109.30
## 1859              nessuno         172.0      nessuno 115.3 110.00
```

```
## 1860              nessuno         158.0      nessuno 108.0 102.90
## 1861              nessuno         162.0      nessuno 115.8 111.80
## 1862              nessuno         149.3      nessuno 103.9 101.20
## 18621             nessuno         149.3      nessuno 101.2 105.50
## 1891              nessuno         170.5      nessuno 105.0  99.20
```

Elimino colonne con variabili nominali cardinali

```
# Rimuovi le colonne nominali
df <- df_cleaned[, !(colnames(df_cleaned) %in% c("problema_BMI", "problema_eta", "step", "data", "birth
dim(df)
```

```
## [1] 144 136
```

Sostituisco i valori yes no e maschio femmina con 1 - 0

```
df[df == "n"] <- 0
df[df == "y"] <- 1
df[df == "m"] <- 0
df[df == "f"] <- 1
```

Creazione della variabile target **Z** con la variazione del peso

```
df$Z <- (df$Y - df$X)


dim(df)
```

```
## [1] 144 137
```

```
str(df)
```

```
## 'data.frame':    144 obs. of  137 variables:
##  $ id                     : num  98 98 98 98 98 121 121 126 225 225 ...
##  $ gender                 : chr  "1" "1" "1" "1" ...
##  $ eta                    : num  60 60 60 60 60 64 64 61 59 59 ...
##  $ qualification          : num  4 4 4 4 4 4 4 2 3 3 ...
##  $ job_category           : num  4 4 4 4 4 12 12 12 12 12 ...
##  $ dm                     : chr  "0" "0" "0" "0" ...
##  $ ret_diab_nprolif       : chr  "0" "0" "0" "0" ...
##  $ ret_diab_prolif        : chr  "0" "0" "0" "0" ...
##  $ nefr_inc               : chr  "0" "0" "0" "0" ...
##  $ insuf_ren_cr           : chr  "0" "0" "0" "0" ...
##  $ neurop_diab            : chr  "0" "0" "0" "0" ...
##  $ BPCO                   : chr  "0" "0" "0" "0" ...
##  $ insuf_resp_cr          : chr  "0" "0" "0" "0" ...
##  $ OSAS                   : chr  "0" "0" "0" "0" ...
##  $ steat_ep               : chr  "0" "0" "0" "0" ...
##  $ cirr_ep                : chr  "0" "0" "0" "0" ...
##  $ cardiop_isc            : chr  "0" "0" "0" "0" ...
##  $ cardiop_dil            : chr  "0" "0" "0" "0" ...
##  $ cardiop_iper_ostr      : chr  "0" "0" "0" "0" ...
##  $ valv_patia             : chr  "0" "0" "0" "0" ...
##  $ pat_osteo_dis          : chr  "0" "0" "0" "0" ...
##  $ dep                    : chr  "0" "0" "0" "0" ...
##  $ psic                   : chr  "0" "0" "0" "0" ...
##  $ DCA                    : chr  "0" "0" "0" "0" ...
##  $ iper_art               : chr  "1" "1" "1" "1" ...
```

```
##  $ ipogon                : chr  "0" "0" "0" "0" ...
##  $ PCO                   : chr  "0" "0" "0" "0" ...
##  $ prev_chirurg_bar      : chr  "0" "0" "0" "0" ...
##  $ altezza               : num  164 164 164 164 164 167 167 171 169 169 ...
##  $ BMI                   : num  41.3 41.3 41.3 41.3 41.3 ...
##  $ circ_vita             : num  118 118 118 118 118 115 115 125 125 125 ...
##  $ circ_fian             : num  135 135 135 135 135 103 103 105 113 113 ...
##  $ rapporto_vita_fian    : num  0.874 0.874 0.874 0.874 0.874 ...
##  $ PAS                   : num  120 120 120 120 120 145 145 140 130 130 ...
##  $ PAD                   : num  80 80 80 80 80 85 85 90 70 70 ...
##  $ freq_card             : num  62 62 62 62 62 72 72 77 56 56 ...
##  $ rapporto_vita_alt     : num  0.719 0.719 0.719 0.719 0.719 0.688 0.688 0.73 0.739 0.739 ...
##  $ bioimped              : chr  "1" "1" "1" "1" ...
##  $ fm_kg                 : num  55.2 55.2 55.2 55.2 55.2 38.3 38.3 39.5 41.7 41.7 ...
##  $ fm_perc               : num  49.9 49.9 49.9 49.9 49.9 37.9 37.9 40.4 38.9 38.9 ...
##  $ ffm_kg                : num  55.4 55.4 55.4 55.4 55.4 62.7 62.7 58.5 65.5 65.5 ...
##  $ ffm_perc              : num  50.1 50.1 50.1 50.1 50.1 62.1 62.1 59.6 61.1 61.1 ...
##  $ massa_musc_kg         : num  28.1 28.1 28.1 28.1 28.1 43 43 28.8 41.5 41.5 ...
##  $ massa_musc_perc       : num  25.4 25.4 25.4 25.4 25.4 42.6 42.6 29.4 38.7 38.7 ...
##  $ acqua_extra           : num  24.2 24.2 24.2 24.2 24.2 22 22 28.9 23.1 23.1 ...
##  $ acqua_intra           : num  16.3 16.3 16.3 16.3 16.3 28.2 28.2 17.9 24.8 24.8 ...
##  $ calorim_ind           : chr  "1" "1" "1" "1" ...
##  $ harris_benedict       : num  1739 1739 1739 1739 1739 ...
##  $ eritroc               : num  4.7 4.7 4.7 4.7 4.7 5.66 5.66 5.05 4.73 4.73 ...
##  $ ematocr               : num  43.6 43.6 43.6 43.6 43.6 35.8 35.8 37.1 43.7 43.7 ...
##  $ emo                   : num  14.2 14.2 14.2 14.2 14.2 10.7 10.7 11.4 14.6 14.6 ...
##  $ vol_glob              : num  92.8 92.8 92.8 92.8 92.8 63.2 63.2 73.5 92.5 92.5 ...
##  $ leuco                 : num  8.4 8.4 8.4 8.4 8.4 11 11 8.1 8.1 8.1 ...
##  $ piastr                : num  220 220 220 220 220 237 237 246 265 265 ...
##  $ VES                   : num  8 8 8 8 8 26 26 8 7 7 ...
##  $ AST                   : num  16 16 16 16 16 41 41 15 20 20 ...
##  $ ALT                   : num  15 15 15 15 15 41 41 14 29 29 ...
##  $ gammaGT               : num  12 12 12 12 12 31 31 21 22 22 ...
##  $ uric                  : num  10 10 10 10 10 5.7 5.7 5.7 6.5 6.5 ...
##  $ creatin               : num  1.1 1.1 1.1 1.1 1.1 0.9 0.9 1.6 0.9 0.9 ...
##  $ micr_album            : num  3 3 3 3 3 4 4 0 11 11 ...
##  $ col_tot               : num  210 210 210 210 210 171 171 144 159 159 ...
##  $ HDL                   : num  68 68 68 68 68 30 30 28 45 45 ...
##  $ LDL                   : num  137 137 137 137 137 121 121 93 85 85 ...
##  $ trigl                 : num  117 117 117 117 117 189 189 192 284 284 ...
##  $ glic_bas              : num  94 94 94 94 94 90 90 118 100 100 ...
##  $ insulinem_bas         : num  16 16 16 16 16 24.7 24.7 10.5 18.6 18.6 ...
##  $ emo_gli               : num  35 35 35 35 35 39 39 45 35 35 ...
##  $ calcemia              : num  9.9 9.9 9.9 9.9 9.9 9 9 9.1 9.5 9.5 ...
##  $ sodio                 : num  144 144 144 144 144 141 141 146 141 141 ...
##  $ pot                   : num  3.7 3.7 3.7 3.7 3.7 4.5 4.5 4.7 4.2 4.2 ...
##  $ prot_C_reat           : num  0.3 0.3 0.3 0.3 0.3 0.3 0.3 0.1 0 0 ...
##  $ TSH                   : num  4.43 4.43 4.43 4.43 4.43 1.41 1.41 1.16 1.74 1.74 ...
##  $ calcifed              : num  9 9 9 9 9 14.5 14.5 33.8 11.9 11.9 ...
##  $ neutrofili            : num  63 63 63 63 63 66 66 69 50 50 ...
##  $ neutrofili_val        : num  5.3 5.3 5.3 5.3 5.3 7.2 7.2 5.6 4 4 ...
##  $ linfociti             : num  26 26 26 26 26 23 23 17 40 40 ...
##  $ linfociti_val         : num  2.2 2.2 2.2 2.2 2.2 2.5 2.5 1.4 3.2 3.2 ...
##  $ monociti              : num  7 7 7 7 7 8 8 8 9 9 ...
```

```
##  $ monociti_val            : num  0.6 0.6 0.6 0.6 0.6 0.9 0.9 0.7 0.7 0.7 ...
##  $ basofili                : num  1 1 1 1 1 0 0 1 0 0 ...
##  $ basofili_val            : num  0.1 0.1 0.1 0.1 0.1 0 0 0.1 0 0 ...
##  $ other_tfa               : chr  "0" "0" "0" "0" ...
##  $ other_endocrine_agent   : chr  "1" "1" "1" "1" ...
##  $ insuline                : chr  "0" "0" "0" "0" ...
##  $ oral_antidiab           : chr  "0" "0" "0" "0" ...
##  $ corticost_per_musculo   : chr  "0" "0" "0" "0" ...
##  $ NSAIDs                  : chr  "0" "0" "0" "0" ...
##  $ antipsychotic           : chr  "0" "0" "0" "0" ...
##  $ antianxiety_antiinsonnia: chr  "0" "0" "0" "0" ...
##  $ antidepres              : chr  "0" "0" "0" "0" ...
##  $ combined_bronchodilators: chr  "0" "0" "0" "0" ...
##  $ corticost_per_bronco    : chr  "0" "0" "0" "0" ...
##  $ methylxanthines         : chr  "0" "0" "0" "0" ...
##  $ anticholinergic         : chr  "0" "0" "0" "0" ...
##  $ beta_adrenergic         : chr  "0" "0" "0" "0" ...
##  $ other_anticoag          : chr  "0" "0" "0" "0" ...
##  $ oral_anticoag           : chr  "0" "0" "0" "0" ...
##  $ other_anti_platelets    : chr  "0" "0" "0" "0" ...
##   [list output truncated]
```

```r
# Individua le colonne di tipo 'chr'
cols_to_transform <- sapply(df, is.character)

# Trasforma le colonne con "0" e "1" in valori booleani
df[cols_to_transform] <- lapply(df[cols_to_transform], function(x) {
  ifelse(x == "1", TRUE, FALSE)
})
```

```r
str(df)
```

```
## 'data.frame':    144 obs. of  137 variables:
##  $ id                      : num  98 98 98 98 98 121 121 126 225 225 ...
##  $ gender                  : logi  TRUE TRUE TRUE TRUE TRUE FALSE ...
##  $ eta                     : num  60 60 60 60 60 64 64 61 59 59 ...
##  $ qualification           : num  4 4 4 4 4 4 4 2 3 3 ...
##  $ job_category            : num  4 4 4 4 4 12 12 12 12 12 ...
##  $ dm                      : logi  FALSE FALSE FALSE FALSE FALSE FALSE ...
##  $ ret_diab_nprolif        : logi  FALSE FALSE FALSE FALSE FALSE FALSE ...
##  $ ret_diab_prolif         : logi  FALSE FALSE FALSE FALSE FALSE FALSE ...
##  $ nefr_inc                : logi  FALSE FALSE FALSE FALSE FALSE FALSE ...
##  $ insuf_ren_cr            : logi  FALSE FALSE FALSE FALSE FALSE FALSE ...
##  $ neurop_diab             : logi  FALSE FALSE FALSE FALSE FALSE FALSE ...
##  $ BPCO                    : logi  FALSE FALSE FALSE FALSE FALSE FALSE ...
##  $ insuf_resp_cr           : logi  FALSE FALSE FALSE FALSE FALSE FALSE ...
##  $ OSAS                    : logi  FALSE FALSE FALSE FALSE FALSE FALSE ...
##  $ steat_ep                : logi  FALSE FALSE FALSE FALSE FALSE FALSE ...
##  $ cirr_ep                 : logi  FALSE FALSE FALSE FALSE FALSE FALSE ...
##  $ cardiop_isc             : logi  FALSE FALSE FALSE FALSE FALSE TRUE ...
##  $ cardiop_dil             : logi  FALSE FALSE FALSE FALSE FALSE FALSE ...
##  $ cardiop_iper_ostr       : logi  FALSE FALSE FALSE FALSE FALSE FALSE ...
##  $ valv_patia              : logi  FALSE FALSE FALSE FALSE FALSE FALSE ...
##  $ pat_osteo_dis           : logi  FALSE FALSE FALSE FALSE FALSE FALSE ...
##  $ dep                     : logi  FALSE FALSE FALSE FALSE FALSE FALSE ...
```

```
##  $ psic                   : logi  FALSE FALSE FALSE FALSE FALSE FALSE ...
##  $ DCA                    : logi  FALSE FALSE FALSE FALSE FALSE FALSE ...
##  $ iper_art               : logi  TRUE TRUE TRUE TRUE TRUE FALSE ...
##  $ ipogon                 : logi  FALSE FALSE FALSE FALSE FALSE FALSE ...
##  $ PCO                    : logi  FALSE FALSE FALSE FALSE FALSE FALSE ...
##  $ prev_chirurg_bar       : logi  FALSE FALSE FALSE FALSE FALSE FALSE ...
##  $ altezza                : num  164 164 164 164 164 167 167 171 169 169 ...
##  $ BMI                    : num  41.3 41.3 41.3 41.3 41.3 ...
##  $ circ_vita              : num  118 118 118 118 118 115 115 125 125 125 ...
##  $ circ_fian              : num  135 135 135 135 135 103 103 105 113 113 ...
##  $ rapporto_vita_fian     : num  0.874 0.874 0.874 0.874 0.874 ...
##  $ PAS                    : num  120 120 120 120 120 145 145 140 130 130 ...
##  $ PAD                    : num  80 80 80 80 80 85 85 90 70 70 ...
##  $ freq_card              : num  62 62 62 62 62 72 72 77 56 56 ...
##  $ rapporto_vita_alt      : num  0.719 0.719 0.719 0.719 0.719 0.688 0.688 0.73 0.739 0.739 ...
##  $ bioimped               : logi  TRUE TRUE TRUE TRUE TRUE TRUE ...
##  $ fm_kg                  : num  55.2 55.2 55.2 55.2 55.2 38.3 38.3 39.5 41.7 41.7 ...
##  $ fm_perc                : num  49.9 49.9 49.9 49.9 49.9 37.9 37.9 40.4 38.9 38.9 ...
##  $ ffm_kg                 : num  55.4 55.4 55.4 55.4 55.4 62.7 62.7 58.5 65.5 65.5 ...
##  $ ffm_perc               : num  50.1 50.1 50.1 50.1 50.1 62.1 62.1 59.6 61.1 61.1 ...
##  $ massa_musc_kg          : num  28.1 28.1 28.1 28.1 28.1 43 43 28.8 41.5 41.5 ...
##  $ massa_musc_perc        : num  25.4 25.4 25.4 25.4 25.4 42.6 42.6 29.4 38.7 38.7 ...
##  $ acqua_extra            : num  24.2 24.2 24.2 24.2 24.2 22 22 28.9 23.1 23.1 ...
##  $ acqua_intra            : num  16.3 16.3 16.3 16.3 16.3 28.2 28.2 17.9 24.8 24.8 ...
##  $ calorim_ind            : logi  TRUE TRUE TRUE TRUE TRUE TRUE ...
##  $ harris_benedict        : num  1739 1739 1739 1739 1739 ...
##  $ eritroc                : num  4.7 4.7 4.7 4.7 4.7 5.66 5.66 5.05 4.73 4.73 ...
##  $ ematocr                : num  43.6 43.6 43.6 43.6 43.6 35.8 35.8 37.1 43.7 43.7 ...
##  $ emo                    : num  14.2 14.2 14.2 14.2 14.2 10.7 10.7 11.4 14.6 14.6 ...
##  $ vol_glob               : num  92.8 92.8 92.8 92.8 92.8 63.2 63.2 73.5 92.5 92.5 ...
##  $ leuco                  : num  8.4 8.4 8.4 8.4 8.4 11 11 8.1 8.1 8.1 ...
##  $ piastr                 : num  220 220 220 220 220 237 237 246 265 265 ...
##  $ VES                    : num  8 8 8 8 8 26 26 8 7 7 ...
##  $ AST                    : num  16 16 16 16 16 41 41 15 20 20 ...
##  $ ALT                    : num  15 15 15 15 15 41 41 14 29 29 ...
##  $ gammaGT                : num  12 12 12 12 12 31 31 21 22 22 ...
##  $ uric                   : num  10 10 10 10 10 5.7 5.7 5.7 6.5 6.5 ...
##  $ creatin                : num  1.1 1.1 1.1 1.1 1.1 0.9 0.9 1.6 0.9 0.9 ...
##  $ micr_album             : num  3 3 3 3 3 4 4 0 11 11 ...
##  $ col_tot                : num  210 210 210 210 210 171 171 144 159 159 ...
##  $ HDL                    : num  68 68 68 68 68 30 30 28 45 45 ...
##  $ LDL                    : num  137 137 137 137 137 121 121 93 85 85 ...
##  $ trigl                  : num  117 117 117 117 117 189 189 192 284 284 ...
##  $ glic_bas               : num  94 94 94 94 94 90 90 118 100 100 ...
##  $ insulinem_bas          : num  16 16 16 16 16 24.7 24.7 10.5 18.6 18.6 ...
##  $ emo_gli                : num  35 35 35 35 35 39 39 45 35 35 ...
##  $ calcemia               : num  9.9 9.9 9.9 9.9 9.9 9 9 9.1 9.5 9.5 ...
##  $ sodio                  : num  144 144 144 144 144 141 141 146 141 141 ...
##  $ pot                    : num  3.7 3.7 3.7 3.7 3.7 4.5 4.5 4.7 4.2 4.2 ...
##  $ prot_C_reat            : num  0.3 0.3 0.3 0.3 0.3 0.3 0.3 0.1 0 0 ...
##  $ TSH                    : num  4.43 4.43 4.43 4.43 4.43 1.41 1.41 1.16 1.74 1.74 ...
##  $ calcifed               : num  9 9 9 9 9 14.5 14.5 33.8 11.9 11.9 ...
##  $ neutrofili             : num  63 63 63 63 63 66 66 69 50 50 ...
##  $ neutrofili_val         : num  5.3 5.3 5.3 5.3 5.3 7.2 7.2 5.6 4 4 ...
```

```
##  $ linfociti               : num  26 26 26 26 26 23 23 17 40 40 ...
##  $ linfociti_val           : num  2.2 2.2 2.2 2.2 2.2 2.5 2.5 1.4 3.2 3.2 ...
##  $ monociti                : num  7 7 7 7 7 8 8 8 9 9 ...
##  $ monociti_val            : num  0.6 0.6 0.6 0.6 0.6 0.9 0.9 0.7 0.7 0.7 ...
##  $ basofili                : num  1 1 1 1 1 0 0 1 0 0 ...
##  $ basofili_val            : num  0.1 0.1 0.1 0.1 0.1 0 0 0.1 0 0 ...
##  $ other_tfa               : logi  FALSE FALSE FALSE FALSE FALSE TRUE ...
##  $ other_endocrine_agent   : logi  TRUE TRUE TRUE TRUE TRUE FALSE ...
##  $ insuline                : logi  FALSE FALSE FALSE FALSE FALSE FALSE ...
##  $ oral_antidiab           : logi  FALSE FALSE FALSE FALSE FALSE FALSE ...
##  $ corticost_per_musculo   : logi  FALSE FALSE FALSE FALSE FALSE FALSE ...
##  $ NSAIDs                  : logi  FALSE FALSE FALSE FALSE FALSE TRUE ...
##  $ antipsychotic           : logi  FALSE FALSE FALSE FALSE FALSE FALSE ...
##  $ antianxiety_antiinsonnia: logi  FALSE FALSE FALSE FALSE FALSE FALSE ...
##  $ antidepres              : logi  FALSE FALSE FALSE FALSE FALSE FALSE ...
##  $ combined_bronchodilators: logi  FALSE FALSE FALSE FALSE FALSE FALSE ...
##  $ corticost_per_bronco    : logi  FALSE FALSE FALSE FALSE FALSE FALSE ...
##  $ methylxanthines         : logi  FALSE FALSE FALSE FALSE FALSE FALSE ...
##  $ anticholinergic         : logi  FALSE FALSE FALSE FALSE FALSE FALSE ...
##  $ beta_adrenergic         : logi  FALSE FALSE FALSE FALSE FALSE FALSE ...
##  $ other_anticoag          : logi  FALSE FALSE FALSE FALSE FALSE FALSE ...
##  $ oral_anticoag           : logi  FALSE FALSE FALSE FALSE FALSE FALSE ...
##  $ other_anti_platelets    : logi  FALSE FALSE FALSE FALSE FALSE FALSE ...
##   [list output truncated]
```

```
df[sapply(df, is.logical)] <- lapply(df[sapply(df, is.logical)], as.numeric)
str(df)
```

```
## 'data.frame':    144 obs. of  137 variables:
##  $ id                      : num  98 98 98 98 98 121 121 126 225 225 ...
##  $ gender                  : num  1 1 1 1 1 0 0 0 0 0 ...
##  $ eta                     : num  60 60 60 60 60 64 64 61 59 59 ...
##  $ qualification           : num  4 4 4 4 4 4 4 2 3 3 ...
##  $ job_category            : num  4 4 4 4 4 12 12 12 12 12 ...
##  $ dm                      : num  0 0 0 0 0 0 0 0 1 1 ...
##  $ ret_diab_nprolif        : num  0 0 0 0 0 0 0 0 0 0 ...
##  $ ret_diab_prolif         : num  0 0 0 0 0 0 0 0 0 0 ...
##  $ nefr_inc                : num  0 0 0 0 0 0 0 0 0 0 ...
##  $ insuf_ren_cr            : num  0 0 0 0 0 0 0 1 0 0 ...
##  $ neurop_diab             : num  0 0 0 0 0 0 0 0 0 0 ...
##  $ BPCO                    : num  0 0 0 0 0 0 0 0 0 0 ...
##  $ insuf_resp_cr           : num  0 0 0 0 0 0 0 0 0 0 ...
##  $ OSAS                    : num  0 0 0 0 0 0 0 0 0 0 ...
##  $ steat_ep                : num  0 0 0 0 0 0 0 0 0 0 ...
##  $ cirr_ep                 : num  0 0 0 0 0 0 0 0 0 0 ...
##  $ cardiop_isc             : num  0 0 0 0 0 1 1 0 1 1 ...
##  $ cardiop_dil             : num  0 0 0 0 0 0 0 0 0 0 ...
##  $ cardiop_iper_ostr       : num  0 0 0 0 0 0 0 0 0 0 ...
##  $ valv_patia              : num  0 0 0 0 0 0 0 0 0 0 ...
##  $ pat_osteo_dis           : num  0 0 0 0 0 0 0 0 1 1 ...
##  $ dep                     : num  0 0 0 0 0 0 0 1 0 0 ...
##  $ psic                    : num  0 0 0 0 0 0 0 0 0 0 ...
##  $ DCA                     : num  0 0 0 0 0 0 0 0 0 0 ...
##  $ iper_art                : num  1 1 1 1 1 0 0 1 1 1 ...
##  $ ipogon                  : num  0 0 0 0 0 0 0 0 0 0 ...
```

```
##  $ PCO                    : num  0 0 0 0 0 0 0 0 0 0 ...
##  $ prev_chirurg_bar       : num  0 0 0 0 0 0 0 0 0 0 ...
##  $ altezza                : num  164 164 164 164 164 167 167 171 169 169 ...
##  $ BMI                    : num  41.3 41.3 41.3 41.3 41.3 ...
##  $ circ_vita              : num  118 118 118 118 118 115 115 125 125 125 ...
##  $ circ_fian              : num  135 135 135 135 135 103 103 105 113 113 ...
##  $ rapporto_vita_fian     : num  0.874 0.874 0.874 0.874 0.874 ...
##  $ PAS                    : num  120 120 120 120 120 145 145 140 130 130 ...
##  $ PAD                    : num  80 80 80 80 80 85 85 90 70 70 ...
##  $ freq_card              : num  62 62 62 62 62 72 72 77 56 56 ...
##  $ rapporto_vita_alt      : num  0.719 0.719 0.719 0.719 0.719 0.688 0.688 0.73 0.739 0.739 ...
##  $ bioimped               : num  1 1 1 1 1 1 1 1 1 1 ...
##  $ fm_kg                  : num  55.2 55.2 55.2 55.2 55.2 38.3 38.3 39.5 41.7 41.7 ...
##  $ fm_perc                : num  49.9 49.9 49.9 49.9 49.9 37.9 37.9 40.4 38.9 38.9 ...
##  $ ffm_kg                 : num  55.4 55.4 55.4 55.4 55.4 62.7 62.7 58.5 65.5 65.5 ...
##  $ ffm_perc               : num  50.1 50.1 50.1 50.1 50.1 62.1 62.1 59.6 61.1 61.1 ...
##  $ massa_musc_kg          : num  28.1 28.1 28.1 28.1 28.1 43 43 28.8 41.5 41.5 ...
##  $ massa_musc_perc        : num  25.4 25.4 25.4 25.4 25.4 42.6 42.6 29.4 38.7 38.7 ...
##  $ acqua_extra            : num  24.2 24.2 24.2 24.2 24.2 22 22 28.9 23.1 23.1 ...
##  $ acqua_intra            : num  16.3 16.3 16.3 16.3 16.3 28.2 28.2 17.9 24.8 24.8 ...
##  $ calorim_ind            : num  1 1 1 1 1 1 1 1 0 0 ...
##  $ harris_benedict        : num  1739 1739 1739 1739 1739 ...
##  $ eritroc                : num  4.7 4.7 4.7 4.7 4.7 5.66 5.66 5.05 4.73 4.73 ...
##  $ ematocr                : num  43.6 43.6 43.6 43.6 43.6 35.8 35.8 37.1 43.7 43.7 ...
##  $ emo                    : num  14.2 14.2 14.2 14.2 14.2 10.7 10.7 11.4 14.6 14.6 ...
##  $ vol_glob               : num  92.8 92.8 92.8 92.8 92.8 63.2 63.2 73.5 92.5 92.5 ...
##  $ leuco                  : num  8.4 8.4 8.4 8.4 8.4 11 11 8.1 8.1 8.1 ...
##  $ piastr                 : num  220 220 220 220 220 237 237 246 265 265 ...
##  $ VES                    : num  8 8 8 8 8 26 26 8 7 7 ...
##  $ AST                    : num  16 16 16 16 16 41 41 15 20 20 ...
##  $ ALT                    : num  15 15 15 15 15 41 41 14 29 29 ...
##  $ gammaGT                : num  12 12 12 12 12 31 31 21 22 22 ...
##  $ uric                   : num  10 10 10 10 10 5.7 5.7 5.7 6.5 6.5 ...
##  $ creatin                : num  1.1 1.1 1.1 1.1 1.1 0.9 0.9 1.6 0.9 0.9 ...
##  $ micr_album             : num  3 3 3 3 3 4 4 0 11 11 ...
##  $ col_tot                : num  210 210 210 210 210 171 171 144 159 159 ...
##  $ HDL                    : num  68 68 68 68 68 30 30 28 45 45 ...
##  $ LDL                    : num  137 137 137 137 137 121 121 93 85 85 ...
##  $ trigl                  : num  117 117 117 117 117 189 189 192 284 284 ...
##  $ glic_bas               : num  94 94 94 94 94 90 90 118 100 100 ...
##  $ insulinem_bas          : num  16 16 16 16 16 24.7 24.7 10.5 18.6 18.6 ...
##  $ emo_gli                : num  35 35 35 35 35 39 39 45 35 35 ...
##  $ calcemia               : num  9.9 9.9 9.9 9.9 9.9 9 9 9.1 9.5 9.5 ...
##  $ sodio                  : num  144 144 144 144 144 141 141 146 141 141 ...
##  $ pot                    : num  3.7 3.7 3.7 3.7 3.7 4.5 4.5 4.7 4.2 4.2 ...
##  $ prot_C_reat            : num  0.3 0.3 0.3 0.3 0.3 0.3 0.3 0.1 0 0 ...
##  $ TSH                    : num  4.43 4.43 4.43 4.43 4.43 1.41 1.41 1.16 1.74 1.74 ...
##  $ calcifed               : num  9 9 9 9 9 14.5 14.5 33.8 11.9 11.9 ...
##  $ neutrofili             : num  63 63 63 63 63 66 66 69 50 50 ...
##  $ neutrofili_val         : num  5.3 5.3 5.3 5.3 5.3 7.2 7.2 5.6 4 4 ...
##  $ linfociti              : num  26 26 26 26 26 23 23 17 40 40 ...
##  $ linfociti_val          : num  2.2 2.2 2.2 2.2 2.2 2.5 2.5 1.4 3.2 3.2 ...
##  $ monociti               : num  7 7 7 7 7 8 8 8 9 9 ...
##  $ monociti_val           : num  0.6 0.6 0.6 0.6 0.6 0.9 0.9 0.7 0.7 0.7 ...
```

```
##  $ basofili                : num  1 1 1 1 1 0 0 1 0 0 ...
##  $ basofili_val            : num  0.1 0.1 0.1 0.1 0.1 0 0 0.1 0 0 ...
##  $ other_tfa               : num  0 0 0 0 0 1 1 1 1 1 ...
##  $ other_endocrine_agent   : num  1 1 1 1 1 0 0 1 0 0 ...
##  $ insuline                : num  0 0 0 0 0 0 0 0 0 0 ...
##  $ oral_antidiab           : num  0 0 0 0 0 0 0 0 1 1 ...
##  $ corticost_per_musculo   : num  0 0 0 0 0 0 0 0 0 0 ...
##  $ NSAIDs                  : num  0 0 0 0 0 1 1 1 0 0 ...
##  $ antipsychotic           : num  0 0 0 0 0 0 0 0 0 0 ...
##  $ antianxiety_antiinsonnia: num  0 0 0 0 0 0 0 0 0 0 ...
##  $ antidepres              : num  0 0 0 0 0 0 0 1 0 0 ...
##  $ combined_bronchodilators: num  0 0 0 0 0 0 0 0 0 0 ...
##  $ corticost_per_bronco    : num  0 0 0 0 0 0 0 0 0 0 ...
##  $ methylxanthines         : num  0 0 0 0 0 0 0 0 0 0 ...
##  $ anticholinergic         : num  0 0 0 0 0 0 0 0 0 0 ...
##  $ beta_adrenergic         : num  0 0 0 0 0 0 0 0 0 0 ...
##  $ other_anticoag          : num  0 0 0 0 0 0 0 0 0 0 ...
##  $ oral_anticoag           : num  0 0 0 0 0 0 0 0 0 0 ...
##  $ other_anti_platelets    : num  0 0 0 0 0 0 0 0 0 0 ...
##   [list output truncated]
```

```
num_id_unici <- length(unique(df$id))

cat("Numero di pazienti finali: ", num_id_unici, "\n")
```

```
## Numero di pazienti finali:  84
```

```
dim(df)
```

```
## [1] 144 137
```

```
head(df)
```

```
##       id gender eta qualification job_category dm ret_diab_nprolif
## 86    98      1  60             4            4  0                0
## 8610  98      1  60             4            4  0                0
## 8611  98      1  60             4            4  0                0
## 8612  98      1  60             4            4  0                0
## 8613  98      1  60             4            4  0                0
## 107  121      0  64             4           12  0                0
##      ret_diab_prolif nefr_inc insuf_ren_cr neurop_diab BPCO insuf_resp_cr OSAS
## 86                 0        0            0           0    0             0    0
## 8610               0        0            0           0    0             0    0
## 8611               0        0            0           0    0             0    0
## 8612               0        0            0           0    0             0    0
## 8613               0        0            0           0    0             0    0
## 107                0        0            0           0    0             0    0
##      steat_ep cirr_ep cardiop_isc cardiop_dil cardiop_iper_ostr valv_patia
## 86          0       0           0           0                 0          0
## 8610        0       0           0           0                 0          0
## 8611        0       0           0           0                 0          0
## 8612        0       0           0           0                 0          0
## 8613        0       0           0           0                 0          0
## 107         0       0           1           0                 0          0
##      pat_osteo_dis dep psic DCA iper_art ipogon PCO prev_chirurg_bar altezza
## 86               0   0    0   0        1      0   0                0     164
```

```
## 8610            0   0    0   0        1      0   0               0     164
## 8611            0   0    0   0        1      0   0               0     164
## 8612            0   0    0   0        1      0   0               0     164
## 8613            0   0    0   0        1      0   0               0     164
## 107             0   0    0   0        0      0   0               0     167
##          BMI circ_vita circ_fian rapporto_vita_fian PAS PAD freq_card
## 86   41.27008       118       135              0.874 120  80        62
## 8610 41.27008       118       135              0.874 120  80        62
## 8611 41.27008       118       135              0.874 120  80        62
## 8612 41.27008       118       135              0.874 120  80        62
## 8613 41.27008       118       135              0.874 120  80        62
## 107  36.39428       115       103              1.116 145  85        72
##      rapporto_vita_alt bioimped fm_kg fm_perc ffm_kg ffm_perc massa_musc_kg
## 86               0.719        1  55.2    49.9   55.4     50.1          28.1
## 8610             0.719        1  55.2    49.9   55.4     50.1          28.1
## 8611             0.719        1  55.2    49.9   55.4     50.1          28.1
## 8612             0.719        1  55.2    49.9   55.4     50.1          28.1
## 8613             0.719        1  55.2    49.9   55.4     50.1          28.1
## 107              0.688        1  38.3    37.9   62.7     62.1          43.0
##      massa_musc_perc acqua_extra acqua_intra calorim_ind harris_benedict
## 86              25.4        24.2        16.3           1         1739.33
## 8610            25.4        24.2        16.3           1         1739.33
## 8611            25.4        24.2        16.3           1         1739.33
## 8612            25.4        24.2        16.3           1         1739.33
## 8613            25.4        24.2        16.3           1         1739.33
## 107             42.6        22.0        28.2           1         1872.29
##      eritroc ematocr  emo vol_glob leuco piastr VES AST ALT gammaGT uric
## 86      4.70    43.6 14.2     92.8   8.4    220   8  16  15      12 10.0
## 8610    4.70    43.6 14.2     92.8   8.4    220   8  16  15      12 10.0
## 8611    4.70    43.6 14.2     92.8   8.4    220   8  16  15      12 10.0
## 8612    4.70    43.6 14.2     92.8   8.4    220   8  16  15      12 10.0
## 8613    4.70    43.6 14.2     92.8   8.4    220   8  16  15      12 10.0
## 107     5.66    35.8 10.7     63.2  11.0    237  26  41  41      31  5.7
##      creatin micr_album col_tot HDL LDL trigl glic_bas insulinem_bas emo_gli
## 86       1.1          3     210  68 137   117       94          16.0      35
## 8610     1.1          3     210  68 137   117       94          16.0      35
## 8611     1.1          3     210  68 137   117       94          16.0      35
## 8612     1.1          3     210  68 137   117       94          16.0      35
## 8613     1.1          3     210  68 137   117       94          16.0      35
## 107      0.9          4     171  30 121   189       90          24.7      39
##      calcemia sodio pot prot_C_reat  TSH calcifed neutrofili neutrofili_val
## 86        9.9   144 3.7         0.3 4.43      9.0         63            5.3
## 8610      9.9   144 3.7         0.3 4.43      9.0         63            5.3
## 8611      9.9   144 3.7         0.3 4.43      9.0         63            5.3
## 8612      9.9   144 3.7         0.3 4.43      9.0         63            5.3
## 8613      9.9   144 3.7         0.3 4.43      9.0         63            5.3
## 107       9.0   141 4.5         0.3 1.41     14.5         66            7.2
##      linfociti linfociti_val monociti monociti_val basofili basofili_val
## 86          26           2.2        7          0.6        1          0.1
## 8610        26           2.2        7          0.6        1          0.1
## 8611        26           2.2        7          0.6        1          0.1
## 8612        26           2.2        7          0.6        1          0.1
## 8613        26           2.2        7          0.6        1          0.1
## 107         23           2.5        8          0.9        0          0.0
```

```
##      other_tfa other_endocrine_agent insuline oral_antidiab
## 86           0                     1        0             0
## 8610         0                     1        0             0
## 8611         0                     1        0             0
## 8612         0                     1        0             0
## 8613         0                     1        0             0
## 107          1                     0        0             0
##      corticost_per_musculo NSAIDs antipsychotic antianxiety_antiinsonnia
## 86                       0      0             0                        0
## 8610                     0      0             0                        0
## 8611                     0      0             0                        0
## 8612                     0      0             0                        0
## 8613                     0      0             0                        0
## 107                      0      1             0                        0
##      antidepres combined_bronchodilators corticost_per_bronco methylxanthines
## 86            0                        0                    0               0
## 8610          0                        0                    0               0
## 8611          0                        0                    0               0
## 8612          0                        0                    0               0
## 8613          0                        0                    0               0
## 107           0                        0                    0               0
##      anticholinergic beta_adrenergic other_anticoag oral_anticoag
## 86                 0               0              0             0
## 8610               0               0              0             0
## 8611               0               0              0             0
## 8612               0               0              0             0
## 8613               0               0              0             0
## 107                0               0              0             0
##      other_anti_platelets dipirydamole clopidogrel ticlopidine acetyl_acid
## 86                      0           0           0          0           0
## 8610                    0           0           0          0           0
## 8611                    0           0           0          0           0
## 8612                    0           0           0          0           0
## 8613                    0           0           0          0           0
## 107                     0           0           0          0           1
##      statin_ezetimibe other_lipid_low ezetimibe fibrate statine
## 86                  0               0         0       0       0
## 8610                0               0         0       0       0
## 8611                0               0         0       0       0
## 8612                0               0         0       0       0
## 8613                0               0         0       0       0
## 107                 0               0         0       0       0
##      diur_pot_sp_diur BB_diur ARB_CCB ARB_diur ACE_CCB ACE_diur other_antihyp
## 86                  0       0       0        1       0        0             0
## 8610                0       0       0        1       0        0             0
## 8611                0       0       0        1       0        0             0
## 8612                0       0       0        1       0        0             0
## 8613                0       0       0        1       0        0             0
## 107                 0       0       0        1       0        0             0
##      diur CCB BB ARB ACE ecocardio stenosi_tricusp stenosi_mitr stenosi_aort
## 86      0   0  0   0   0         1               0            0            0
## 8610    0   0  0   0   0         1               0            0            0
## 8611    0   0  0   0   0         1               0            0            0
## 8612    0   0  0   0   0         1               0            0            0
```

```
## 8613    0   0  0   0   0         1               0            0           0
## 107     0   1  1   0   0         1               0            0           0
##      insuff_mitr insuff_polm insuff_aort IVS fib_atr_std segni_IVS_std
## 86             1           0           0   1           0             0
## 8610           1           0           0   1           0             0
## 8611           1           0           0   1           0             0
## 8612           1           0           0   1           0             0
## 8613           1           0           0   1           0             0
## 107            0           0           0   1           0             0
##      ritmo_sin_std ECG_STD eventi_cv altezza_step1     X     Y    Z
## 86               1       1         0           164 111.0 107.1 -3.9
## 8610             1       1         0           164 107.1 103.5 -3.6
## 8611             1       1         0           164 103.5  98.8 -4.7
## 8612             1       1         0           164  98.8  97.1 -1.7
## 8613             1       1         0           164  97.1  96.3 -0.8
## 107              1       1         1           167 101.5  97.6 -3.9
```

3. MODELS

Modelli senza VSURF

```
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:ggplot2':
##
##     margin
```

```
library(caret)
```

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

```
library(gbm)
```

```
## Warning: package 'gbm' was built under R version 4.3.3
```

```
## Loaded gbm 2.2.2
```

```
## This version of gbm is no longer under development. Consider transitioning to gbm3, https://github.co
```

```
X <- df[, !(colnames(df) %in% c('id', 'Y', 'Z'))]
y <- df$Z  # Utilizziamo la colonna 'Z' come target

# Standardizzazione per Bagging e Gradient
preProcess_scale <- preProcess(X, method = c("center", "scale"))
```

```
## Warning in preProcess.default(X, method = c("center", "scale")): These
## variables have zero variances: ret_diab_prolif, cirr_ep, ipogon, PCO, bioimped,
## corticost_per_bronco, methylxanthines, dipirydamole, ARB_CCB, ecocardio,
## stenosi_tricusp, insuff_polm, ECG_STD
```

```
X_scaled <- predict(preProcess_scale, X)
```

```r
# Cross-validation: K-fold con 10 fold
train_control <- trainControl(method = "cv", number = 10)

models <- list(
    "Random Forest" = train(X, y, method = "rf", trControl = trainControl(method = "cv", number = 10)),
    "Bagging" = train(X_scaled, y, method = "treebag", trControl = trainControl(method = "cv", number =
    "Gradient Boosting" = train(X_scaled, y, method = "gbm", trControl = trainControl(method = "cv", nu
)
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 7: ret_diab_prolif has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 15: cirr_ep has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 25: ipogon has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 26: PCO has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 37: bioimped has no variation.

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## "bernoulli", : variable 93: methylxanthines has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 99: dipirydamole has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 110: ARB_CCB has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 120: ecocardio has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 121: stenosi_tricusp has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 125: insuff_polm has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 131: ECG_STD has no variation.

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## "bernoulli", : variable 7: ret_diab_prolif has no variation.

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## "bernoulli", : variable 37: bioimped has no variation.
```

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## "bernoulli", : variable 99: dipirydamole has no variation.

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```

```
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## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 86: corticost_per_musculo has no variation.

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## "bernoulli", : variable 110: ARB_CCB has no variation.
```

```
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## "bernoulli", : variable 120: ecocardio has no variation.

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## "bernoulli", : variable 121: stenosi_tricusp has no variation.

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## "bernoulli", : variable 7: ret_diab_prolif has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 15: cirr_ep has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 23: DCA has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 25: ipogon has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 26: PCO has no variation.

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## "bernoulli", : variable 120: ecocardio has no variation.

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## "bernoulli", : variable 125: insuff_polm has no variation.

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## "bernoulli", : variable 131: ECG_STD has no variation.

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## "bernoulli", : variable 7: ret_diab_prolif has no variation.

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## "bernoulli", : variable 15: cirr_ep has no variation.

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## "bernoulli", : variable 23: DCA has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 25: ipogon has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 26: PCO has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 37: bioimped has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 92: corticost_per_bronco has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 93: methylxanthines has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 99: dipirydamole has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 110: ARB_CCB has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 120: ecocardio has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 121: stenosi_tricusp has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 125: insuff_polm has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 131: ECG_STD has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 7: ret_diab_prolif has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 15: cirr_ep has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 23: DCA has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 25: ipogon has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 26: PCO has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 37: bioimped has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 92: corticost_per_bronco has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 93: methylxanthines has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 99: dipirydamole has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 110: ARB_CCB has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 120: ecocardio has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 121: stenosi_tricusp has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 125: insuff_polm has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 131: ECG_STD has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 7: ret_diab_prolif has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 8: nefr_inc has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 15: cirr_ep has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 25: ipogon has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 26: PCO has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 37: bioimped has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 92: corticost_per_bronco has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 93: methylxanthines has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 99: dipirydamole has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 110: ARB_CCB has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 120: ecocardio has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 121: stenosi_tricusp has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 125: insuff_polm has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 131: ECG_STD has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 7: ret_diab_prolif has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 8: nefr_inc has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 15: cirr_ep has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 25: ipogon has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 26: PCO has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 37: bioimped has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 92: corticost_per_bronco has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 93: methylxanthines has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 99: dipirydamole has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 110: ARB_CCB has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 120: ecocardio has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 121: stenosi_tricusp has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 125: insuff_polm has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 131: ECG_STD has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 7: ret_diab_prolif has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 8: nefr_inc has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 15: cirr_ep has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 25: ipogon has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 26: PCO has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 37: bioimped has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 92: corticost_per_bronco has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 93: methylxanthines has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 99: dipirydamole has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 110: ARB_CCB has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 120: ecocardio has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 121: stenosi_tricusp has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 125: insuff_polm has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 131: ECG_STD has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 7: ret_diab_prolif has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 15: cirr_ep has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 25: ipogon has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 26: PCO has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 37: bioimped has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 92: corticost_per_bronco has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 93: methylxanthines has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 99: dipirydamole has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 110: ARB_CCB has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 120: ecocardio has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 121: stenosi_tricusp has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 125: insuff_polm has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 131: ECG_STD has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 7: ret_diab_prolif has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 15: cirr_ep has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 25: ipogon has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 26: PCO has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 37: bioimped has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 92: corticost_per_bronco has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 93: methylxanthines has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 99: dipirydamole has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 110: ARB_CCB has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 120: ecocardio has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 121: stenosi_tricusp has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 125: insuff_polm has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 131: ECG_STD has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 7: ret_diab_prolif has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 15: cirr_ep has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 25: ipogon has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 26: PCO has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 37: bioimped has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 92: corticost_per_bronco has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 93: methylxanthines has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 99: dipirydamole has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 110: ARB_CCB has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 120: ecocardio has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 121: stenosi_tricusp has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 125: insuff_polm has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 131: ECG_STD has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 7: ret_diab_prolif has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 15: cirr_ep has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 25: ipogon has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 26: PCO has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 37: bioimped has no variation.

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## "bernoulli", : variable 92: corticost_per_bronco has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 93: methylxanthines has no variation.

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## "bernoulli", : variable 99: dipirydamole has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 110: ARB_CCB has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 120: ecocardio has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 121: stenosi_tricusp has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 125: insuff_polm has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 131: ECG_STD has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 7: ret_diab_prolif has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 15: cirr_ep has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 25: ipogon has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 26: PCO has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 37: bioimped has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 92: corticost_per_bronco has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 93: methylxanthines has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 99: dipirydamole has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 110: ARB_CCB has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 120: ecocardio has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 121: stenosi_tricusp has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 125: insuff_polm has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 131: ECG_STD has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 7: ret_diab_prolif has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 15: cirr_ep has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 25: ipogon has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 26: PCO has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 37: bioimped has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 92: corticost_per_bronco has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 93: methylxanthines has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 99: dipirydamole has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 110: ARB_CCB has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 120: ecocardio has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 121: stenosi_tricusp has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 125: insuff_polm has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 131: ECG_STD has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 7: ret_diab_prolif has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 15: cirr_ep has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 25: ipogon has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 26: PCO has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 37: bioimped has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 92: corticost_per_bronco has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 93: methylxanthines has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 99: dipirydamole has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 110: ARB_CCB has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 120: ecocardio has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 121: stenosi_tricusp has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 125: insuff_polm has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 131: ECG_STD has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 7: ret_diab_prolif has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 15: cirr_ep has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 25: ipogon has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 26: PCO has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 37: bioimped has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 92: corticost_per_bronco has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 93: methylxanthines has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 99: dipirydamole has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 110: ARB_CCB has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 120: ecocardio has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 121: stenosi_tricusp has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 125: insuff_polm has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 131: ECG_STD has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 7: ret_diab_prolif has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 15: cirr_ep has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 25: ipogon has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 26: PCO has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 37: bioimped has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 92: corticost_per_bronco has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 93: methylxanthines has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 99: dipirydamole has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 110: ARB_CCB has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 120: ecocardio has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 121: stenosi_tricusp has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 125: insuff_polm has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 131: ECG_STD has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 7: ret_diab_prolif has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 15: cirr_ep has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 18: cardiop_iper_ostr has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 25: ipogon has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 26: PCO has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 37: bioimped has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 92: corticost_per_bronco has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 93: methylxanthines has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 99: dipirydamole has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 110: ARB_CCB has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 120: ecocardio has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 121: stenosi_tricusp has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 125: insuff_polm has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 131: ECG_STD has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 7: ret_diab_prolif has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 15: cirr_ep has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 18: cardiop_iper_ostr has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 25: ipogon has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 26: PCO has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 37: bioimped has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 92: corticost_per_bronco has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 93: methylxanthines has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 99: dipirydamole has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 110: ARB_CCB has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 120: ecocardio has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 121: stenosi_tricusp has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 125: insuff_polm has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 131: ECG_STD has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 7: ret_diab_prolif has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 15: cirr_ep has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 18: cardiop_iper_ostr has no variation.

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## "bernoulli", : variable 26: PCO has no variation.
```

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## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
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## "bernoulli", : variable 37: bioimped has no variation.

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## "bernoulli", : variable 93: methylxanthines has no variation.

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## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 125: insuff_polm has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 131: ECG_STD has no variation.

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## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 15: cirr_ep has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 25: ipogon has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 26: PCO has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 37: bioimped has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 92: corticost_per_bronco has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 93: methylxanthines has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 99: dipirydamole has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 110: ARB_CCB has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 120: ecocardio has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 121: stenosi_tricusp has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 125: insuff_polm has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 131: ECG_STD has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 7: ret_diab_prolif has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 15: cirr_ep has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
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## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
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## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
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## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 92: corticost_per_bronco has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 93: methylxanthines has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 99: dipirydamole has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 110: ARB_CCB has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 120: ecocardio has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 121: stenosi_tricusp has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 125: insuff_polm has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 131: ECG_STD has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 7: ret_diab_prolif has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 15: cirr_ep has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 25: ipogon has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 26: PCO has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 37: bioimped has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 92: corticost_per_bronco has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 93: methylxanthines has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 99: dipirydamole has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 110: ARB_CCB has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 120: ecocardio has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 121: stenosi_tricusp has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 125: insuff_polm has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 131: ECG_STD has no variation.
```

```r
# Funzione per restituire le previsioni con cross-validation
get_predictions_cv <- function(model, X) {
    predictions <- predict(model, X)
    return(predictions)
}
```

```r
df_predictions <- df

for (name in names(models)) {
    if (name == "Random Forest") {
        df_predictions[[paste0(name, "_prediction")]] <- get_predictions_cv(models[[name]], X)  # Previ
    } else {
        df_predictions[[paste0(name, "_prediction")]] <- get_predictions_cv(models[[name]], X_scaled)
    }
}

head(df_predictions)
```

```
##       id gender eta qualification job_category dm ret_diab_nprolif
## 86    98      1  60             4            4  0                0
## 8610  98      1  60             4            4  0                0
## 8611  98      1  60             4            4  0                0
## 8612  98      1  60             4            4  0                0
## 8613  98      1  60             4            4  0                0
## 107  121      0  64             4           12  0                0
##      ret_diab_prolif nefr_inc insuf_ren_cr neurop_diab BPCO insuf_resp_cr OSAS
## 86                 0        0            0           0    0             0    0
## 8610               0        0            0           0    0             0    0
## 8611               0        0            0           0    0             0    0
## 8612               0        0            0           0    0             0    0
## 8613               0        0            0           0    0             0    0
## 107                0        0            0           0    0             0    0
##      steat_ep cirr_ep cardiop_isc cardiop_dil cardiop_iper_ostr valv_patia
## 86          0       0           0           0                 0          0
## 8610        0       0           0           0                 0          0
## 8611        0       0           0           0                 0          0
## 8612        0       0           0           0                 0          0
## 8613        0       0           0           0                 0          0
## 107         0       0           1           0                 0          0
##      pat_osteo_dis dep psic DCA iper_art ipogon PCO prev_chirurg_bar altezza
## 86               0   0    0   0        1      0   0                0     164
## 8610             0   0    0   0        1      0   0                0     164
## 8611             0   0    0   0        1      0   0                0     164
## 8612             0   0    0   0        1      0   0                0     164
## 8613             0   0    0   0        1      0   0                0     164
## 107              0   0    0   0        0      0   0                0     167
##           BMI circ_vita circ_fian rapporto_vita_fian PAS PAD freq_card
## 86   41.27008       118       135              0.874 120  80        62
## 8610 41.27008       118       135              0.874 120  80        62
## 8611 41.27008       118       135              0.874 120  80        62
## 8612 41.27008       118       135              0.874 120  80        62
## 8613 41.27008       118       135              0.874 120  80        62
## 107  36.39428       115       103              1.116 145  85        72
##      rapporto_vita_alt bioimped fm_kg fm_perc ffm_kg ffm_perc massa_musc_kg
## 86               0.719        1  55.2    49.9   55.4     50.1          28.1
## 8610             0.719        1  55.2    49.9   55.4     50.1          28.1
## 8611             0.719        1  55.2    49.9   55.4     50.1          28.1
## 8612             0.719        1  55.2    49.9   55.4     50.1          28.1
## 8613             0.719        1  55.2    49.9   55.4     50.1          28.1
## 107              0.688        1  38.3    37.9   62.7     62.1          43.0
```

```
##      massa_musc_perc acqua_extra acqua_intra calorim_ind harris_benedict
## 86              25.4        24.2        16.3           1         1739.33
## 8610            25.4        24.2        16.3           1         1739.33
## 8611            25.4        24.2        16.3           1         1739.33
## 8612            25.4        24.2        16.3           1         1739.33
## 8613            25.4        24.2        16.3           1         1739.33
## 107             42.6        22.0        28.2           1         1872.29
##      eritroc ematocr  emo vol_glob leuco piastr VES AST ALT gammaGT uric
## 86      4.70    43.6 14.2     92.8   8.4    220   8  16  15      12 10.0
## 8610    4.70    43.6 14.2     92.8   8.4    220   8  16  15      12 10.0
## 8611    4.70    43.6 14.2     92.8   8.4    220   8  16  15      12 10.0
## 8612    4.70    43.6 14.2     92.8   8.4    220   8  16  15      12 10.0
## 8613    4.70    43.6 14.2     92.8   8.4    220   8  16  15      12 10.0
## 107     5.66    35.8 10.7     63.2  11.0    237  26  41  41      31  5.7
##      creatin micr_album col_tot HDL LDL trigl glic_bas insulinem_bas emo_gli
## 86       1.1          3     210  68 137   117       94          16.0      35
## 8610     1.1          3     210  68 137   117       94          16.0      35
## 8611     1.1          3     210  68 137   117       94          16.0      35
## 8612     1.1          3     210  68 137   117       94          16.0      35
## 8613     1.1          3     210  68 137   117       94          16.0      35
## 107      0.9          4     171  30 121   189       90          24.7      39
##      calcemia sodio pot prot_C_reat  TSH calcifed neutrofili neutrofili_val
## 86        9.9   144 3.7         0.3 4.43      9.0         63            5.3
## 8610      9.9   144 3.7         0.3 4.43      9.0         63            5.3
## 8611      9.9   144 3.7         0.3 4.43      9.0         63            5.3
## 8612      9.9   144 3.7         0.3 4.43      9.0         63            5.3
## 8613      9.9   144 3.7         0.3 4.43      9.0         63            5.3
## 107       9.0   141 4.5         0.3 1.41     14.5         66            7.2
##      linfociti linfociti_val monociti monociti_val basofili basofili_val
## 86          26           2.2        7          0.6        1          0.1
## 8610        26           2.2        7          0.6        1          0.1
## 8611        26           2.2        7          0.6        1          0.1
## 8612        26           2.2        7          0.6        1          0.1
## 8613        26           2.2        7          0.6        1          0.1
## 107         23           2.5        8          0.9        0          0.0
##      other_tfa other_endocrine_agent insuline oral_antidiab
## 86           0                     1        0             0
## 8610         0                     1        0             0
## 8611         0                     1        0             0
## 8612         0                     1        0             0
## 8613         0                     1        0             0
## 107          1                     0        0             0
##      corticost_per_musculo NSAIDs antipsychotic antianxiety_antiinsonnia
## 86                       0      0             0                       0
## 8610                     0      0             0                       0
## 8611                     0      0             0                       0
## 8612                     0      0             0                       0
## 8613                     0      0             0                       0
## 107                      0      1             0                       0
##      antidepres combined_bronchodilators corticost_per_bronco methylxanthines
## 86            0                        0                    0               0
## 8610          0                        0                    0               0
## 8611          0                        0                    0               0
## 8612          0                        0                    0               0
```

```
## 8613          0                       0                   0              0
## 107           0                       0                   0              0
##      anticholinergic beta_adrenergic other_anticoag oral_anticoag
## 86                 0              0              0             0
## 8610               0              0              0             0
## 8611               0              0              0             0
## 8612               0              0              0             0
## 8613               0              0              0             0
## 107                0              0              0             0
##      other_anti_platelets dipirydamole clopidogrel ticlopidine acetyl_acid
## 86                      0           0           0           0           0
## 8610                    0           0           0           0           0
## 8611                    0           0           0           0           0
## 8612                    0           0           0           0           0
## 8613                    0           0           0           0           0
## 107                     0           0           0           0           1
##      statin_ezetimibe other_lipid_low ezetimibe fibrate statine
## 86                 0               0         0       0       0
## 8610               0               0         0       0       0
## 8611               0               0         0       0       0
## 8612               0               0         0       0       0
## 8613               0               0         0       0       0
## 107                0               0         0       0       0
##      diur_pot_sp_diur BB_diur ARB_CCB ARB_diur ACE_CCB ACE_diur other_antihyp
## 86                  0       0       0        1       0        0             0
## 8610                0       0       0        1       0        0             0
## 8611                0       0       0        1       0        0             0
## 8612                0       0       0        1       0        0             0
## 8613                0       0       0        1       0        0             0
## 107                 0       0       0        1       0        0             0
##      diur CCB BB ARB ACE ecocardio stenosi_tricusp stenosi_mitr stenosi_aort
## 86      0   0  0   0   0         1               0            0            0
## 8610    0   0  0   0   0         1               0            0            0
## 8611    0   0  0   0   0         1               0            0            0
## 8612    0   0  0   0   0         1               0            0            0
## 8613    0   0  0   0   0         1               0            0            0
## 107     0   1  1   0   0         1               0            0            0
##      insuff_mitr insuff_polm insuff_aort IVS fib_atr_std segni_IVS_std
## 86             1           0           0   1           0            0
## 8610           1           0           0   1           0            0
## 8611           1           0           0   1           0            0
## 8612           1           0           0   1           0            0
## 8613           1           0           0   1           0            0
## 107            0           0           0   1           0            0
##      ritmo_sin_std ECG_STD eventi_cv altezza_step1     X     Y    Z
## 86               1       1         0           164 111.0 107.1 -3.9
## 8610             1       1         0           164 107.1 103.5 -3.6
## 8611             1       1         0           164 103.5  98.8 -4.7
## 8612             1       1         0           164  98.8  97.1 -1.7
## 8613             1       1         0           164  97.1  96.3 -0.8
## 107              1       1         1           167 101.5  97.6 -3.9
##      Random Forest_prediction Bagging_prediction Gradient Boosting_prediction
## 86                 -3.366263         -3.683799                   -3.703701
## 8610               -3.361562         -3.518658                   -3.703701
```

```
## 8611                -3.341072          -3.290476                  -3.340387
## 8612                -3.264288          -2.974060                  -3.340387
## 8613                -3.251789          -2.974060                  -2.849843
## 107                 -3.644078          -2.662059                  -3.409129
```

```
library(Metrics)
```

```
##
## Attaching package: 'Metrics'
```

```
## The following objects are masked from 'package:caret':
##
##     precision, recall
```

```
calculate_performance_metrics <- function(y_true, y_pred) {
    mae <- mae(y_true, y_pred)
    mse <- mse(y_true, y_pred)
    rmse <- sqrt(mse)
    varianza <- var(y_true)
    mse_vs_var <- mse / varianza

    return(c(
        'MAE' = mae,
        'MSE' = mse,
        'RMSE' = rmse,
        'MSE vs Varianza' = mse_vs_var
    ))
}

performance_results <- list()

for (model_name in c('Random Forest', 'Bagging', 'Gradient Boosting')) {
    pred_column <- paste0(model_name, "_prediction")  # Nome della colonna per ogni modello
    performance_results[[model_name]] <- calculate_performance_metrics(df_predictions$Z, df_predictions
}

# Converti i risultati in un dataframe
df_performance <- as.data.frame(do.call(rbind, performance_results))
print(df_performance)
```

```
##                         MAE      MSE     RMSE MSE vs Varianza
## Random Forest      2.575763 15.09613 3.885374       0.6594754
## Bagging            2.326149 14.39607 3.794215       0.6288933
## Gradient Boosting 2.775643 17.19050 4.146142       0.7509679
```

con VSURF

```
library(randomForest)
library(caret)  # Per Bagging e cross-validation
library(gbm)    # Gradient Boosting
library(VSURF)  # Per la selezione delle variabili con VSURF


X <- df[, !(colnames(df) %in% c('id', 'Y', 'Z'))]
y <- df$Z
```

```r
# Applica VSURF per la selezione delle variabili
vsurf_model <- VSURF(X, y)
```

```
## Thresholding step
## Estimated computational time (on one core): 11 sec.
##   |                                                                              |
## Interpretation step (on 20 variables)
## Estimated computational time (on one core): between 1.8 sec. and  4.4 sec.
##   |                                                                              |
## Prediction step (on 2 variables)
## Maximum estimated computational time (on one core): 0.2 sec.
##   |                                                                              |
```

```r
# Ottieni le variabili selezionate
selected_variables <- vsurf_model$varselect.pred

if (length(selected_variables) > 0) {
    # Usa solo le variabili selezionate da VSURF
    X_selected <- X[, selected_variables]

    X_selected <- as.data.frame(X_selected)

    # Standardizzazione delle caratteristiche (necessaria per Bagging e Gradient Boosting)
    preProcess_scale <- preProcess(X_selected, method = c("center", "scale"))
    X_scaled_selected <- predict(preProcess_scale, X_selected)

    # Definizione della cross-validation: K-fold con 10 fold
    train_control <- trainControl(method = "cv", number = 10)

    models_vsurf <- list(
        "Random Forest" = train(X_selected, y, method = "rf", trControl = trainControl(method = "cv", nu
        "Bagging" = train(X_scaled_selected, y, method = "treebag", trControl = trainControl(method = "
        "Gradient Boosting" = train(X_scaled_selected, y, method = "gbm", trControl = trainControl(metho
    )

    # Funzione per restituire le previsioni con cross-validation
    get_predictions_cv <- function(model, X) {
        predictions <- predict(model, X)
        return(predictions)
    }

    df_predictions_vsurf <- df  # Questa è la copia che conterrà le previsioni

    for (name in names(models_vsurf)) {
        if (name == "Random Forest") {
            df_predictions_vsurf[[paste0(name, "_VSURF_prediction")]] <- get_predictions_cv(models_vsuri
        } else {
            df_predictions_vsurf[[paste0(name, "_VSURF_prediction")]] <- get_predictions_cv(models_vsuri
        }
    }

    head(df_predictions_vsurf)
} else {
    print("VSURF non ha selezionato alcuna variabile.")
```

```
}
```

```
## note: only 1 unique complexity parameters in default grid. Truncating the grid to 1 .
```

```
##       id gender eta qualification job_category dm ret_diab_nprolif
## 86    98      1  60             4            4  0                0
## 8610  98      1  60             4            4  0                0
## 8611  98      1  60             4            4  0                0
## 8612  98      1  60             4            4  0                0
## 8613  98      1  60             4            4  0                0
## 107  121      0  64             4           12  0                0
##      ret_diab_prolif nefr_inc insuf_ren_cr neurop_diab BPCO insuf_resp_cr OSAS
## 86                 0        0            0           0    0             0    0
## 8610               0        0            0           0    0             0    0
## 8611               0        0            0           0    0             0    0
## 8612               0        0            0           0    0             0    0
## 8613               0        0            0           0    0             0    0
## 107                0        0            0           0    0             0    0
##      steat_ep cirr_ep cardiop_isc cardiop_dil cardiop_iper_ostr valv_patia
## 86          0       0           0           0                 0          0
## 8610        0       0           0           0                 0          0
## 8611        0       0           0           0                 0          0
## 8612        0       0           0           0                 0          0
## 8613        0       0           0           0                 0          0
## 107         0       0           1           0                 0          0
##      pat_osteo_dis dep psic DCA iper_art ipogon PCO prev_chirurg_bar altezza
## 86               0   0    0   0        1      0   0                0     164
## 8610             0   0    0   0        1      0   0                0     164
## 8611             0   0    0   0        1      0   0                0     164
## 8612             0   0    0   0        1      0   0                0     164
## 8613             0   0    0   0        1      0   0                0     164
## 107              0   0    0   0        0      0   0                0     167
##           BMI circ_vita circ_fian rapporto_vita_fian PAS PAD freq_card
## 86   41.27008       118       135              0.874 120  80        62
## 8610 41.27008       118       135              0.874 120  80        62
## 8611 41.27008       118       135              0.874 120  80        62
## 8612 41.27008       118       135              0.874 120  80        62
## 8613 41.27008       118       135              0.874 120  80        62
## 107  36.39428       115       103              1.116 145  85        72
##      rapporto_vita_alt bioimped fm_kg fm_perc ffm_kg ffm_perc massa_musc_kg
## 86               0.719        1  55.2    49.9   55.4     50.1          28.1
## 8610             0.719        1  55.2    49.9   55.4     50.1          28.1
## 8611             0.719        1  55.2    49.9   55.4     50.1          28.1
## 8612             0.719        1  55.2    49.9   55.4     50.1          28.1
## 8613             0.719        1  55.2    49.9   55.4     50.1          28.1
## 107              0.688        1  38.3    37.9   62.7     62.1          43.0
##      massa_musc_perc acqua_extra acqua_intra calorim_ind harris_benedict
## 86              25.4        24.2        16.3           1         1739.33
## 8610            25.4        24.2        16.3           1         1739.33
## 8611            25.4        24.2        16.3           1         1739.33
## 8612            25.4        24.2        16.3           1         1739.33
## 8613            25.4        24.2        16.3           1         1739.33
## 107             42.6        22.0        28.2           1         1872.29
##      eritroc ematocr  emo vol_glob leuco piastr VES AST ALT gammaGT uric
```

```
## 86      4.70    43.6 14.2     92.8   8.4    220   8  16  15      12 10.0
## 8610    4.70    43.6 14.2     92.8   8.4    220   8  16  15      12 10.0
## 8611    4.70    43.6 14.2     92.8   8.4    220   8  16  15      12 10.0
## 8612    4.70    43.6 14.2     92.8   8.4    220   8  16  15      12 10.0
## 8613    4.70    43.6 14.2     92.8   8.4    220   8  16  15      12 10.0
## 107     5.66    35.8 10.7     63.2  11.0    237  26  41  41      31  5.7
##      creatin micr_album col_tot HDL LDL trigl glic_bas insulinem_bas emo_gli
## 86       1.1          3     210  68 137   117       94          16.0      35
## 8610     1.1          3     210  68 137   117       94          16.0      35
## 8611     1.1          3     210  68 137   117       94          16.0      35
## 8612     1.1          3     210  68 137   117       94          16.0      35
## 8613     1.1          3     210  68 137   117       94          16.0      35
## 107      0.9          4     171  30 121   189       90          24.7      39
##      calcemia sodio pot prot_C_reat  TSH calcifed neutrofili neutrofili_val
## 86        9.9   144 3.7         0.3 4.43      9.0         63            5.3
## 8610      9.9   144 3.7         0.3 4.43      9.0         63            5.3
## 8611      9.9   144 3.7         0.3 4.43      9.0         63            5.3
## 8612      9.9   144 3.7         0.3 4.43      9.0         63            5.3
## 8613      9.9   144 3.7         0.3 4.43      9.0         63            5.3
## 107       9.0   141 4.5         0.3 1.41     14.5         66            7.2
##      linfociti linfociti_val monociti monociti_val basofili basofili_val
## 86          26           2.2        7          0.6        1          0.1
## 8610        26           2.2        7          0.6        1          0.1
## 8611        26           2.2        7          0.6        1          0.1
## 8612        26           2.2        7          0.6        1          0.1
## 8613        26           2.2        7          0.6        1          0.1
## 107         23           2.5        8          0.9        0          0.0
##      other_tfa other_endocrine_agent insuline oral_antidiab
## 86           0                     1        0             0
## 8610         0                     1        0             0
## 8611         0                     1        0             0
## 8612         0                     1        0             0
## 8613         0                     1        0             0
## 107          1                     0        0             0
##      corticost_per_musculo NSAIDs antipsychotic antianxiety_antiinsonnia
## 86                       0      0             0                        0
## 8610                     0      0             0                        0
## 8611                     0      0             0                        0
## 8612                     0      0             0                        0
## 8613                     0      0             0                        0
## 107                      0      1             0                        0
##      antidepres combined_bronchodilators corticost_per_bronco methylxanthines
## 86            0                        0                    0               0
## 8610          0                        0                    0               0
## 8611          0                        0                    0               0
## 8612          0                        0                    0               0
## 8613          0                        0                    0               0
## 107           0                        0                    0               0
##      anticholinergic beta_adrenergic other_anticoag oral_anticoag
## 86                 0               0              0             0
## 8610               0               0              0             0
## 8611               0               0              0             0
## 8612               0               0              0             0
## 8613               0               0              0             0
```

```
## 107                0               0              0             0
##      other_anti_platelets dipirydamole clopidogrel ticlopidine acetyl_acid
## 86                      0            0           0           0           0
## 8610                    0            0           0           0           0
## 8611                    0            0           0           0           0
## 8612                    0            0           0           0           0
## 8613                    0            0           0           0           0
## 107                     0            0           0           0           1
##      statin_ezetimibe other_lipid_low ezetimibe fibrate statine
## 86                  0               0         0       0       0
## 8610                0               0         0       0       0
## 8611                0               0         0       0       0
## 8612                0               0         0       0       0
## 8613                0               0         0       0       0
## 107                 0               0         0       0       0
##      diur_pot_sp_diur BB_diur ARB_CCB ARB_diur ACE_CCB ACE_diur other_antihyp
## 86                  0       0       0        1       0        0             0
## 8610                0       0       0        1       0        0             0
## 8611                0       0       0        1       0        0             0
## 8612                0       0       0        1       0        0             0
## 8613                0       0       0        1       0        0             0
## 107                 0       0       0        1       0        0             0
##      diur CCB BB ARB ACE ecocardio stenosi_tricusp stenosi_mitr stenosi_aort
## 86      0   0  0   0   0         1               0            0            0
## 8610    0   0  0   0   0         1               0            0            0
## 8611    0   0  0   0   0         1               0            0            0
## 8612    0   0  0   0   0         1               0            0            0
## 8613    0   0  0   0   0         1               0            0            0
## 107     0   1  1   0   0         1               0            0            0
##      insuff_mitr insuff_polm insuff_aort IVS fib_atr_std segni_IVS_std
## 86             1           0           0   1           0            0
## 8610           1           0           0   1           0            0
## 8611           1           0           0   1           0            0
## 8612           1           0           0   1           0            0
## 8613           1           0           0   1           0            0
## 107            0           0           0   1           0            0
##      ritmo_sin_std ECG_STD eventi_cv altezza_step1     X     Y    Z
## 86               1       1         0           164 111.0 107.1 -3.9
## 8610             1       1         0           164 107.1 103.5 -3.6
## 8611             1       1         0           164 103.5  98.8 -4.7
## 8612             1       1         0           164  98.8  97.1 -1.7
## 8613             1       1         0           164  97.1  96.3 -0.8
## 107              1       1         1           167 101.5  97.6 -3.9
##      Random Forest_VSURF_prediction Bagging_VSURF_prediction
## 86                       -6.434545                -5.451100
## 8610                     -4.211353                -4.988040
## 8611                     -3.814360                -3.379389
## 8612                     -2.859160                -3.610805
## 8613                     -1.875517                -2.329302
## 107                      -4.520687                -3.998637
##      Gradient Boosting_VSURF_prediction
## 86                           -6.070773
## 8610                         -4.766060
## 8611                         -3.817128
```

```
## 8612                          -3.555147
## 8613                          -2.902764
## 107                           -3.548144
```

```
performance_results_vsurf <- list()

for (model_name in c('Random Forest', 'Bagging', 'Gradient Boosting')) {
    pred_column <- paste0(model_name, "_VSURF_prediction")  # Nome della colonna per i modelli con VSUR
    performance_results_vsurf[[model_name]] <- calculate_performance_metrics(df_predictions_vsurf$Z, df_
}

df_performance_vsurf <- as.data.frame(do.call(rbind, performance_results_vsurf))
print(df_performance_vsurf)
```

```
##                         MAE       MSE     RMSE MSE vs Varianza
## Random Forest      1.704859  7.246312 2.691897       0.3165556
## Bagging            2.560376 16.207055 4.025799       0.7080063
## Gradient Boosting  3.021911 19.405986 4.405223       0.8477518
```

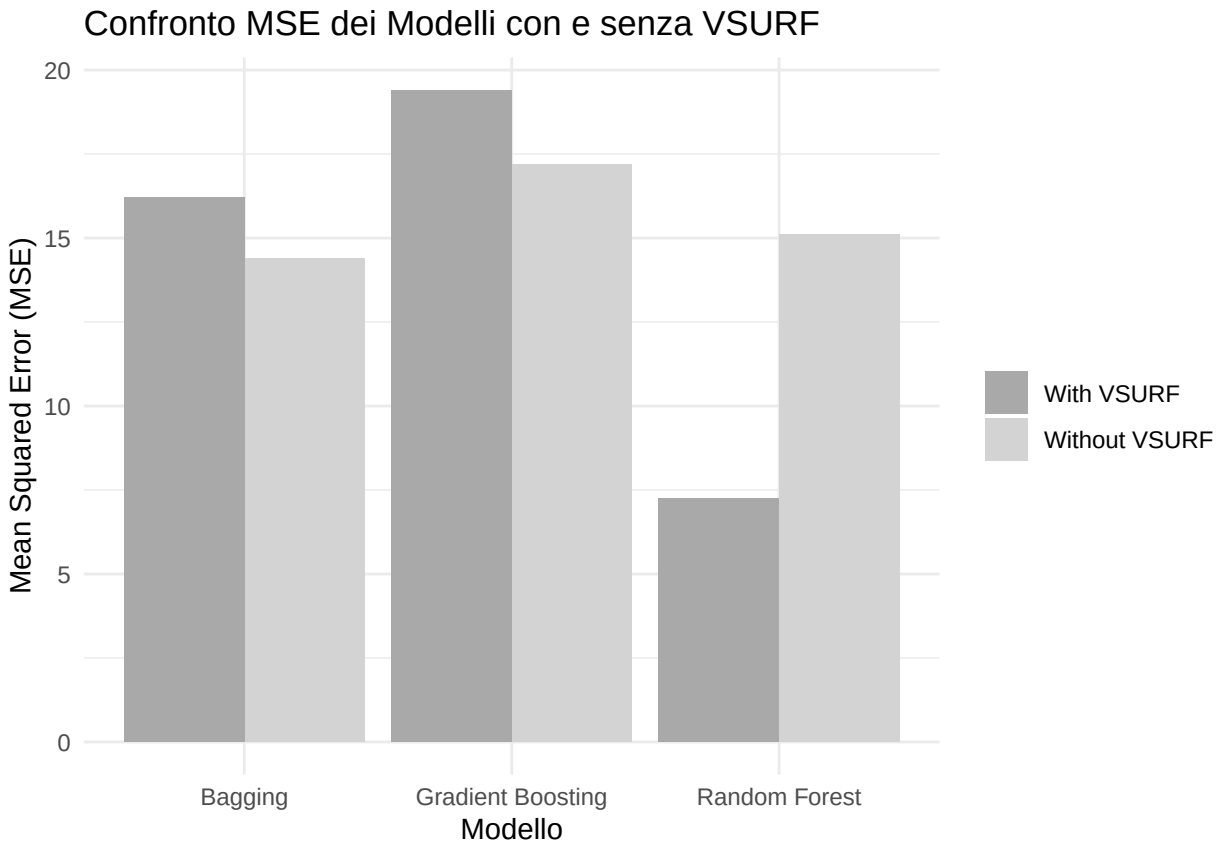
```
mse_data <- data.frame(
    Model = rep(c("Random Forest", "Bagging", "Gradient Boosting"), each = 2),
    VSURF = rep(c("Without VSURF", "With VSURF"), times = 3),
    MSE = c(
        df_performance$MSE[1], df_performance_vsurf$MSE[1],
        df_performance$MSE[2], df_performance_vsurf$MSE[2],
        df_performance$MSE[3], df_performance_vsurf$MSE[3]
    )
)

print(mse_data)
```

```
##               Model          VSURF       MSE
## 1     Random Forest Without VSURF 15.096130
## 2     Random Forest    With VSURF  7.246312
## 3           Bagging Without VSURF 14.396070
## 4           Bagging    With VSURF 16.207055
## 5 Gradient Boosting Without VSURF 17.190496
## 6 Gradient Boosting    With VSURF 19.405986
```

```
library(ggplot2)

ggplot(mse_data, aes(x = Model, y = MSE, fill = VSURF)) +
    geom_bar(stat = "identity", position = "dodge") +
    labs(title = "Confronto MSE dei Modelli con e senza VSURF",
         x = "Modello",
         y = "Mean Squared Error (MSE)") +
    theme_minimal() +
    scale_fill_manual(values = c("Without VSURF" = "light grey", "With VSURF" = "dark grey")) +
    theme(legend.title = element_blank())
```

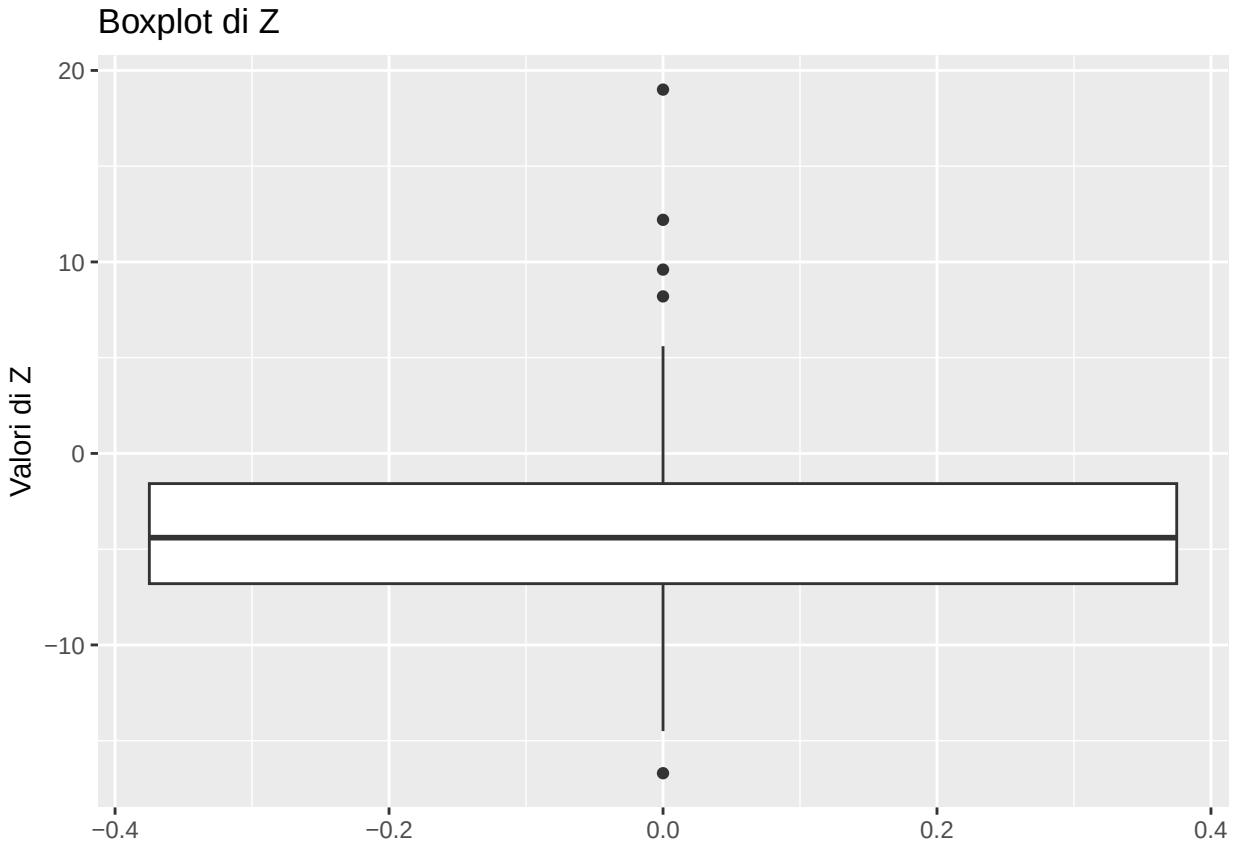


Gestione outliers

Elimino gli outliers della variabile target che possono creare dei problemi ai modelli

```
library(ggplot2)

ggplot(df, aes(y = Z)) +
  geom_boxplot() +
  labs(title = "Boxplot di Z", y = "Valori di Z")
```




```
identify_and_remove_outliers <- function(df, column) {

  Q1 <- quantile(df[[column]], 0.25)
  Q3 <- quantile(df[[column]], 0.75)
  IQR <- Q3 - Q1

  lower_bound <- Q1 - 1.5 * IQR
  upper_bound <- Q3 + 1.5 * IQR

  # Identifica gli outliers
  outliers <- df[df[[column]] < lower_bound | df[[column]] > upper_bound, ]

  # Stampo numero
  cat("Outliers identificati:\n")
  print(outliers)

  # Rimozione
  df_cleaned <- df[df[[column]] >= lower_bound & df[[column]] <= upper_bound, ]

  return(df_cleaned)
}

#eseguo sulla colonna Z
df_no_outliers <- identify_and_remove_outliers(df, 'Z')
```

```
## Outliers identificati:
##         id gender eta qualification job_category dm ret_diab_nprolif
```

```
## 9481   985      0  56             3           10  1               0
## 13561 1406      0  66             3           12  0               0
## 1377  1428      0  84             3           12  1               1
## 13771 1428      0  84             3           12  1               1
## 14391 1493      0  58             4           10  0               0
##       ret_diab_prolif nefr_inc insuf_ren_cr neurop_diab BPCO insuf_resp_cr OSAS
## 9481                0        0            0           0    1             0    1
## 13561               0        0            0           0    1             0    1
## 1377                0        0            0           1    1             0    0
## 13771               0        0            0           1    1             0    0
## 14391               0        0            0           0    0             0    0
##       steat_ep cirr_ep cardiop_isc cardiop_dil cardiop_iper_ostr valv_patia
## 9481         0       0           0           0                 0          0
## 13561        1       0           0           0                 0          0
## 1377         0       0           1           0                 0          1
## 13771        0       0           1           0                 0          1
## 14391        1       0           0           0                 0          0
##       pat_osteo_dis dep psic DCA iper_art ipogon PCO prev_chirurg_bar altezza
## 9481              0   0    0   0        1      0   0                0   168.0
## 13561             0   0    0   0        1      0   0                0   166.6
## 1377              1   0    0   0        1      0   0                0   162.0
## 13771             1   0    0   0        1      0   0                0   162.0
## 14391             0   0    0   0        0      0   0                0   178.0
##           BMI circ_vita circ_fian rapporto_vita_fian PAS PAD freq_card
## 9481  51.79989       148       140              1.057 150  80        96
## 13561 36.74939       122       106              1.150 140  90        81
## 1377  42.29538       136       133              1.022 140  80        80
## 13771 42.29538       136       133              1.022 140  80        80
## 14391 53.30766       156       163              0.957 150 100        93
##       rapporto_vita_alt bioimped fm_kg fm_perc ffm_kg ffm_perc massa_musc_kg
## 9481              0.880        1  61.1    42.0   84.3     58.0          52.6
## 13561             0.732        1  36.7    36.0   65.0     64.0          39.5
## 1377              0.839        1  46.4    42.6   62.6     57.4          33.9
## 13771             0.839        1  46.4    42.6   62.6     57.4          33.9
## 14391             0.876        1  64.5    38.4  103.4     61.6          52.4
##       massa_musc_perc acqua_extra acqua_intra calorim_ind harris_benedict
## 9481             36.2        30.3        31.4           0         2544.61
## 13561            38.9        26.5        25.5           0         2303.96
## 1377             31.1        28.6        21.4           1         1835.15
## 13771            31.1        28.6        21.4           1         1835.15
## 14391            31.2        45.3        30.4           0         2885.96
##       eritroc ematocr  emo vol_glob leuco piastr VES AST ALT gammaGT uric
## 9481     4.97    42.2 14.1     84.9   7.9    169  26  32  37      39  7.4
## 13561    4.44    43.7 14.5     98.4   6.5    226  26  45  37     174 10.0
## 1377     3.91    38.6 12.9     98.6   5.8    125  46  14  13      19  6.8
## 13771    3.91    38.6 12.9     98.6   5.8    125  46  14  13      19  6.8
## 14391    4.67    42.6 13.6     91.3  10.0    289  38  20  22      37  6.7
##       creatin micr_album col_tot HDL LDL trigl glic_bas insulinem_bas emo_gli
## 9481     0.50          9     162  44 107   161      157          26.2      53
## 13561    0.94         13     226  52 155   183      109          14.2      45
## 1377     1.07         13     238  58 174    79      178           9.9      52
## 13771    1.07         13     238  58 174    79      178           9.9      52
## 14391    1.00          5     176  38 120   136      109          15.6      41
##       calcemia sodio pot prot_C_reat  TSH calcifed neutrofili neutrofili_val
```

```
## 9481       9.6   139 4.1         0.5 1.75     26.2         60            4.7
## 13561      9.6   141 4.5         0.2 2.16     24.1         60            3.8
## 1377       9.2   139 4.4         0.3 2.05     11.9         49            2.9
## 13771      9.2   139 4.4         0.3 2.05     11.9         49            2.9
## 14391      9.4   140 4.0         0.9 1.05      9.0         57            5.7
##       linfociti linfociti_val monociti monociti_val basofili basofili_val
## 9481         29           2.3        8          0.6        1          0.0
## 13561        25           1.6       13          0.8        1          0.0
## 1377         34           2.0       11          0.6        1          0.0
## 13771        34           2.0       11          0.6        1          0.0
## 14391        29           2.9        9          0.9        1          0.1
##       other_tfa other_endocrine_agent insuline oral_antidiab
## 9481          1                     0        0             1
## 13561         1                     0        0             0
## 1377          1                     0        1             0
## 13771         1                     0        1             0
## 14391         1                     0        0             0
##       corticost_per_musculo NSAIDs antipsychotic antianxiety_antiinsonnia
## 9481                      0      0             0                       0
## 13561                     0      0             0                       0
## 1377                      0      0             0                       0
## 13771                     0      0             0                       0
## 14391                     0      1             0                       0
##       antidepres combined_bronchodilators corticost_per_bronco methylxanthines
## 9481           0                        1                    0               0
## 13561          0                        1                    0               0
## 1377           0                        0                    0               0
## 13771          0                        0                    0               0
## 14391          0                        0                    0               0
##       anticholinergic beta_adrenergic other_anticoag oral_anticoag
## 9481                1               0              0             0
## 13561               0               0              0             0
## 1377                0               0              0             0
## 13771               0               0              0             0
## 14391               0               0              0             0
##       other_anti_platelets dipirydamole clopidogrel ticlopidine acetyl_acid
## 9481                     0           0           0          0           0
## 13561                    0           0           0          0           0
## 1377                     0           0           0          1           0
## 13771                    0           0           0          1           0
## 14391                    0           0           0          0           0
##       statin_ezetimibe other_lipid_low ezetimibe fibrate statine
## 9481                 0               0         0       0       0
## 13561                0               0         0       0       0
## 1377                 0               0         0       0       0
## 13771                0               0         0       0       0
## 14391                0               0         0       0       0
##       diur_pot_sp_diur BB_diur ARB_CCB ARB_diur ACE_CCB ACE_diur other_antihyp
## 9481                 0       0       0        0       0        1             0
## 13561                0       0       0        1       0        0             0
## 1377                 0       0       0        0       0        0             0
## 13771                0       0       0        0       0        0             0
## 14391                0       0       0        0       0        0             0
##       diur CCB BB ARB ACE ecocardio stenosi_tricusp stenosi_mitr stenosi_aort
```

```
## 9481     0   0  0   0   0         1               0            0            0
## 13561    0   0  0   0   0         1               0            0            0
## 1377     1   0  0   0   1         1               0            0            1
## 13771    1   0  0   0   1         1               0            0            1
## 14391    0   0  0   0   0         1               0            0            0
##       insuff_mitr insuff_polm insuff_aort IVS fib_atr_std segni_IVS_std
## 9481            0           0           1   1           0             0
## 13561           1           0           0   1           1             0
## 1377            0           0           0   1           0             0
## 13771           0           0           0   1           0             0
## 14391           1           0           0   1           0             0
##       ritmo_sin_std ECG_STD eventi_cv altezza_step1     X     Y     Z
## 9481              1       1         0         168.0 137.1 149.3  12.2
## 13561             0       1         0         166.6  97.4 107.0   9.6
## 1377              1       1         1         162.0 111.0  94.3 -16.7
## 13771             1       1         1         162.0  94.3 102.5   8.2
## 14391             1       1         0         178.0 157.0 176.0  19.0
```

```
cat("Numero di righe prima della rimozione degli outliers:", nrow(df), "\n")
```

```
## Numero di righe prima della rimozione degli outliers: 144
```

```
cat("Numero di righe dopo la rimozione degli outliers:", nrow(df_no_outliers), "\n")
```

```
## Numero di righe dopo la rimozione degli outliers: 139
```

```
df <- df_no_outliers
```

Modelli senza VSURF

```
library(randomForest)
library(caret)
library(gbm)


X <- df[, !(colnames(df) %in% c('id', 'Y', 'Z'))]
y <- df$Z  # Utilizziamo la colonna 'Z' come target

# Standardizzazione per Bagging e Gradient
preProcess_scale <- preProcess(X, method = c("center", "scale"))
```

```
## Warning in preProcess.default(X, method = c("center", "scale")): These
## variables have zero variances: ret_diab_prolif, cirr_ep, ipogon, PCO, bioimped,
## corticost_per_bronco, methylxanthines, dipirydamole, ticlopidine, ARB_CCB,
## ecocardio, stenosi_tricusp, insuff_polm, ECG_STD
```

```
X_scaled <- predict(preProcess_scale, X)

# Cross-validation: K-fold con 10 fold
train_control <- trainControl(method = "cv", number = 10)

models <- list(
    "Random Forest" = train(X, y, method = "rf", trControl = trainControl(method = "cv", number = 10)),
    "Bagging" = train(X_scaled, y, method = "treebag", trControl = trainControl(method = "cv", number =
    "Gradient Boosting" = train(X_scaled, y, method = "gbm", trControl = trainControl(method = "cv", nu
)
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 7: ret_diab_prolif has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 15: cirr_ep has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 25: ipogon has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 26: PCO has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 37: bioimped has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 92: corticost_per_bronco has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 93: methylxanthines has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 99: dipirydamole has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 101: ticlopidine has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 110: ARB_CCB has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 120: ecocardio has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 121: stenosi_tricusp has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
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## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
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## "bernoulli", : variable 15: cirr_ep has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 25: ipogon has no variation.

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```

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## "bernoulli", : variable 131: ECG_STD has no variation.
```

```
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## "bernoulli", : variable 25: ipogon has no variation.

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## "bernoulli", : variable 26: PCO has no variation.

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## "bernoulli", : variable 37: bioimped has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 86: corticost_per_musculo has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 92: corticost_per_bronco has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 93: methylxanthines has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 99: dipirydamole has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 101: ticlopidine has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 110: ARB_CCB has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 120: ecocardio has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 121: stenosi_tricusp has no variation.

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## "bernoulli", : variable 125: insuff_polm has no variation.

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## "bernoulli", : variable 131: ECG_STD has no variation.

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```

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```
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## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 98: other_anti_platelets has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
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## "bernoulli", : variable 25: ipogon has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 26: PCO has no variation.

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## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 93: methylxanthines has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 98: other_anti_platelets has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 99: dipirydamole has no variation.

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## "bernoulli", : variable 101: ticlopidine has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 110: ARB_CCB has no variation.

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## "bernoulli", : variable 125: insuff_polm has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 131: ECG_STD has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
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## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 15: cirr_ep has no variation.

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## "bernoulli", : variable 25: ipogon has no variation.

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## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
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## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
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## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 93: methylxanthines has no variation.

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## "bernoulli", : variable 98: other_anti_platelets has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 99: dipirydamole has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 101: ticlopidine has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 110: ARB_CCB has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 120: ecocardio has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 121: stenosi_tricusp has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 125: insuff_polm has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 131: ECG_STD has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 7: ret_diab_prolif has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 15: cirr_ep has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 25: ipogon has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 26: PCO has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 37: bioimped has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 92: corticost_per_bronco has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 93: methylxanthines has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 99: dipirydamole has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 101: ticlopidine has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 110: ARB_CCB has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 120: ecocardio has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 121: stenosi_tricusp has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 125: insuff_polm has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 131: ECG_STD has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 7: ret_diab_prolif has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 15: cirr_ep has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 25: ipogon has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 26: PCO has no variation.

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## "bernoulli", : variable 92: corticost_per_bronco has no variation.

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## "bernoulli", : variable 93: methylxanthines has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 99: dipirydamole has no variation.
```

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## "bernoulli", : variable 110: ARB_CCB has no variation.

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## "bernoulli", : variable 120: ecocardio has no variation.

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## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 131: ECG_STD has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 7: ret_diab_prolif has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 8: nefr_inc has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 15: cirr_ep has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 25: ipogon has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
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## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 120: ecocardio has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 121: stenosi_tricusp has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 125: insuff_polm has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 131: ECG_STD has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 7: ret_diab_prolif has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 15: cirr_ep has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 25: ipogon has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 26: PCO has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 37: bioimped has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 92: corticost_per_bronco has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 93: methylxanthines has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 99: dipirydamole has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 101: ticlopidine has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 110: ARB_CCB has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 120: ecocardio has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 121: stenosi_tricusp has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 125: insuff_polm has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 131: ECG_STD has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 7: ret_diab_prolif has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 15: cirr_ep has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 25: ipogon has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 26: PCO has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 37: bioimped has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 92: corticost_per_bronco has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 93: methylxanthines has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 99: dipirydamole has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 101: ticlopidine has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 110: ARB_CCB has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 120: ecocardio has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 121: stenosi_tricusp has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 125: insuff_polm has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 131: ECG_STD has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 7: ret_diab_prolif has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 15: cirr_ep has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 18: cardiop_iper_ostr has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 25: ipogon has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 26: PCO has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 37: bioimped has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 92: corticost_per_bronco has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 93: methylxanthines has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 99: dipirydamole has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 101: ticlopidine has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 110: ARB_CCB has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 120: ecocardio has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 121: stenosi_tricusp has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 125: insuff_polm has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 131: ECG_STD has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 7: ret_diab_prolif has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 15: cirr_ep has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 18: cardiop_iper_ostr has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 25: ipogon has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 26: PCO has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 37: bioimped has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 92: corticost_per_bronco has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 93: methylxanthines has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 99: dipirydamole has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 101: ticlopidine has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 110: ARB_CCB has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 120: ecocardio has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 121: stenosi_tricusp has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 125: insuff_polm has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 131: ECG_STD has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 7: ret_diab_prolif has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 15: cirr_ep has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 18: cardiop_iper_ostr has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 25: ipogon has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 26: PCO has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 37: bioimped has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 92: corticost_per_bronco has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 93: methylxanthines has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 99: dipirydamole has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 101: ticlopidine has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 110: ARB_CCB has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 120: ecocardio has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 121: stenosi_tricusp has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 125: insuff_polm has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 131: ECG_STD has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 7: ret_diab_prolif has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 15: cirr_ep has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 25: ipogon has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 26: PCO has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 37: bioimped has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 92: corticost_per_bronco has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 93: methylxanthines has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 99: dipirydamole has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 101: ticlopidine has no variation.
```

```
## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 110: ARB_CCB has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 120: ecocardio has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 121: stenosi_tricusp has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 125: insuff_polm has no variation.

## Warning in (function (x, y, offset = NULL, misc = NULL, distribution =
## "bernoulli", : variable 131: ECG_STD has no variation.
```

```r
# Funzione per restituire le previsioni con cross-validation
get_predictions_cv <- function(model, X) {
    predictions <- predict(model, X)
    return(predictions)
}

df_predictions <- df

for (name in names(models)) {
    if (name == "Random Forest") {
        df_predictions[[paste0(name, "_prediction")]] <- get_predictions_cv(models[[name]], X)  # Previ
    } else {
        df_predictions[[paste0(name, "_prediction")]] <- get_predictions_cv(models[[name]], X_scaled)
    }
}

head(df_predictions)
```

```
##       id gender eta qualification job_category dm ret_diab_nprolif
## 86    98      1  60             4            4  0                0
## 8610  98      1  60             4            4  0                0
## 8611  98      1  60             4            4  0                0
## 8612  98      1  60             4            4  0                0
## 8613  98      1  60             4            4  0                0
## 107  121      0  64             4           12  0                0
##      ret_diab_prolif nefr_inc insuf_ren_cr neurop_diab BPCO insuf_resp_cr OSAS
## 86                 0        0            0           0    0             0    0
## 8610               0        0            0           0    0             0    0
## 8611               0        0            0           0    0             0    0
## 8612               0        0            0           0    0             0    0
## 8613               0        0            0           0    0             0    0
## 107                0        0            0           0    0             0    0
##      steat_ep cirr_ep cardiop_isc cardiop_dil cardiop_iper_ostr valv_patia
## 86          0       0           0           0                 0          0
## 8610        0       0           0           0                 0          0
## 8611        0       0           0           0                 0          0
## 8612        0       0           0           0                 0          0
## 8613        0       0           0           0                 0          0
## 107         0       0           1           0                 0          0
##      pat_osteo_dis dep psic DCA iper_art ipogon PCO prev_chirurg_bar altezza
## 86               0   0    0   0        1      0   0               0     164
## 8610             0   0    0   0        1      0   0               0     164
```

```
## 8611             0   0    0   0        1      0   0                0     164
## 8612             0   0    0   0        1      0   0                0     164
## 8613             0   0    0   0        1      0   0                0     164
## 107              0   0    0   0        0      0   0                0     167
##           BMI circ_vita circ_fian rapporto_vita_fian PAS PAD freq_card
## 86   41.27008       118       135              0.874 120  80        62
## 8610 41.27008       118       135              0.874 120  80        62
## 8611 41.27008       118       135              0.874 120  80        62
## 8612 41.27008       118       135              0.874 120  80        62
## 8613 41.27008       118       135              0.874 120  80        62
## 107  36.39428       115       103              1.116 145  85        72
##      rapporto_vita_alt bioimped fm_kg fm_perc ffm_kg ffm_perc massa_musc_kg
## 86               0.719        1  55.2    49.9   55.4     50.1          28.1
## 8610             0.719        1  55.2    49.9   55.4     50.1          28.1
## 8611             0.719        1  55.2    49.9   55.4     50.1          28.1
## 8612             0.719        1  55.2    49.9   55.4     50.1          28.1
## 8613             0.719        1  55.2    49.9   55.4     50.1          28.1
## 107              0.688        1  38.3    37.9   62.7     62.1          43.0
##      massa_musc_perc acqua_extra acqua_intra calorim_ind harris_benedict
## 86              25.4        24.2        16.3           1         1739.33
## 8610            25.4        24.2        16.3           1         1739.33
## 8611            25.4        24.2        16.3           1         1739.33
## 8612            25.4        24.2        16.3           1         1739.33
## 8613            25.4        24.2        16.3           1         1739.33
## 107             42.6        22.0        28.2           1         1872.29
##      eritroc ematocr  emo vol_glob leuco piastr VES AST ALT gammaGT uric
## 86      4.70    43.6 14.2     92.8   8.4    220   8  16  15      12 10.0
## 8610    4.70    43.6 14.2     92.8   8.4    220   8  16  15      12 10.0
## 8611    4.70    43.6 14.2     92.8   8.4    220   8  16  15      12 10.0
## 8612    4.70    43.6 14.2     92.8   8.4    220   8  16  15      12 10.0
## 8613    4.70    43.6 14.2     92.8   8.4    220   8  16  15      12 10.0
## 107     5.66    35.8 10.7     63.2  11.0    237  26  41  41      31  5.7
##      creatin micr_album col_tot HDL LDL trigl glic_bas insulinem_bas emo_gli
## 86       1.1          3     210  68 137   117       94          16.0      35
## 8610     1.1          3     210  68 137   117       94          16.0      35
## 8611     1.1          3     210  68 137   117       94          16.0      35
## 8612     1.1          3     210  68 137   117       94          16.0      35
## 8613     1.1          3     210  68 137   117       94          16.0      35
## 107      0.9          4     171  30 121   189       90          24.7      39
##      calcemia sodio pot prot_C_reat  TSH calcifed neutrofili neutrofili_val
## 86        9.9   144 3.7         0.3 4.43      9.0         63            5.3
## 8610      9.9   144 3.7         0.3 4.43      9.0         63            5.3
## 8611      9.9   144 3.7         0.3 4.43      9.0         63            5.3
## 8612      9.9   144 3.7         0.3 4.43      9.0         63            5.3
## 8613      9.9   144 3.7         0.3 4.43      9.0         63            5.3
## 107       9.0   141 4.5         0.3 1.41     14.5         66            7.2
##      linfociti linfociti_val monociti monociti_val basofili basofili_val
## 86          26          2.2        7          0.6        1          0.1
## 8610        26          2.2        7          0.6        1          0.1
## 8611        26          2.2        7          0.6        1          0.1
## 8612        26          2.2        7          0.6        1          0.1
## 8613        26          2.2        7          0.6        1          0.1
## 107         23          2.5        8          0.9        0          0.0
##      other_tfa other_endocrine_agent insuline oral_antidiab
```

```
## 86           0                    1        0             0
## 8610         0                    1        0             0
## 8611         0                    1        0             0
## 8612         0                    1        0             0
## 8613         0                    1        0             0
## 107          1                    0        0             0
##      corticost_per_musculo NSAIDs antipsychotic antianxiety_antiinsonnia
## 86                       0      0             0                        0
## 8610                     0      0             0                        0
## 8611                     0      0             0                        0
## 8612                     0      0             0                        0
## 8613                     0      0             0                        0
## 107                      0      1             0                        0
##      antidepres combined_bronchodilators corticost_per_bronco methylxanthines
## 86            0                        0                    0               0
## 8610          0                        0                    0               0
## 8611          0                        0                    0               0
## 8612          0                        0                    0               0
## 8613          0                        0                    0               0
## 107           0                        0                    0               0
##      anticholinergic beta_adrenergic other_anticoag oral_anticoag
## 86                 0               0              0             0
## 8610               0               0              0             0
## 8611               0               0              0             0
## 8612               0               0              0             0
## 8613               0               0              0             0
## 107                0               0              0             0
##      other_anti_platelets dipirydamole clopidogrel ticlopidine acetyl_acid
## 86                      0            0           0           0           0
## 8610                    0            0           0           0           0
## 8611                    0            0           0           0           0
## 8612                    0            0           0           0           0
## 8613                    0            0           0           0           0
## 107                     0            0           0           0           1
##      statin_ezetimibe other_lipid_low ezetimibe fibrate statine
## 86                  0               0         0       0       0
## 8610                0               0         0       0       0
## 8611                0               0         0       0       0
## 8612                0               0         0       0       0
## 8613                0               0         0       0       0
## 107                 0               0         0       0       0
##      diur_pot_sp_diur BB_diur ARB_CCB ARB_diur ACE_CCB ACE_diur other_antihyp
## 86                  0       0       0        1       0        0             0
## 8610                0       0       0        1       0        0             0
## 8611                0       0       0        1       0        0             0
## 8612                0       0       0        1       0        0             0
## 8613                0       0       0        1       0        0             0
## 107                 0       0       0        1       0        0             0
##      diur CCB BB ARB ACE ecocardio stenosi_tricusp stenosi_mitr stenosi_aort
## 86      0   0  0   0   0         1               0            0            0
## 8610    0   0  0   0   0         1               0            0            0
## 8611    0   0  0   0   0         1               0            0            0
## 8612    0   0  0   0   0         1               0            0            0
## 8613    0   0  0   0   0         1               0            0            0
```

```
## 107     0   1  1   0   0         1               0           0           0
##      insuff_mitr insuff_polm insuff_aort IVS fib_atr_std segni_IVS_std
## 86             1           0           0   1           0             0
## 8610           1           0           0   1           0             0
## 8611           1           0           0   1           0             0
## 8612           1           0           0   1           0             0
## 8613           1           0           0   1           0             0
## 107            0           0           0   1           0             0
##      ritmo_sin_std ECG_STD eventi_cv altezza_step1     X     Y    Z
## 86               1       1         0           164 111.0 107.1 -3.9
## 8610             1       1         0           164 107.1 103.5 -3.6
## 8611             1       1         0           164 103.5  98.8 -4.7
## 8612             1       1         0           164  98.8  97.1 -1.7
## 8613             1       1         0           164  97.1  96.3 -0.8
## 107              1       1         1           167 101.5  97.6 -3.9
##      Random Forest_prediction Bagging_prediction Gradient Boosting_prediction
## 86                  -3.330998         -3.662719                   -3.816335
## 8610                -3.319186         -3.662719                   -3.625509
## 8611                -3.288571         -3.541971                   -3.625509
## 8612                -3.239443         -3.140466                   -3.625509
## 8613                -3.231049         -3.140466                   -3.625509
## 107                 -3.940272         -3.711171                   -3.453547
```

```r
library(Metrics)

calculate_performance_metrics <- function(y_true, y_pred) {
    mae <- mae(y_true, y_pred)
    mse <- mse(y_true, y_pred)
    rmse <- sqrt(mse)
    varianza <- var(y_true)
    mse_vs_var <- mse / varianza

    return(c(
        'MAE' = mae,
        'MSE' = mse,
        'RMSE' = rmse,
        'MSE vs Varianza' = mse_vs_var
    ))
}

performance_results <- list()

for (model_name in c('Random Forest', 'Bagging', 'Gradient Boosting')) {
    pred_column <- paste0(model_name, "_prediction")  # Nome della colonna con le predizioni
    performance_results[[model_name]] <- calculate_performance_metrics(df_predictions$Z, df_predictions
}

# Converti i risultati in un dataframe
df_performance <- as.data.frame(do.call(rbind, performance_results))
print(df_performance)
```

```
##                       MAE      MSE     RMSE MSE vs Varianza
## Random Forest     2.023665 7.380935 2.716788       0.5175032
## Bagging           1.897807 6.870970 2.621253       0.4817478
## Gradient Boosting 2.194035 8.137905 2.852701       0.5705771
```

```r
library(Metrics)

calculate_performance_metrics <- function(y_true, y_pred) {
    mae <- mae(y_true, y_pred)
    mse <- mse(y_true, y_pred)
    rmse <- sqrt(mse)
    varianza <- var(y_true)
    mse_vs_var <- mse / varianza

    return(c(
        'MAE' = mae,
        'MSE' = mse,
        'RMSE' = rmse,
        'MSE vs Varianza' = mse_vs_var
    ))
}

performance_results <- list()

# Ciclo sui modelli
for (model_name in c('Random Forest', 'Bagging', 'Gradient Boosting')) {
    pred_column <- paste0(model_name, "_prediction")
    performance_results[[model_name]] <- calculate_performance_metrics(df_predictions$Z, df_predictions
}

df_performance <- as.data.frame(do.call(rbind, performance_results))

print(df_performance)
```

```
##                         MAE      MSE     RMSE MSE vs Varianza
## Random Forest     2.023665 7.380935 2.716788       0.5175032
## Bagging           1.897807 6.870970 2.621253       0.4817478
## Gradient Boosting 2.194035 8.137905 2.852701       0.5705771
```

con VSURF

```r
library(randomForest)
library(caret)
library(gbm)
library(VSURF)


X <- df[, !(colnames(df) %in% c('id', 'Y', 'Z'))]
y <- df$Z

# Applica VSURF per la selezione delle variabili
vsurf_model <- VSURF(X, y)
```

```
## Thresholding step
## Estimated computational time (on one core): 9.6 sec.
##   |                                                                              |
## Interpretation step (on 21 variables)
## Estimated computational time (on one core): between 1.7 sec. and  4.4 sec.
##   |                                                                              |
```

```
## Prediction step (on 3 variables)
## Maximum estimated computational time (on one core): 0.2 sec.
##   |                                                                      |
```

```r
# Ottieni le variabili selezionate
selected_variables <- vsurf_model$varselect.pred

if (length(selected_variables) > 0) {
    # Usa solo le variabili selezionate da VSURF
    X_selected <- X[, selected_variables]

    X_selected <- as.data.frame(X_selected)

    # Standardizzazione delle caratteristiche (necessaria per Bagging e Gradient Boosting)
    preProcess_scale <- preProcess(X_selected, method = c("center", "scale"))
    X_scaled_selected <- predict(preProcess_scale, X_selected)

    # Definizione della cross-validation: K-fold con 10 fold
    train_control <- trainControl(method = "cv", number = 10)

    models_vsurf <- list(
        "Random Forest" = train(X_selected, y, method = "rf", trControl = trainControl(method = "cv", nu
        "Bagging" = train(X_scaled_selected, y, method = "treebag", trControl = trainControl(method = "
        "Gradient Boosting" = train(X_scaled_selected, y, method = "gbm", trControl = trainControl(metho
    )

    # Funzione per restituire le previsioni con cross-validation
    get_predictions_cv <- function(model, X) {
        predictions <- predict(model, X)
        return(predictions)
    }

    df_predictions_vsurf <- df  # Questa è la copia che conterrà le previsioni

    for (name in names(models_vsurf)) {
        if (name == "Random Forest") {
            df_predictions_vsurf[[paste0(name, "_VSURF_prediction")]] <- get_predictions_cv(models_vsuri
        } else {
            df_predictions_vsurf[[paste0(name, "_VSURF_prediction")]] <- get_predictions_cv(models_vsuri
        }
    }

    head(df_predictions_vsurf)
} else {
    print("VSURF non ha selezionato alcuna variabile.")
}
```

```
## note: only 1 unique complexity parameters in default grid. Truncating the grid to 1 .
```

```
##       id gender eta qualification job_category dm ret_diab_nprolif
## 86    98      1  60             4            4  0                0
## 8610  98      1  60             4            4  0                0
## 8611  98      1  60             4            4  0                0
## 8612  98      1  60             4            4  0                0
## 8613  98      1  60             4            4  0                0
```

```
## 107  121      0  64             4           12  0               0
##      ret_diab_prolif nefr_inc insuf_ren_cr neurop_diab BPCO insuf_resp_cr OSAS
## 86                 0        0            0           0    0             0    0
## 8610               0        0            0           0    0             0    0
## 8611               0        0            0           0    0             0    0
## 8612               0        0            0           0    0             0    0
## 8613               0        0            0           0    0             0    0
## 107                0        0            0           0    0             0    0
##      steat_ep cirr_ep cardiop_isc cardiop_dil cardiop_iper_ostr valv_patia
## 86          0       0           0           0                 0          0
## 8610        0       0           0           0                 0          0
## 8611        0       0           0           0                 0          0
## 8612        0       0           0           0                 0          0
## 8613        0       0           0           0                 0          0
## 107         0       0           1           0                 0          0
##      pat_osteo_dis dep psic DCA iper_art ipogon PCO prev_chirurg_bar altezza
## 86               0   0    0   0        1      0   0                0     164
## 8610             0   0    0   0        1      0   0                0     164
## 8611             0   0    0   0        1      0   0                0     164
## 8612             0   0    0   0        1      0   0                0     164
## 8613             0   0    0   0        1      0   0                0     164
## 107              0   0    0   0        0      0   0                0     167
##           BMI circ_vita circ_fian rapporto_vita_fian PAS PAD freq_card
## 86   41.27008       118       135              0.874 120  80        62
## 8610 41.27008       118       135              0.874 120  80        62
## 8611 41.27008       118       135              0.874 120  80        62
## 8612 41.27008       118       135              0.874 120  80        62
## 8613 41.27008       118       135              0.874 120  80        62
## 107  36.39428       115       103              1.116 145  85        72
##      rapporto_vita_alt bioimped fm_kg fm_perc ffm_kg ffm_perc massa_musc_kg
## 86               0.719        1  55.2    49.9   55.4     50.1          28.1
## 8610             0.719        1  55.2    49.9   55.4     50.1          28.1
## 8611             0.719        1  55.2    49.9   55.4     50.1          28.1
## 8612             0.719        1  55.2    49.9   55.4     50.1          28.1
## 8613             0.719        1  55.2    49.9   55.4     50.1          28.1
## 107              0.688        1  38.3    37.9   62.7     62.1          43.0
##      massa_musc_perc acqua_extra acqua_intra calorim_ind harris_benedict
## 86              25.4        24.2        16.3           1         1739.33
## 8610            25.4        24.2        16.3           1         1739.33
## 8611            25.4        24.2        16.3           1         1739.33
## 8612            25.4        24.2        16.3           1         1739.33
## 8613            25.4        24.2        16.3           1         1739.33
## 107             42.6        22.0        28.2           1         1872.29
##      eritroc ematocr  emo vol_glob leuco piastr VES AST ALT gammaGT uric
## 86      4.70    43.6 14.2     92.8   8.4    220   8  16  15      12 10.0
## 8610    4.70    43.6 14.2     92.8   8.4    220   8  16  15      12 10.0
## 8611    4.70    43.6 14.2     92.8   8.4    220   8  16  15      12 10.0
## 8612    4.70    43.6 14.2     92.8   8.4    220   8  16  15      12 10.0
## 8613    4.70    43.6 14.2     92.8   8.4    220   8  16  15      12 10.0
## 107     5.66    35.8 10.7     63.2  11.0    237  26  41  41      31  5.7
##      creatin micr_album col_tot HDL LDL trigl glic_bas insulinem_bas emo_gli
## 86       1.1          3     210  68 137   117       94          16.0      35
## 8610     1.1          3     210  68 137   117       94          16.0      35
## 8611     1.1          3     210  68 137   117       94          16.0      35
```

```
## 8612     1.1          3     210  68 137   117       94          16.0      35
## 8613     1.1          3     210  68 137   117       94          16.0      35
## 107      0.9          4     171  30 121   189       90          24.7      39
##      calcemia sodio pot prot_C_reat  TSH calcifed neutrofili neutrofili_val
## 86        9.9   144 3.7         0.3 4.43      9.0         63            5.3
## 8610      9.9   144 3.7         0.3 4.43      9.0         63            5.3
## 8611      9.9   144 3.7         0.3 4.43      9.0         63            5.3
## 8612      9.9   144 3.7         0.3 4.43      9.0         63            5.3
## 8613      9.9   144 3.7         0.3 4.43      9.0         63            5.3
## 107       9.0   141 4.5         0.3 1.41     14.5         66            7.2
##      linfociti linfociti_val monociti monociti_val basofili basofili_val
## 86          26           2.2        7          0.6        1          0.1
## 8610        26           2.2        7          0.6        1          0.1
## 8611        26           2.2        7          0.6        1          0.1
## 8612        26           2.2        7          0.6        1          0.1
## 8613        26           2.2        7          0.6        1          0.1
## 107         23           2.5        8          0.9        0          0.0
##      other_tfa other_endocrine_agent insuline oral_antidiab
## 86           0                     1        0             0
## 8610         0                     1        0             0
## 8611         0                     1        0             0
## 8612         0                     1        0             0
## 8613         0                     1        0             0
## 107          1                     0        0             0
##      corticost_per_musculo NSAIDs antipsychotic antianxiety_antiinsonnia
## 86                       0      0             0                        0
## 8610                     0      0             0                        0
## 8611                     0      0             0                        0
## 8612                     0      0             0                        0
## 8613                     0      0             0                        0
## 107                      0      1             0                        0
##      antidepres combined_bronchodilators corticost_per_bronco methylxanthines
## 86            0                        0                    0               0
## 8610          0                        0                    0               0
## 8611          0                        0                    0               0
## 8612          0                        0                    0               0
## 8613          0                        0                    0               0
## 107           0                        0                    0               0
##      anticholinergic beta_adrenergic other_anticoag oral_anticoag
## 86                 0               0              0             0
## 8610               0               0              0             0
## 8611               0               0              0             0
## 8612               0               0              0             0
## 8613               0               0              0             0
## 107                0               0              0             0
##      other_anti_platelets dipirydamole clopidogrel ticlopidine acetyl_acid
## 86                      0           0           0           0           0
## 8610                    0           0           0           0           0
## 8611                    0           0           0           0           0
## 8612                    0           0           0           0           0
## 8613                    0           0           0           0           0
## 107                     0           0           0           0           1
##      statin_ezetimibe other_lipid_low ezetimibe fibrate statine
## 86                  0               0         0       0       0
```

```
## 8610                0              0         0       0       0
## 8611                0              0         0       0       0
## 8612                0              0         0       0       0
## 8613                0              0         0       0       0
## 107                 0              0         0       0       0
##      diur_pot_sp_diur BB_diur ARB_CCB ARB_diur ACE_CCB ACE_diur other_antihyp
## 86                  0       0       0        1       0        0             0
## 8610                0       0       0        1       0        0             0
## 8611                0       0       0        1       0        0             0
## 8612                0       0       0        1       0        0             0
## 8613                0       0       0        1       0        0             0
## 107                 0       0       0        1       0        0             0
##      diur CCB BB ARB ACE ecocardio stenosi_tricusp stenosi_mitr stenosi_aort
## 86      0   0  0   0   0         1               0            0            0
## 8610    0   0  0   0   0         1               0            0            0
## 8611    0   0  0   0   0         1               0            0            0
## 8612    0   0  0   0   0         1               0            0            0
## 8613    0   0  0   0   0         1               0            0            0
## 107     0   1  1   0   0         1               0            0            0
##      insuff_mitr insuff_polm insuff_aort IVS fib_atr_std segni_IVS_std
## 86             1           0           0   1           0             0
## 8610           1           0           0   1           0             0
## 8611           1           0           0   1           0             0
## 8612           1           0           0   1           0             0
## 8613           1           0           0   1           0             0
## 107            0           0           0   1           0             0
##      ritmo_sin_std ECG_STD eventi_cv altezza_step1     X     Y    Z
## 86               1       1         0           164 111.0 107.1 -3.9
## 8610             1       1         0           164 107.1 103.5 -3.6
## 8611             1       1         0           164 103.5  98.8 -4.7
## 8612             1       1         0           164  98.8  97.1 -1.7
## 8613             1       1         0           164  97.1  96.3 -0.8
## 107              1       1         1           167 101.5  97.6 -3.9
##      Random Forest_VSURF_prediction Bagging_VSURF_prediction
## 86                       -2.226555                -4.050673
## 8610                     -3.914257                -4.350982
## 8611                     -3.667903                -2.869176
## 8612                     -1.684610                -2.716962
## 8613                     -1.640717                -2.657301
## 107                      -4.123343                -3.262514
##      Gradient Boosting_VSURF_prediction
## 86                           -4.442646
## 8610                         -4.243170
## 8611                         -3.507336
## 8612                         -3.394092
## 8613                         -3.097309
## 107                          -3.394092
```

```r
performance_results_vsurf <- list()

for (model_name in c('Random Forest', 'Bagging', 'Gradient Boosting')) {
    pred_column <- paste0(model_name, "_VSURF_prediction")  # Nome della colonna con le predizioni
    performance_results_vsurf[[model_name]] <- calculate_performance_metrics(df_predictions_vsurf$Z, df_
}
```

```r
df_performance_vsurf <- as.data.frame(do.call(rbind, performance_results_vsurf))
print(df_performance_vsurf)
```

```
##                         MAE      MSE     RMSE MSE vs Varianza
## Random Forest      1.396422 3.722259 1.929316       0.2609807
## Bagging            2.076209 8.121281 2.849786       0.5694115
## Gradient Boosting 2.398762 9.834642 3.136023       0.6895413
```

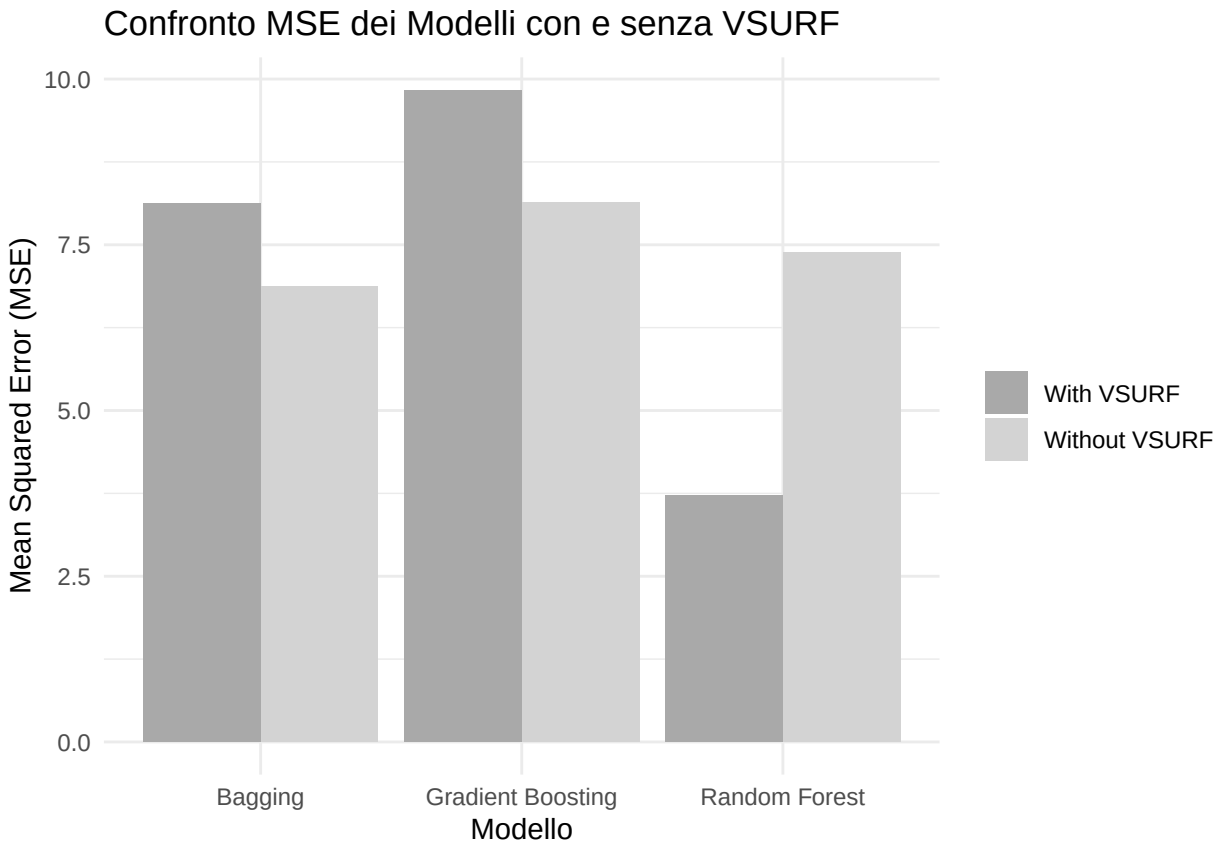
```r
mse_data <- data.frame(
    Model = rep(c("Random Forest", "Bagging", "Gradient Boosting"), each = 2),
    VSURF = rep(c("Without VSURF", "With VSURF"), times = 3),
    MSE = c(
        df_performance$MSE[1], df_performance_vsurf$MSE[1],
        df_performance$MSE[2], df_performance_vsurf$MSE[2],
        df_performance$MSE[3], df_performance_vsurf$MSE[3]
    )
)


print(mse_data)
```

```
##               Model         VSURF      MSE
## 1     Random Forest Without VSURF 7.380935
## 2     Random Forest    With VSURF 3.722259
## 3           Bagging Without VSURF 6.870970
## 4           Bagging    With VSURF 8.121281
## 5 Gradient Boosting Without VSURF 8.137905
## 6 Gradient Boosting    With VSURF 9.834642
```

```r
library(ggplot2)

ggplot(mse_data, aes(x = Model, y = MSE, fill = VSURF)) +
    geom_bar(stat = "identity", position = "dodge") +
    labs(title = "Confronto MSE dei Modelli con e senza VSURF",
         x = "Modello",
         y = "Mean Squared Error (MSE)") +
    theme_minimal() +
    scale_fill_manual(values = c("Without VSURF" = "light grey", "With VSURF" = "dark grey")) +
    theme(legend.title = element_blank())
```


Confronto MSE dei Modelli con e senza VSURF
Mean Squared Error (MSE)
10.0
7.5
5.0
2.5
0.0
Bagging
Gradient Boosting
Random Forest
Modello
With VSURF
Without VSURF